LECTURE NOTES

For Nursing Students

Operating Room Technique

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University of Gondar

In collaboration with the Ethiopia Public Health Training Initiative, The Carter Center, the Ethiopia Ministry of Health, and the Ethiopia Ministry of Education

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PREFACE

The author has felt for several years that there was a need for a material that would fill the gap between the demands of the learners' and the availability of a material of this type. As we, instructors and healthcare provider professionals know, over the years the number of students requesting to join nursing education and the number of patients that need quality care have grown many fold in our country but the training and the availability of training materials have lagged behind. Consequently, this lecture note is envisaged to fill the gap in some way and serve as a reference material for students as well as for those interested in providing quality patient care.

The operating room work is a teamwork where two or more persons recognize **common goals** and coordinate their efforts to achieve them. Broadly defined, the health care team includes all personnel relating to the patient, those in direct patient contact, and those in other departments, whose services are essential and contribute indirectly to **patient care.** Interdependence characterizes a team, without the other members, the goals cannot be met.

The team approach to patient care should be a coordinated effort that is performed with the cooperation of all care givers. Team members should communicate and should have a

shared division of duties to perform specified tasks as a unified body. The failure of any one member to perform her or his role can seriously affect the success of the entire team. Performing as a team requires that each member exert an effort to attain the common goals in a competent and safe manner. The actions of each team member are important. **No one** individual can accomplish the goal without the cooperation of the rest of the teams and individuals.

This lecture note is organized into **fourteen** chapters. Each chapter begins with a list of objectives that address the major emphases of the chapter. The student can use them as a basis for outline or self-testing, or the instructor may use them for evaluating students' knowledge, attitude and skills.

Self-evaluation questions are also included at the end of each chapter to facilitate mastery of chapter contents.

Every effort has been made to make the learners familiar with the following areas:

- Situations of the perioperative environment,
- Principles of aseptic and sterile techniques and their application
- Preparation of the patient for surgical procedure,
- Preparation of the health care team for optimum postoperative patient care

- Use and handling of instruments and supplies
- Principles of anesthesia

A glossary appears at the end of the lecture note for easy understanding of some key terms within the material.

Finally, the different materials used in the preparation of this lecture note have been listed so as to help those interested for further reading and references.

Abebaw Eredie Abebe

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List of Abbreviations and Acronyms

ACP	**A**nesthesia **C**are **P**roviders
AIDS	**A**cquired **I**mmune **D**eficiency **S**yndrome
AORN	**A**ssociation of peri**O**perative **R**egistered **N**urses
B & S	**B**rown and **S**harp
CDC	**C**enter for **D**isease **C**ontrol and Prevention
cm	**c**enti**m**eter
CPR	**C**ardio**p**ulmonary **R**esuscitation
ECG	**E**lectro**c**ardio**g**raphy
EO/ETO	**E**thylene **O**xide
EPHTI	**E**thiopia **P**ublic **H**ealth **T**raining **I**nitiative
ESU	**e**lectro**s**urgical **u**nit

FDA	**F**ood and **D**rug **A**dministration
Fig.	**Fig**ure
HBV	**H**epatitis **B**-**V**irus
HCV	**H**epatitis **C**-**V**irus
HIV	**H**uman **I**mmunodeficiency **V**irus
ICU	**I**ntensive **C**are **U**nit
I.D.	**Id**entification
i.e.	that is
IM	**I**ntra**m**uscular
IP	**I**nfection **P**revention
IV	**I**ntra**v**enous
MH	**M**alignant **H**yper **T**hermia
ml	**m**illi**l**iter
N/A	**N**o **A**ctivity/ **N**ot **A**pplicable
NATN	**N**ational **A**ssociation of **T**heatre **N**urses
N. B.	**N**ota **B**ene
NRL	**N**atural **R**ubber **L**atex
OR	**O**perating **R**oom
OSHA	**O**ccupational **S**afety and **H**ealth **A**dministration
PPE	**P**ersonal **P**rotective **E**quipment
RR	**R**ecovery **R**oom
TB	Tuberculosis
U. S. P.	**U**nited **S**tates **P**harmacopeia
WHO	**W**orld **H**ealth **O**rganization

Operating Room Technique

General Course Learning Objectives

1. **Describe the three areas of the operation department and the proper attire for each area.**
2. **Describe the physical environment of the operating room and the holding area.**

3. **Describe the functions of the members of the operation team.**
4. **Identify needs experienced by the patient undergoing surgical procedures.**
5. **Discuss the role of the perioperative nurse when managing the care of the patient undergoing surgery.**
6. **Describe basic principles of aseptic techniques used in the operating room.**
7. **Discuss the importance of safety in the positioning of patients.**
8. **Differentiate between general and regional or local anesthesia, including advantages, disadvantages, and the rationale for choice of the anesthetic techniques.**
9. **Identify the basic techniques used to induce and maintain general anesthesia.**
10. **Discuss techniques for administering local and regional anesthesia.**

CHAPTER ONE
PERIOPERATIVE PATIENT ENVIRONMENT

1.1 Learning Objectives

After studying this chapter, the learner will be able to:

1. Define perioperative nursing and operating room nurse.
2. Describe phases of the perioperative period.
3. Show specific areas within the operating room (OR).
4. Locate and describe the use of furniture and equipment in the operating room.
5. Identify the role of each member of the operating room team.
6. Discuss how environmental layout contributes to aseptic technique.

1.2. Introduction

Usually the treatment of a wide variety of illnesses and injurie includes some type of *surgical intervention*. Surgery is an invasive method of treatment that may be planned or unplanned, major or minor, and that may involve any body part or system.

Surgical procedures require physical and psychosocial adaptations and are stressors for both the patient and the family, no matter what the extent might be. The patient's recovery from a surgical procedure requires skillful and knowledgeable nursing care whether the surgery is done on an outpatient basis or in the ideal operation room. All phases of the nursing process are used perioperatively to make assessments, arrive at a diagnosis, make appropriate plans and provide interventions necessary to:

- Promote the recovery of health,
- Prevent further injury or illness, and
- Facilitate coping with alterations in physical structure and function.

1.3. The nursing process

Perioperative patient care requires developing a plan of care and identifying expected outcomes through the nursing process. The nursing process is a systematic approach to nursing practice using problem-solving techniques. This six part process provides a systemic foundation for assessing the patient, establishing a nursing diagnosis, identifying desired outcomes, planning interventions, implementing care, and evaluating the success of the plan.

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The six components of the nursing process are integrated into the three phases of the patient's perioperative experience:

- The preoperative phase,
- The intraoperative phase, and
- The postoperative phase.

Throughout the entire perioperative period, the patient is continually assessed, the plan of care is modified, implementation is effected, and the cycle is evaluated for the attainment of outcomes.

Nursing Activities Surrounding the Surgical Experience

Assessment

The assessment of patient needs is a continuous cycle which ensures that accurate and timely information for individualized patient care can be planned, implemented, and evaluated.

A. Home/Clinic/Holding Area

- Initiates preoperative assessment
- Plans teaching methods appropriate to patient's needs
- Involves family interview

B. Surgical Unit

- Completes preoperative assessment
- Coordinates patient teaching with other nursing staff
- Develops a plan of care

C. Surgical Suite

- Identifies patient
- Verifies surgical site
- Assesses patient's level of consciousness, skin integrity, mobility, emotional status, and functional limitations.
- Reviews chart

Planning

- Determines a plan of care that incorporates and respects the patient's value system, lifestyle, ethnicity, and culture; care plan reflects the patient's level of function and ability during the intraoperative period.
- Ensures all supplies and equipment needed for surgery are available, functioning properly, and sterile, if appropriate.
- Contributes to the optimum and effective use of valuable resources.

Implementation

A. Maintenance of safety

- Ensures the integrity of the sterile field
- Ensures that the sponge, needle, and instrument counts are correct

- Positions the patient to ensure correct alignment, exposure of surgical site, and prevention of injury
- Prevents chemical injury from prepping solutions, pharmaceuticals, etc.
- Ensures safe use of electrical equipment, lasers, and radiation.
- Safely administers appropriate medications

B. Monitoring of Physical Status

- Monitors and reports changes in patient's vital signs
- Monitors blood loss
- Monitors urine output as applicable

C. Monitoring of Psychologic Status

- Provides emotional support to patient
- Stands near or touches patient during procedures and induction
- Ensures that the patient's right to privacy is maintained
- Communicates patient's emotional status to other appropriate members of the health care team.

Evaluation

A. Postanesthesia / discharge area

- Determines patient's immediate response to surgical intervention
- Monitors vital signs and safely administers appropriate medications.

B. Surgical Unit

- Evaluates effectiveness of nursing care in the OR using patient outcome criteria
- Determines patient's level of satisfaction with care given during intraoperative period.
- Evaluates products used on patient in the OR.
- Determines patient's psychologic status
- Assists with discharge planning

C. Home / Clinic

- Seeks patient's perception of surgery in terms of the effects of anesthetic agents, impact on body image, immobilization.
- Determines family's perceptions of surgery

1.4. Preoperative Nursing and Operating Room Nurse

Perioperative nursing is a term used to describe the nursing functions in the total surgical experience of the patient.

Operating Room Nurse is on the frontline of the most complex life-saving procedures. She/he is responsible for planning, directing and coordinating activities of the operating room. The OR nurse provides professional nursing care to patients undergoing surgery; prepares and maintains the operating room for all surgical procedures and assembles the

type and quality of materials and special equipment needed for daily procedures and possible emergencies.

The OR nurse conducts both pre- and postoperative visits on patients. She/he also coordinates with other units like recovery room (RR), intensive care unit (ICU), obstetric and nursing units to ensure patients' progress.

In general, the OR nurse plans, directs, and coordinates activities of the OR, maintaining optimum standards of nursing care and practice through preoperative and postoperative assessments, planning, implementation, and evaluation of patient care. The OR nurse manages operating room activities, directing and instructing personnel. Other responsibilities include maintaining concise and complete records and reports, and coordinating an ongoing in-service education program to continually update the knowledge and skills of all assigned operating room nursing personnel.

Phases of the perioperative period

A. ***Preoperative phase*** – from the time the decision is made for surgical intervention to the transfer of the patient to the operating room.
B. ***Intraoperative phase*** – from the time the patient is received in the operating room until s/he is admitted to the recovery room.

C.Postoperative phase – from the time of admission to the recovery room to the follow-up home or clinic evaluation.

1.5. Organization of the Operating Room

Organization of areas in the operating room

The efficiency of the operating room depends much upon its physical organization and the organization of its personnel. An intelligent design in the layout of the operating room facilitates the efficient movement of patients and staff and the economical use of space.

Design of the operating room

Principles in design

The universal problem of environmental control to prevent wound infection exerts a great influence on the design of the operating room (OR) suite. Clean and contaminated areas should be well differentiated. Architects follow two principles in planning the physical layout of the OR suite:

- Exclusion of contamination from outside the suite with sensible traffic patterns within the suite
- Separation of clean areas from contaminated areas within the suite.

Physical planning of an OR suite, which separates clean from contaminated areas, makes it easier to carry out good aseptic

techniques. The clean area is often referred to as the restricted area.

For operating rooms, there are many different designs. The basic design principles which are common to all operating rooms must fulfill the following criteria:

1. The design must always be simple and easy to keep it clean
2. Wall and floor surfaces should be smooth and made of nonporous materials
3. In order to prevent cross – contamination (the transfer of disease causing microorganisms from one source to another), there should be separate rooms for clean or sterile instruments and soiled ones.
4. There should be sufficient space to ensure the safe transportation of patients and staff.
5. The layout of the department should be convenient for the supervisor to control the incoming and outgoing traffics.
6. The recovery room should be near the operating room, so that patients can be transported safely and quickly following surgery.

Space Allocation within the Operation Room and Traffic Patterns

Space is allocated within the OR suite to provide for the work to be done, with consideration given to the efficiency with which it can be accomplished. The OR suite should be large enough to allow for correct technique, yet small enough to minimize the movement of patients, personnel, and supplies. Provision must be made for traffic control. The type of design will predetermine traffic patterns. All persons – staff, patients, and visitors – should follow the delineated patterns in appropriate attire. Signs should be posted that clearly indicate the attire and environmental controls required. The OR suite is divided into three areas that are designated by the physical activities performed in each area.

A. Unrestricted Area

- Street cloths are permitted.
- A corridor on the periphery accommodates traffic from outside, including patients.
- This area is isolated by doors from the main corridor and from other areas of OR suite.
- It serves as an outside-to-inside access area.
- Traffic, although not limited, is monitored at a central location.

B. Semirestricted Area

- Traffic is limited to properly attired (dressed) personnel
- Body and head coverings are required
- This area includes peripheral support areas and access corridors to the operating rooms.
- The patient may be transferred to a clean inside stretcher on entry to this area
- The patient's hair must be covered

C. Restricted Area

- Masks are required to supplement surgical attire
- Sterile procedures are carried out in this area
- The area includes the operating rooms, scrub sink areas and substerile rooms or clean core area(s) where unwrapped supplies are sterilized.

Figure 1.1 below illustrates areas within the operating room.

- The **supervisor's Office** (A**)** has direct access to the outside of the operating room. The supervisor may need to receive visitors and significant others who are not dressed in scrub attire.
- **Dressing rooms** (B) for operating room personnel have a door to the outside corridors so that personnel may enter there, change into scrub attire and go directly into the operating room.
- The **holding area** (C) is on area designated for the parking of stretchers with patients awaiting surgery.

This is the area where the health care givers properly identify the patient and make sure that all preoperative cares are carried out and other important data are in the patient's chart.

- **Scrub sink areas** (D) are located in several places close the operating suites. Scrub brushes, Caps, Soaps, masks are located at each scrub station/
- The **workroom** (E) is located so as to be away from the direct traffic of the operating suites. It is divided into two separate areas, one for clean instruments and supplies and one for soiled equipment.
- The **sterile supply room** (F) serves as a supply depot for wrapped sterile articles. This area should be dusted frequently with a damp cloth and have storage cabinets with doors to minimize exposure of the supplies to room air and dust.
- **Storage areas** (G) for extra equipment and supplies are used to store these extra instruments and supplies for each unit.
- The **recovery room (**H**)** has an access to the outside of the operating room for transporting patients back to their rooms.
- The **operating suites** (I) are rooms where surgery is performed. These rooms are wide enough to allow scrub personnel to move around non sterile equipment without their contamination.

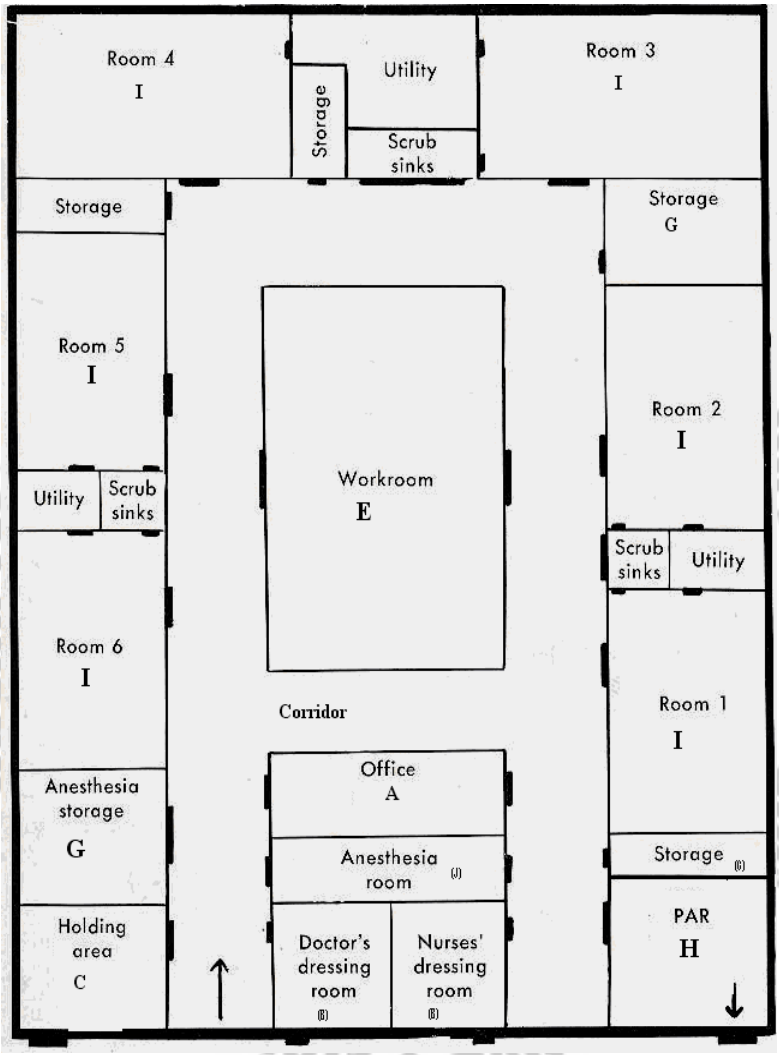

Fig. 1-1. Floor plan of the operating room (Note that the workroom is centrally located. Brocks, Shirley M.: fundamentals of operating room nursing, 2nd ed. St. Louis, the C.V. Mosby Company, 1979 P-26).

Doors

Ideally, sliding doors should be used in the OR. They eliminate the air currents caused by swinging doors. Microorganisms that have previously settled in the room are disturbed with each swing of the door. The microbial count is usually at its peak at the time of the skin incision because this follows disturbance of air by gowning, draping, movements of personnel, and opening and closing of doors. During the surgical procedure, the microbial count rises every time doors swing open from either direction. Also, swinging doors may touch a sterile table or person. The risk of catching hands, equipment cords, iv line tubing, or other supplies is increased.

Operating Room Equipment and Furniture

- **Wall Clock**

Since time is often critical during surgery, each room should have a wall clock that is easy to read. The clock is used to time tourniquet applications, administration of medications, the duration of cardiac and respiratory arrests and to note the time of events such as childbirth.

- **X-ray Viewing Boxes**

The surgeon may need to view an x-ray before or during the procedure.

- **Lights**

The overhead lights should specially designed to provide a range of intensity. They should be freely movable, shadowless and less heat emitting.

The Operating Table

The table should be fully adjustable in all directions to create postures needed for various surgical positions.

- **Mayo Stands**

This stand is used to hold instruments that will be used frequently during a particular case.

- **Back Table**

The back table is used to place extra supplies and instruments used during surgery.

- **Ring Stand**

The ring stand is used to hold basins which contains normal saline or sterile water during surgery.

- **Kick Bucket**

The kick bucket (a bucket on wheels) is used to place soiled sponges during surgery.

- **Supply Cabinets**

These cabinets are used to store frequently used items such as drapes, dressings, solutions, sutures, etc. Cabinets with doors are preferred to those without so as to reduce exposure of the content to dust.

- **Anesthesia Equipment**

Equipment, including the gas machine, physiological monitor, anesthesia supply cart, and sitting stools, is located in each room.

1.6. Operating Room Personnel Organization

Just as there is a logical order to the physical design, there is a logical division of duties among the operating room staff.

Operating Room Team

When the patient arrives to the operating room, he/she is received and surrounded by a surgeon, one or two assistants, an anesthesia provider, a scrubbed nurse, a circulating nurse etc. These individuals, each with specific functions to perform, form the operating team. This team literally has the ***patient's life in its hands.*** The operating room team works in harmony with his/her colleagues for the successful accomplishment of the expected outcomes of the patient.

The operating room team is subdivided according to the functions of its members:

1. The sterile team consists of:
    a. Surgeon
    b. Assistants to the surgeon
    c. Scrub nurse
2. The unsterile team includes:
    a. Anesthesia provider

b. Circulator/ Runner nurse

c. Others, such as students, cleaners and those who may be needed to set up and operate specialized equipment or monitoring devices.

Fig. 1-2. Some of the OR team members while performing operation

Responsibilities of Each Member

Sterile team members wash (scrub) their hands and arms, put on (don) a sterile gown and gloves, and enter the sterile

field, the sterile field is the area of the operating room that immediately surrounds and is specially prepared for the patient. To establish a sterile field, all items needed for the surgical procedure are sterilized (a process by which all living microorganisms are killed). After this process, the scrubbed and sterile team members function within this limited area and handle only sterile items.

Unsterile team members, on the other hand, do not enter the sterile field; they function outside and around it. They assume responsibility for maintaining sterile technique during the surgical procedure, but they handle supplies and equipment that are not considered sterile. Following the principles of aseptic technique, they keep the sterile team supplied, provide direct patient care, and handle other requirements that may arise during the surgical procedure.

A. Responsibilities of the Surgeon

The surgeon must have the knowledge, skill, and judgment required to successfully perform the intended surgical procedure and any deviations necessitated by unforeseen difficulties. The surgeon's responsibilities include, but are not limited to, the following:

- Preoperative diagnosis and care
- Selection and performance of the surgical procedure
- Postoperative management of care

B. Responsibilities of the Assistant Surgeons

Under the direction of the operating surgeon, one or two assistants help to:

- maintain visibility of the surgical site
- control bleeding
- close wounds
- and apply dressings

C. Responsibilities of the Scrub Nurse

Individual surgeons and other team members have individual preferences in their effort to standardize operative procedures. The "scrubbed" nurses learn how best to work with each surgeon and other team members as a smooth working team. He/she is guided and directed constantly by what the surgeon is doing. This means that the "scrubbed" nurse must have a constant attention to the operation field.

The activities of the "scrubbed" nurse include, but are not limited to, the following:

- Reviews anatomy, physiology, and the surgical procedure.
- Assists with preparation of the room.

- Scrubs, gowns, and gloves self and other members of the sterile surgical team.
- Passes instrument to the surgeon in a prescribed manner.
- Maintains sterile and an orderly surgical field.
- Assists with the draping procedure.
- Keeps track of irrigation solutions used for calculation of blood loss.
- Keeps the instrument table neat so that supplies can be handed quickly and efficiently.
- Anticipates and meets the needs of the surgeon by watching the progress of the surgery and knowing the various steps of the procedure.
- Takes part in sponge, needle, and instrument counts
- Identifies and preserves specimens properly.

D. Responsibilities of the Circulating Nurse

The circulating nurse is responsible for maintaining a neat, quiet, well-organized OR and must be able to anticipate and meet the needs of the other team members such as - the scrub nurse, the anesthesia provider, the surgeon and above all the *patient.*

The activities of the circulating nurse include, but are not limited to, the following:

- Reviews anatomy, physiology, and the surgical procedure.
- Assists with preparing the room, observes aseptic technique at all times to see that it is maintained properly.
- Identifies and assesses the patient. Then plans and coordinates the intraoperative cares.
- Admits the patient to the operating room and assumes responsibility with the other members of the team for the comfort and the safety of the patient.
- Keeps the "scrub" nurse with supplies e.g. suture materials, dressings etc.
- Opens sterile supplies before and during the case, replace saline or water in basins as necessary.
- Positions the patient on the surgery table
- Assists the anesthetist when required
- Takes part in sponge and instrument counts and their documentation,
- Ties the gowns of scrubbed personnel
- Adjusts the surgical lights; attaches the suction apparatus and check to see its function; participates in insertion and application of monitoring devices.
- Wipes the surgeons' brows as needed
- Handles all nonsterile equipment in the room during surgery, places buckets properly to receive discarded sponges.

- Accompanies the patient to the recovery room.
- Checks the chart and relates pertinent data
- Measures blood and fluid loss
- Documents and preserves any specimens received during surgery
- Reports pertinent information to the recovery area nurses.

When supplying the "scrub" nurse with the needed items, the circulating nurse may have to use sterile *transfer forceps*.
The transfer forceps and its container are first sterilized (a single forceps for each container).

The prongs (tips or jaws) should permit the grasping of circular objects, gloves, suture materials, fine surgical needles etc.

N.B. Do not use transfer forceps to pick up anything with an ***adhering base***, such as petrolatum gauze, should this occur, clean and sterilize the forceps.
From the responsibilities listed, it is essential that the circulating nurse must posses the ability to:

- Organize activities and direct personnel with due understanding of interpersonal relations,
- Anticipate needs,

- Differentiate between situations that demand immediate attention and those of lesser importance,
- Maintain a quiet, neat and well equipped unit,
- Understand thoroughly the principles of asepsis,
- Teach actively and by the examples he/she sets.

E. Responsibilities of the Anesthesia Provider

Anesthesia and surgery are two distinct, but inseparable disciplines; they are two parts of one entity. Adequate communication between the surgeon and the anesthesia provider is the patient's greater safeguard. The anesthesia provider is an indispensable member of the OR team. Functioning as a guardian of the patient, the anesthesia provider should observe the principles of aseptic technique.

The main activities of the anesthesia provider are:

- Monitoring vital functions and parameters
- Fluid and electrolyte administration
- Administering anesthetic agent/anesthesia
- Maintaining anesthesia at the required levels
- Managing untoward reactions to anesthesia throughout the surgical procedure.

Medically delegated functions of an anesthetic nature are performed under the overall supervision of a responsible physician or in accordance with individual written guidelines approved within the health care facility.

1.7. Coordinated Roles of the Scrub Nurse and the Circulator

The coordinated role

- The circulator and the scrub nurses should plan their duties so that, through coordination of their efforts, the sterile and the unsterile parts of the surgical procedure move along simultaneously.
- From the time the scrub nurse starts the surgical scrub until the surgical procedure is completed and dressings are applied, an invisible line separates the duties of the scrub nurse and the circulator, which neither person may cross.
- In the previous sections, the responsibilities of both the scrub and circulating nurses are listed separately, but a spirit of mutual cooperation is essential to move the schedule of surgical procedures efficiently and to serve the best interests of the patient.
- As a coordinated effort, the scrub nurse and the circulator nurse should complete the preparation of the environment.

Sponge, Sharp, and Instrument Count

Items are counted before and after use. The operating team members should be accountable for the performance of quality patient care. Accountability is a professional

responsibility. The surgeon and patient rely on the accuracy of this accountability by the team. Item counts are performed for patient and personnel safety, infection control, and inventory purposes. An item left in the wound after closure is a possible cause for a lawsuit following a surgical procedure.
A foreign body unintentionally left in a patient can be the source of wound infection or disruption.
Consequences of foreign body left in the patient's body will be:

- Formation of an abscess and development of fistula between organs
- Foreign body reaction may be immediate or delayed for years
- Sometimes difficult and costly to diagnose
- Removal of the object usually requires major surgery

A contaminated sponge or needle that is unaccounted for at the close of procedure could also in advertently come in contact with the personnel who clean the room. Blood or any other body fluids are sources of pathogens such as Human Immunodeficiency Virus (HIV), Hepatitis B-Virus (HBV) or Hepatitis C-Virus (HCV).

Inventory control is monitored by accounting for the instrument set in its entirety. Counting ensures that expensive

instruments such as towel clips and scissors are not accidentally thrown away or discarded with the drapes. Injury to laundry and housekeeping/environmental services personnel by the contaminated sharp edges of surgical instruments, blades, and needles is a potential risk. Surgical instruments also can cause major damage to equipment in the laundry service.

A count must be undertaken for all procedures in which the likelihood exists that swabs, instruments and/or sharps could be retained.

Counting Procedure

A counting procedure is a method of accounting for items put on the sterile table for use during the surgical procedure. Sponges, sharps, and instruments should be counted and/or accounted for on all surgical procedures. This includes any material introduced into the patient during the procedure. A counting procedure is made three times in a surgical procedure.

A. First Count

The person who assembles and wraps items for sterilization will count them. In commercially prepackaged sterile items, the count is performed by the manufacturer.

B. Second Count

The scrub nurse and the circulator together count all items before the surgical procedure begins and during the surgical procedure as each additional package is opened and added to the sterile field. These initial counts provide the baseline for subsequent counts. Any item initially placed in the wound is recorded. A useful method for counting is as follows:

- As the scrub nurse touches each item, she/he and the circulator number each item aloud until all items are counte.
- The circulator immediately records the count for each type of item on the count record.
- Additional packages should be counted away from counted items already on the table, incase it is necessary to repeat the count or to discard an item
- Counting should not be interrupted. The count should be repeated if there is uncertainty because of interruption, fumbling, or any other reason.

C. Third Count

Counts are taken in three areas before the surgeon starts the closure of a body cavity or a deep/large incision:

- ***Field Count*.** Either the surgeon or the assistant assists the scrub nurse with the surgical field count. Additional items are accounted for at this time.
- ***Table Count.*** The scrub nurse and the circulating nurse together count all items on the Mayo stand and instrument table. The surgeon and assistant may be closing the wound, while this count is in process.
- ***Floor Count.*** The circulating nurse counts sponges and any other items that have been recovered from the floor or passed off the sterile field to the kick buckets. These counts should be verified by the scrub nurse.

1.8. Qualities of the Operating Room Nurse

The occupation of operating room nurses is both demanding and rewarding. Certain qualifications are a prerequisite to join this field.

A. Stamina

Since the job requires long hours of standing, lifting heavy instrument trays, positioning patients, and many other physical tasks, the OR nurse should be in good physical condition and have the energy to complete her/his daily work in a safe and efficient manner.

B. Emotional stability

The operating room work is stressful. The nature of the work can cause team members to be tense or to display aggressive behavior while working. The operating room nurse must be able to cope with her/his own tension and with that of her/his teammates. Occasionally, the surgeon may express feelings of stress by being verbally abrupt or harsh. While extremely inappropriate behavior should not be tolerated by the operating room supervisor, all team members must appreciate the responsibility that rests on the surgeon and not become personally offended by occasional outbursts.

C. Respect

Respect for the patient's rights for privacy, for other team members, and for her-/himself is an important quality of the operating room nurse. The operating room relies on chain of command for efficient and safe patient care. Those who experience problems in responding to authority should not work.

D. Stable health

The surgery department relies upon the daily presence of its employees. If one person is ill, the workload of other team members is increased because they must perform the work of

the absentee. Cases are generally not cancelled because of absenteeism. Since the operating room is a stressful situation and because stress can contribute to ill health, the nurse must be careful to guard against illness and injury. Of particular importance are prevention of injury to the back and maintenance of healthy skin and respiratory tract (common areas of illness).

E. Good Humor

In a difficult and demanding environment such as the operating room, it is important to have a proper perspective on the day's events and to share in good spirit. It is a senseless waste of energy for a team member to allow one distressing episode to influence an entire day's work. Team members who are consistently sullen can lower the morale of the whole department, while those who are cheerful can raise everyone's spirit.

F. Team spirit

The ability to work with team members toward a common goal is very important in surgery. The patient expects and should receive the undivided attention of all who care for him/her. To accomplish this, the nurse should recognize the importance of not only of her/his own job, but also of those of the other team members. She or he should either put

personnel problems aside or bring them to the attention of the supervisor, who might able to resolve them.

1.9. Co-operation and Economical Use of Hospital Supplies, Equipment and Time

The team approach to care should be a coordinated effort that is performed with the cooperation of all caregivers. Team members should communicate and should have a shared division of duties to perform specified tasks as a unified body. The failure of any one member to perform her/his role can seriously impact the success of the entire team. Performing as a team requires that each member exert an effort to attain the common goals in a competent and safe manner. No one individual can accomplish the goal without the cooperation of the rest of the team.

A. Economical use of supplies and hospital Equipment

Most of the hospital equipment is being imported from abroad and it is costly and, therefore economical and proper usage of it is mandatory.

As the cost of supplies and equipment increases, the OR team members should be conscious of ways to eliminate wasteful practices. For example, throw away disposable items only. Avoid throwing away reusable items.

The operation room is one of the most expensive departments of a hospital. Adequate instruments and supplies are necessary for patient care, and cost is not always the primary consideration. Economy becomes a hazard when exercised beyond the point of safety. Nevertheless, supplies do not need to be used lavishly, just because they are available. Remember the principles mentioned in the following sections.

"Just Enough Is Enough"

The varieties and numbers of instruments and supplies needed for each surgical procedure can be kept to a minimum. Materials no longer used can be eliminated. Items to "have available" are not opened unnecessarily. The following procedures should be observed:

- Pour just enough antiseptic solution
- Follow the procedures for draping
- Do not open another packet of sutures for the last stitch unless absolutely necessary. A few leftover pieces are usually long enough to complete the closure.
- Supplies should be opened only as needed, not routinely "just in case" they may be needed
- Turnoff lights when they are not needed

B. Time Economy

Time is money; do not waste it. Know the policies and procedures, and follow them efficiently. Learn to do things right the first time and continue to do them that way; time is wasted in correcting errors.

Time is an important element in the OR. If time is wasted between surgical procedures, the day's schedule is slowed down and later procedures are delayed. The patients and families become anxious during these delays. By reducing time we can reduce the prolonged administration of anesthetic agents, and other medication. The hazards of surgery will also be decreased with reduced time.

1.10. Questions for Study and Review

1. Define perioperative nursing.
2. Discuss the phases of perioperative nursing.
3. Show specific areas within the operating room.
4. Locate and describe the use of furniture and equipment in the operating room.
5. Identify the role of each member of the operating room team.
6. Discuss how environmental layout contributes to aseptic technique.

CHAPTER TWO
INFECTION PREVENTION IN THE OPERATING ROOM

2.1. Learning Objectives

After the completion of this chapter, the learner will be able to:

1. Demonstrate infection prevention techniques.
2. Minimize the risk of transmitting serious infections among patients and service providers.
3. Define aseptic technique.
4. Define sterile technique.
5. Describe the modes of transmission of microorganisms from the source to the susceptible host.

2.2. Introduction

Infection prevention

The infection prevention (IP) practices are intended for use in all types of health care facilities – from large urban hospitals to small rural clinics.

The principles are based on the guidelines issued by Centers for Disease Control and Prevention, CDC (Atlanta, Georgia 1996).

The recommended infection prevention practices are based on the following principles:

- Consider every person potentially infectious and susceptible to infection.
- Washing hands before and after any procedure is the most practical procedure for preventing cross-contamination.
- Donning (wearing) gloves before touching anything potentially infectious and wet such as broken skin, mucous membrane, body fluids, body secretions and excretions, or soiled instruments and other items – or before performing invasive procedures.
- Using personal protective equipment (PPE) to provide barriers, if splashes or spills of any blood, body fluids, secretions or excretions are anticipated.

- Using antiseptic agents for cleansing the skin or mucous membrane prior to surgery, cleaning wounds, or doing handrubs or surgical handscrub.
- Using safe work practices, such as not recapping or bending needles, safely passing sharp instruments, and disposing sharps in puncture resistant containers.
- Processing instruments and other items that come in contact with blood, body fluids, secretions and excretions.
- Routinely cleaning and disinfecting equipment and furniture in patient care areas.
- Disposing contaminated materials and contaminated waste properly.

Proper infection prevention practices are fundamental to quality of care, and essential to protect health care providers, patients, and communities. Particularly in a country such as Ethiopia, where the prevalence of serious infectious diseases such as ***Hepatitis B*** and ***HIV*** is so high, and preventive interventions for both these diseases are minimal, failure to follow proper infection prevention practices puts health care providers, patients and the communities at high risk.

Proper infection prevention practices break the disease transmission cycle (Fig. 2-1: the chain of infection). This is achieved by:

- Reducing the number of infection causing microorganisms present (e.g., simple handwashing, cleaning of instruments);
- Killing or inactivating infection causing microorganisms (e.g., hand washing with a waterless alcohol preparation, decontamination);
- Creating barriers to prevent infectious agents from spreading (e.g., wearing gloves or personal protective equipment); or
- Reducing or eliminating risky practices (e.g., using disposable gloves and syringes)

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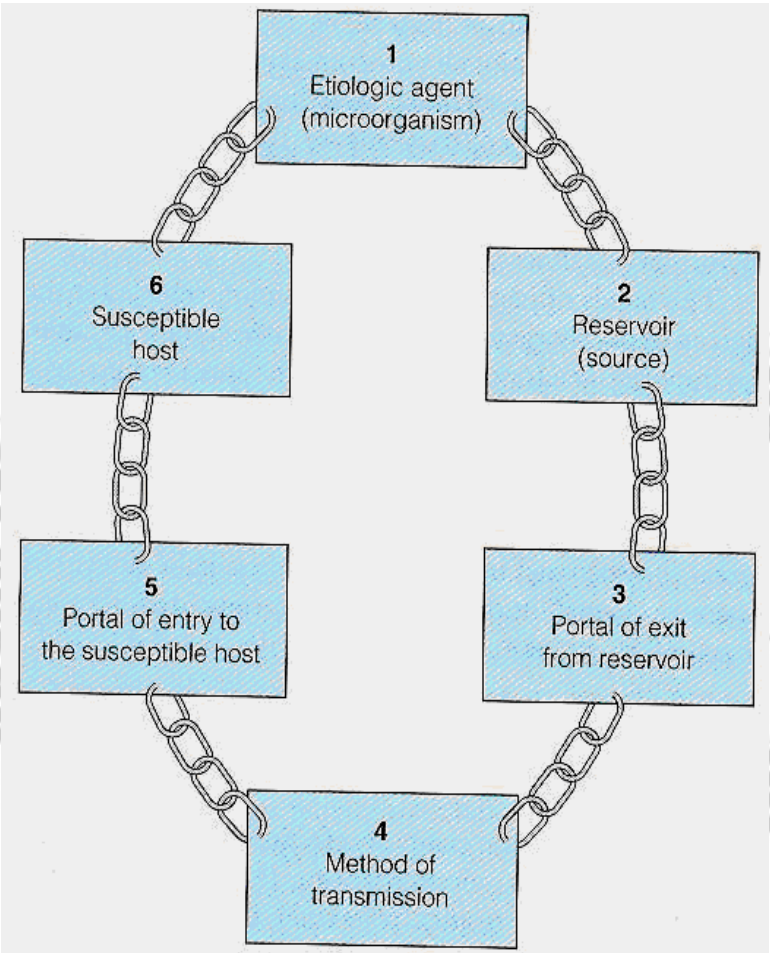


Fig. 2-1. The Chain of Infection

***Source**: Barbara Kozier et al. Fundamentals of Nursing; the Nature of Nursing Practice in Canada, 2004.*

2.3. Hand Hygiene

Proper hand hygiene and the use of protective gloves in the operating room is a key component in minimizing the transmission of disease causing microorganisms and maintaining an infection-free environment.

Appropriate hand hygiene must be carried out:

- Before coming in direct contact with patients
- Before putting on sterile surgical gloves or examination gloves
- After any situation in which hands may be contaminated, such as (handling contaminated objects, including used instruments; touching mucous membranes , blood, body fluids, secretions or excretions except sweats)
- After removing gloves

Hand Hygiene Techniques

Routine Hand washing

The purpose of handwashing is to mechanically remove soil and debris from skin and reduce the number of transient microorganisms.

For appropriate handwashing:

- Thoroughly wet hands
- Apply a hand washing agent (plain soap or detergent)

- Vigorously rub all areas of hands and fingers for 10-15 seconds, paying close attention to fingernails, and areas between the fingers
- Rinse hands thoroughly with clean running water from a tap or a bucket
- Dry hands with personal dry clean towel, paper towel or air dry (using shared towel is not recommended as they quickly become contaminated)

Hand antisepsis

The purpose of hand antisepsis is to remove soil and debris and reduce both transient and resident flora on the hands.

The technique for hand antisepsis is similar to hand washing except that it involves use of soap containing an antimicrobial agent instead of plain soap or detergent.

Hand antiseptic should be done before:

- Examining or caring for highly susceptible patients (e.g., premature infants, elderly patients or those with advanced Acquired Immunodeficiency Syndrome (AIDS), etc.)
- Performing an invasive procedure such as placement of an intravascular device, and
- Leaving the room of patients on Contact Precaution (e.g., Hepatitis A or E), or who have drug resistance infections

Antiseptic Handrub

The purpose of antiseptic handrub is to inhibit or kill transient and resident flora. Use of a waterless, alcohol-based handrub product is more effective in killing **transient** and **resident** flora than antimicrobial handwashing agents or plain soap and water. Antiseptic handrub is quicker and easier to perform, and gives a greater initial reduction in hand flora. This handrub solution contains a small amount of an emollient such as glycerin or sorbitol that protects and softens skin (Infection Prevention Guidelines, Federal Democratic Republic of Ethiopia Ministry of Health, Disease Prevention and Control Department, 2005)

A nonirritating, antiseptic handrub can be made by adding glycerin to alcohol (2 ml glycerin in 100 ml of 60% to 90% ethyl or isopropyl alcohol solution) (Larson 1990; Pierce 1990).

Use 5 ml (about one teaspoonful) for each application and continue rubbing the solution over the hands until it is dry (15 to 30 seconds).

To be effective an adequate amount (5 ml) of antiseptic handrub solution should be used. For appropriate handrub:

- Apply enough alcohol-based antiseptic to cover the entire surface of hands and fingers.
- Rub the solutions vigorously into hands, especially between the fingers and under the nails until dry.
- Do not rinse hands after applying handrub.

Since alcohol based handrubs do not remove soil or organic materials, if hands are visibly soiled or contaminated with blood or body fluids, hand washing with soap and water should be done first. In addition, to reduce the “build up” of emollients on hands after repeated use of alcohol based handrubs, washing hands with soap and water every 5 to 10 applications is recommended (Infection Prevention Guidelines 2005).

2.4. Aseptic and sterile techniques

Aseptic and **sterile** techniques are based on sound scientific principles and are carried out primarily to prevent the transmission of microorganisms that can cause infection. Microorganisms are invisible, but are present in the surrounding environment including in the air, animate and inanimate objects. To prevent infection, all possible measures are taken to create and maintain an aseptic environment for the patient.

The term **asepsis** is used to describe the techniques of keeping the work area and personnel as free from microorganisms as possible with the intent of protecting the patient and the caregiver. The four important steps for the practitioner are:

1. Know what is clean, disinfected, or sterile.
2. Know what is not clean, disinfected, or sterile.

3. Keep clean, disinfected, and sterile items separate from contaminated items.
4. Take immediate action if contamination occurs.

Practices and studies have showed that it is impossible to make the environment free from microorganisms. Although patient care situations and settings vary, basic principles of asepsis dictate the proper course of action to reduce microbial contamination. It is important that the basic principles of asepsis be consistently incorporated into patient care.

Infections in the health care settings may occur in the post operative wound or as a complication unrelated to the surgical site. A postoperative infection is a very serious, potentially fatal complication that may result from a single break in sterile technique. Therefore the basis of prevention is the *knowledge* of *causative agents* and their *controls* as well as the principles of *aseptic* and *sterile* techniques.

Asepsis literally means without infection and it implies the absence of microorganisms that cause infection. It is impossible to exclude all microorganisms from the environment, but for the safety of both patients and caregivers, every effort is made to minimize and control these microorganisms. The methods by which microbial

contamination is prevented in the environment are referred to as *aseptic techniques.*

Sterile technique refers to creating and working within the sterile field. To protect the patient during invasive procedures, microorganisms in the sterile field are kept to an irreducible minimum. The patient is at risk for infection any time tissues are interrupted or instrumentation is introduced into the vascular system. Sterile items should be used to prevent the introduction of pathogens into the patient's body.

People remain the major source of infecting organisms in the environment. Everything on or around a human being is contaminated by the body in some way. The action and interaction of personnel and patients also contribute to the spread of organisms.

Although air is a vehicle for the transmission of microorganisms, direct ***person-to-person contact*** is the most common route of transmission.

Therefore, the risk of infection can be minimized by:

1. Maximizing the patient's normal defenses
2. Avoiding external compromises
3. Controlling or eliminating infectious agents by proper management of the physical environment, including appropriate cleaning, disinfection or sterilization of devices and instruments.

Nurses are in a position to influence positively others' behavior and to change their own behavior through health education. Health education activities have important applications and a common basis in work settings. Health education enables personnel to make changes in their work behavior that promote health or prevent disease.

2.5. Sources of Contamination and Infection

1. Members of the operating team,
2. The patients,
3. All articles used in the wound and in the sterile setup,
4. Dust in the air,
5. Other personnel or visitors in the operating room..

The incidence and type of infections that occur in surgical patients may be the result of:

- A preexisting localized infectious process,
- A systemic communicable disease, or
- An acquired preoperative complication.

Need for Aseptic Technique

Strict aseptic technique is needed at all times in an operating room. Freshly cut living tissue can become infected easily. Therefore, it is essential for the nurse and all members of the operating team to know the common sources of

microorganisms in an operating room and the means by which they reach the sterile field to contaminate it. The nurses must also know how to prevent contamination of a sterile field. Sterile technique is the responsibility of everyone in the operating room.

The principles of sterile technique are applicable, in various measures, to nursing in general. Their value will be demonstrated throughout the nursing career.

2.6. Principles of Sterile Technique

Historical Perspectives of Antisepsis in Surgery

In ancient times demons and evil spirits were thought to be the cause of pestilence and infection. The strange methods used to drive them away were replaced with purification by fire. Heat is still used today as one means of destroying microorganisms.

Not until **Ignaze Semmelweis** (1818-1865) advocated the value of hand washing and **Louis Pasteur** (1822-1895) taught his germ theory did physicians begin to study the cause of infections and the means of controlling them. **Robert Koch** (1843-1910), who isolated the tubercle bacillus, advocated the use of bichloride of mercury as an antiseptic. These events triggered interest in antisepsis.

Pasteur's work was pursued by **Joseph Lister** (1827-1912), the English surgeon who became known as the father of

modern surgery. Since the relationship between bacteria and infection was then known, he searched for a chemical that could combat bacteria and surgical infections. He was the first to use a carbolic solution on dressings, which reduced the mortality of his patients to some degree. Lister believed that infections were airborne. In 1865, he started to use carbolic spray in the operating room (OR). He then used it in the wound, on articles in contact with the wound, and on the hands of the surgical team. The result was a notable decrease in mortality, but the carbolic solution caused wound necrosis and skin irritation in both patients and team members. The solution also had an anticoagulant effect, which made homeostasis difficult. Not all surgeons were convinced of the value of surgical antiseptics. It was not until 1879, at a medical meeting in Amsterdam, that Lister's antiseptic principles of surgery were truly accepted by the medical profession.

German surgeons played a role in the transition from antisepsis to asepsis. **Gustav Neuber** (1850-1932) introduced mercuric chloride in 1886 to clean his apron, and he advocated scrubbing the furniture with disinfectant and wearing gowns, boots, and caps. He eventually sterilized everything that came in contact with wounds. The first steam sterilizer was introduced in **Germany in 1886**. Surgeons began to accept that all things coming into contact with a

wound should be sterile. Aseptic technique evolved through the refinement of surgical technique, the use of a controlled environment, precise housekeeping methods, and aseptic precautions to protect patients and personnel from infection.

The principles of sterile technique are applied in various ways. If the principle itself is understood, the applications of it become obvious.

The Sterile Technique

Sterile technique is the basis of modern surgery. The patient is the center of the sterile field, which includes the personnel wearing sterile attire and the areas of the patient, operating bed, and furniture that are covered with sterile drapes. Strict adherence to the recommended practices of sterile technique reflects the surgical conscience of the perioperative team and is mandatory for the safety of the patient and personnel in the environment. The principles of sterile technique are applied under the following conditions:

- In preparation for an invasive procedure by sterilization of necessary materials and supplies
- In preparation of the sterile team to handle sterile supplies and intimately contact the surgical site by scrubbing, gowning, and gloving
- In the creation and maintenance of the sterile field, including skin preparation and draping of the patient

- In the maintenance of asepsis throughout the surgical procedure
- In terminal sterilization and disinfection at the conclusion of the surgical procedure

If these principles are understood, the need for their application becomes obvious.

Basic Rules of Asepsis

The outcome of a patient's surgical experience is influenced by the knowledge and application of aseptic technique by the perioperative staff. All persons involved in the preparation and performance of surgical procedures are responsible for providing a safe environment for the patient. This is best achieved by maintaining asepsis and limiting the risk of contamination.

To prevent infections, aseptic technique is practiced in the OR. This is implemented through the creation and maintenance of a sterile field. The center of the sterile field is the site of the surgical incision. Inanimate items in the sterile field include surgical items and equipment that have been sterilized by appropriate sterilization methods.

There are specific principles that the team members should understand to practice aseptic technique. Unless these principles are followed, the safety of the patient is

compromised, and the potential for postoperative infection is increased. In addition to following the principles of aseptic techniques, the surgical team is responsible for following the guidelines established by the Occupational Safety and Health Administration (OSHA) and the Association of PeriOperative Registered Nurses to protect the patient and the team from exposure to blood borne pathogens.

Principles of Basic Aseptic Technique in the Operating Room

- All materials that enter the sterile field must be sterile.
- Sterile team members must wear only sterile gowns and gloves and they keep well within the sterile field.
- Unsterile persons don't reach over sterile surfaces.
- Talking during surgery is kept to a minimum
- Bacteria travel on airborne particles and will enter the sterile field with excessive air movement and currents. Therefore, movement is kept to a minimum during surgery.
- Sterile team members face each other. They face the sterile field.
- Sterile personnel handle only sterile equipment. Unsterile personnel handle only unsterile equipment.
- If a sterile item comes in contact with an unsterile item, it is contaminated.

- If the sterility of an item is questionable, the item is considered contaminated.
- Sterile tables are sterile only at table height.
- Gowns are sterile in front from the ***axillary line*** to the ***waist***, and the sleeves to 2-3 inches above the elbow.
- The edges of anything that encloses sterile contents are considered unsterile.
- Moisture carries bacteria from a non sterile surface to a sterile surface.
- A wide margin of safety must be maintained between the sterile and unsterile field.
- Contaminated items should be removed immediately from the sterile field.
- The sterile field is created as close as possible to the time of use.
- Destruction of the integrity of microbial barriers results in contamination.
- Sterile persons keep contact with sterile areas/goods to a minimum.
- Some operative areas cannot be sterile. Steps are taken to keep contami-nation to a minimum.
- No compromise of sterility.

Standard Precautions

As established by the CDC and enforced by Occupational Safety and Health Administration (OSHA), standard

precautions protect health care workers from contact with blood and body fluids of all patients. Standard precautions include considerations for the following:

- All body fluids
- Handwashing
- Barrier clothing
- Handling of used patient care equipment and linen
- Occupational exposure to blood-borne pathogens
- Patient placement

Recommendations for standard precautions have been modified to reflect routes of transmission. The CDC-identified routes of transmission include, airborne, droplet, and contact precautions. The potential for becoming infected through skin exposure depends on:

- Localization
- Duration of contact
- The presence of skin lesions on the hands, and
- Immune status of the host.

Standard precautions supplement other recommended practices for environmental control and are the minimum precautions for all invasive procedures. An ***invasive*** procedure involves any entry into body tissues or cavities in any procedural environment. Standard precautions are in effect for any procedure during which bleeding occurs or for which the potential for bleeding or exposure to body substances exists.

Application of Sterile Technique

Sterile technique prevents the transfer of microorganisms into body tissue during invasive procedures. Freshly incised or traumatized tissue can become infected easily, regardless of the area of the body. Intact skin and mucous membranes are the body's first line of defense against infection, but a portal for microorganisms is created if the integrity of the skin is interrupted.

Surgical procedures are performed under sterile conditions; contamination with microorganisms is prevented to maintain sterility throughout the procedure. A sterile field is created around the site of incision into tissues or the site of introduction of sterile instruments into a body orifice. Conversely, all material and equipment used during a surgical procedure are terminally decontaminated and sterilized after use with the assumption that every patient is a potential source of infection for other persons.

It is essential that all operating room team members know the common sources and mechanisms of contamination by microorganisms in the perioperative environment. Sterile technique is the particular responsibility of everyone caring for the patient in the OR. All members of the OR team must

be vigilant in safeguarding the sterility of the sterile field. Any contamination must be remedied immediately.

2.7. Questions for Study and Review

1. Describe four principles on which the recommended infection prevention practices are based.
2. How do you achieve proper infection prevention practices?
3. What is the purpose of antiseptic handrub?
4. Why do we recommend washing hands which are contaminated with organic matter before applying antiseptic handrub?
5. Define the terms asepsis and sterile techniques.
6. Mention at least six basic rules of asepsis.
7. List down the route of infection transmission as identified by CDC.

CHAPTER THREE
ATTIRE, SURGICAL SCRUB, GOWNING, AND GLOVING

3.1 Learning objectives

After the completion of this chapter, the learner will be able to:

1. State the purpose of operating room attire (cloth).
2. Identify the components of appropriate OR attire
3. Describe surgical scrub.
4. Write down the purposes of surgical scrub.
5. List at least three antimicrobial agents used for the surgical scrub.
6. Demonstrate surgical scrubbing, gowning and gloving.
7. Describe the sterile parameters of the surgical gown.
8. Mention the types of gloves available in Ethiopia.
9. Show the techniques of removing gown and gloves after the procedure.

3.2. Introduction

Historical Background

The evolution of special operating room ***attire*** as an adjunct to asepsis paralleled the development of ***aseptic*** and ***sterile*** techniques in the latter half of the nineteenth century. Many surgeons of that time continued to perform surgical procedures while wearing street clothes under pus- and bloodencrusted aprons despite the expansion of germ theory knowledge.

One of the earliest mentions of specific OR attire appeared in a nurse's training handbook that advised the nurse to bathe before a surgical procedure, to take a carbolic bath before laparotomy, and to wear long sleeves and a clean apron for the surgical procedure. Long sleeves were recommended for anesthesia providers and circulators to reduce the shedding of microorganisms and to protect them from contact with body substances.

The first use of caps and sterile gowns occurred in Germany, while principles of antiseptic surgery were still being debated (Joseph Lister (1827 – 1912). In some ORs bacteria-laden,

infection-causing woolen suits were replaced by OR garb made of sterilizable material that lessened the introduction of pathogenic microorganisms into the wound. The use of sterile gowns antedated the routine use of caps, gloves, and masks; although in 1883 ***Gustav Neuber*** (1850-1932) insisted that team members wear caps also.

Emphasis on personal cleanliness promoted acceptance of special OR attire, but these standards were not rigidly practiced in all hospitals. Various styles of turbans and shower cap-style head coverings were worn from about 1908 to the 1930s, when hair was generally found to be an attraction for and shedder of bacteria.

Rubber surgical gloves were introduced, not to protect the patient, but to protect the wearer's hands from the harsh, irritating antiseptic solutions. Disposable latex gloves, introduced about 1958, were welcome innovation that saved countless hours of daily glove reprocessing, repairing, and sterilizing.

Gauze masks were advocated by ***Miculicz*** in 1897, when the droplet theory of infection was demonstrated. However, it was not until 1926, when wound infections yielded the same organism as found in the nasopharynx of the surgeons and nurses, that masks became obligatory.

By the 1930s and 1940s, scrub dresses began to replace nurse's regular uniforms, heretofore worn under the sterile gown. Observers in the OR wore gowns, caps, and masks. In 1950, as restrictions became more rigid, OR personnel were required to change shoes when entering the OR suite and to wear only those shoes when within the suite. Shoe covers became popular both as a method of keeping the shoes clean and for preventing dissemination of soil from the shoes.

3.3. Operating Room Attire

The techniques employed by operating room personnel when preparing themselves to take part in sterile procedures can be varied. However, the fundamental principles of aseptic technique **must** be adhered to when scrubbing, gowning and gloving prior to surgical intervention.

Purpose: the purpose of operating room ***attire*** is to provide effective barriers that prevent the dissemination of microorganisms to the patient and protect personnel from blood and body substances of patients.

Definition: operating room attire consists of body covers, such as trousers, shirts, head covers, masks, gowns, gloves and shoe covers, as appropriate. Each has an appropriate

purpose to combat sources of contamination external (exogenous) to the patient.

Dress code: the operating room should have specific written policies and procedures for proper attire to be worn within the operating room suite. The policies include:

- Dressing rooms are located in the unrestricted area of the OR suite.
- Only freshly laundered, clean attire is worn in the OR
- OR attire should not be worn outside the operating room suite.
- Impeccable personal hygiene is emphasized (frequent and thorough handwashing, removal of jewelry, keeping fingernails short and clean, denial of access to team members with acute infections …).
- Comfortable, supportive shoes should be worn to minimize fatigue and for personal safety.
- Masks and head covers should be changed between patients.

Components of Attire*:* body cover, head cover, shoe cover, mask, apron, gloves, gown, eyewear /goggles and face shield.

Criteria for Operating Room Attire: attire should be:

- An effective barrier to microorganisms.
- Designed and composed to minimize microbial shedding.

- Made of closely woven material void of dangerous electrostatic properties.
- Resistant to blood, aqueous fluids and abrasion to prevent penetration by microorganisms.
- Designed for maximal skin coverage.
- Hypoallergenic, cool, and comfortable
- Made of a pliable material to permit freedom of movement.
- Able to transmit heat and water vapor to protect the wearer.
- Colored to reduce glare under lights.
- Easy to don and remove.

3.4. Surgical Scrub

The *Surgical scrub* is the process of removing as many microorganisms as possible from the hands and arms by mechanical washing and chemical antisepsis before participating in a surgical procedure.

The surgical scrub is done just before gowning and gloving for each surgical procedure. Despite the mechanical action and the chemical antimicrobial component of the scrub process, skin is never rendered sterile.

Microbiology of the Skin

Skin harbors two types of microorganisms:

A. Transient organisms:

- Acquired by direct contact from a contaminated source
- Usually loosely attached to the skin surfaces
- Are almost completely removed, by thorough washing with soap or detergent and water.
- If introduced into the surgical wound, could cause a serious postoperative infection

B. Resident organisms:

- Found below the skin surface in hair follicles, and in sebaceous and sweat glands.
- They are more adherent and more resistant to removal.
- Most resident bacteria are nonpathogenic, unless the skin is broken or the patient is debilitated in some way.
- They can cause an infection if they are carried into the deeper tissues of the body.

The goal of the surgical prep is to get rid the skin of most microbes so that the risk of surgical wound contamination is reduced.

In freeing the skin of as many organisms as possible, two processes are used:

Mechanical - this process removes soil and transient organisms with friction.

Chemical - this process reduces resident flora and inactivates microorganisms with an antimicrobial or antiseptic agent.

Purpose of Surgical Scrub

To remove soil, debris, natural skin oils, hand lotions and transient microorganisms from the hands and forearms of sterile team members. More specifically, the purposes are as follows:

- To decrease the number of resident microorganisms on skin to an irreducible minimum
- To keep the population of microorganisms minimal during the surgical procedure by suppression of growth
- To reduce the hazard of microbial contamination of the surgical wound by skin flora

Scrub Sink

- Adequate scrubbing and handwashing facilities should be provided for all operating team members.
- The scrub room is adjacent to the OR for safety and convenience.
- The sink should be deep and wide enough to prevent splash.
- Scrub sinks should be used only for scrubbing or handwashing.

- They should not be used to clean or rinse contaminated instruments or equipment.

Equipment

- Soft brush or disposable sponges
- Soap or detergent
- Running water

Antimicrobial scrub agents

Various antimicrobial (antiseptic) detergents are used for the surgical scrub. The following are characteristics of the scrub agent:

- Broad-spectrum antimicrobial
- Fast acting and effective
- Nonirritating and nonsensitizing
- Prolonged action (i.e., leaves an antimicrobial residue on the skin to temporarily prevent growth of microorganisms)
- Independent of cumulative action

Although the action of the agent is important in relation to its efficacy, mechanical friction and effort while scrubbing are equally important.

Antiseptic and antimicrobial skin scrub products are chosen from among those approved by the Food and Drug Administration (FDA) for surgical hand scrub. Each product has a specific antimicrobial agent. Antiseptics alter the physical or chemical properties of the cell membrane of

microorganisms, thus destroying or inhibiting cellular function. The following is list of antimicrobial scrub agents:

- Chlorhexidine Gluconate
- Iodophors
- Triclosan
- Alcohol
- Hexachlorophene
- parachlorometaxylenol

Preparation for the Surgical Scrub

General preparations

1. The skin and nails should be kept clean and in good condition
2. Finger nails should not reach beyond the fingertip to avoid glove puncture.
3. Fingernail polishing should be avoided, since nail polish can potentially crack and/or peel off as a result of which pathogens may be embedded underneath.
4. Artificial devices should not cover natural fingernails.
5. All Jewelry should be removed from the fingers and wrists *(Because Jewelry harbors microorganisms).*

Preparation Immediately Before the Scrub

1. Inspect the hands for cuts and abrasions. Skin integrity of the hands and forearms should be intact (without lesions and cracks)
2. Be sure all hair is covered by headgear including the ears
3. Adjust the disposable mask snugly and comfortably over the nose and mouth
4. Clean eyeglasses if worn. Adjust protective eyewear or the face shield comfortably in relation to the mask.
5. Adjust water to a comfortable temperature.

Surgical Scrub Procedure

The length of the surgical scrub varies depending on the following factors:

- The frequency of scrubbing
- The agent used and
- The method

A vigorous 5-minute scrub with a reliable agent may be as effective as a 10-minute scrub done with less mechanical action. Prolonged scrubbing raises resident microbes from deep dermal layer so that they can be removed from the skin and therefore is more effective. Care should be taken not to abrade the skin during the scrub process. Denuded areas allow the entry of microorganisms.

Activities which bring individuals in contact with soil or other dirt need longer periods of scrubbing. For example, persons who participate in gardening, painting, mechanics etc. need longer time for scrubbing. Likewise, one who scrubs less frequently such as once every 3 to 4 days will need a longer scrub than a person who scrubs daily.

When gloves are removed at the end of the surgical procedure, the hands are contaminated and should be immediately washed. Resident microorganisms multiply rapidly in the warm, moist environment under the gloves.

Methods of Scrubbing

There are two methods of scrub procedures.

1. The counted brush-stroke method or
2. The timed scrub method

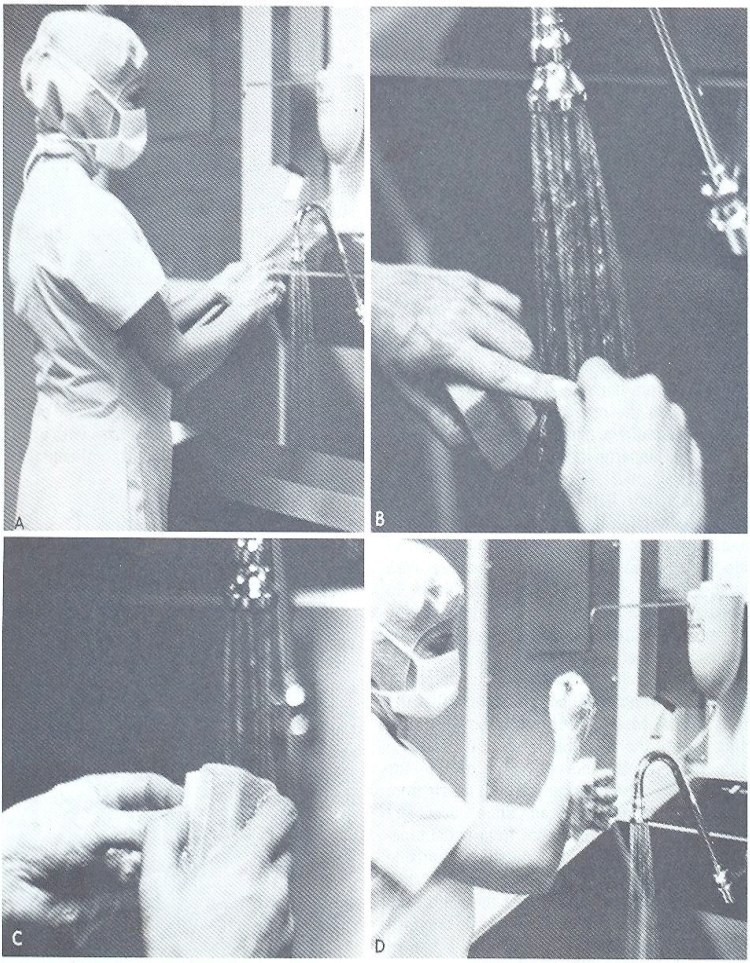
If properly executed, they are both effective, and each exposes all surfaces of the hands and forearms to mechanical cleansing and chemical antisepsis. One should think of the fingers, hands, and arms as having four sides or surfaces.

In cases of a numbered stroke method, a certain number of brush strokes are designated for each finger, palm, back of hand, and arm.

The alternative method is the timed scrub, and each scrub should in average last 5-minute consisting of the following:

1. Locate scrub equipment (brushes, soaps, nail cleaners) which are available at each scrub station.
2. Remove Jewelry (watch and rings)
3. Wash hands and arms with soap and water (Fig 3-1 A)
4. Clean subungual areas with a nail file (Fig 3-1 B)
5. Start timing – scrub each side of each finger, between the fingers, and the back and front of the hand for 2 minutes (Fig 3-1 C)
6. Proceed to scrub the arms, keeping the hand higher than the arm at all times. This prevents bacteria – laden soap and water from contaminating the hand (Fig 3-1 D)
7. Wash each side of the arm to 2 inches (5cm) above the elbow for 1 minute.
8. Repeat the process on the other hand and arm, keeping hands above elbows at all times. If at any time the hands touch any thing except the brush and or soap, the scrub must be lengthened by one minute for the area that has been contaminated.
9. Rinse hands and arms by passing them through the water in one direction only, from fingertips to elbow (Fig 3-1 E). Do not move the arm back and forth through the water.

Proceed to the operating room suite holding hands above elbow


A
B
C
D

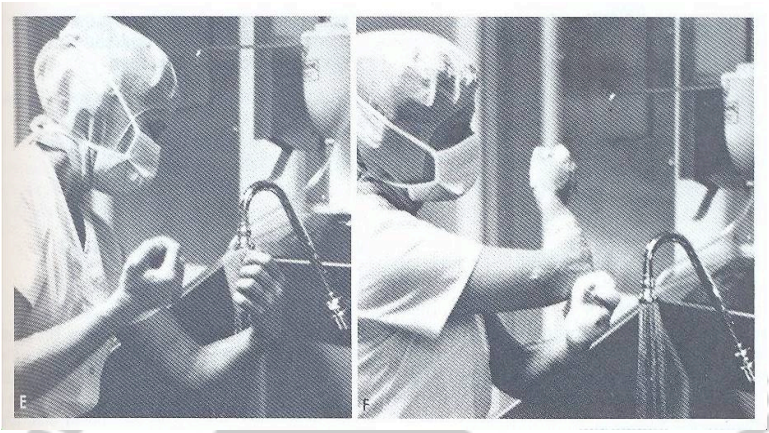


Fig. 3-1. Technique for hand and arm scrub. **A**, Hands are washed as usual.**B**, Subungual area is cleaned. **C**, The timed scrub begins. **D**, After the hand is scrubbed, the arm is scrubbed and timed separately. **E**, The scrub extends to 3 inches above the elbow. **F**, the hand and arm are rinsed by passing them through the water in one direction only. (From Joanna R Fuller, 1986, page 38)

Drying the Hands and Arms

After scrubbing, the hands and the arms should be thoroughly dried before the sterile gown is donned to prevent contamination of the gown by strike-through of organisms from wet skin.

The sterile gown, in the package, is folded before sterilization with the inside out so that the bare scrubbed hands will not contaminate the sterile outside of the gown. A reusable or disposable towel for drying the hands is placed on top of the gown during packaging.

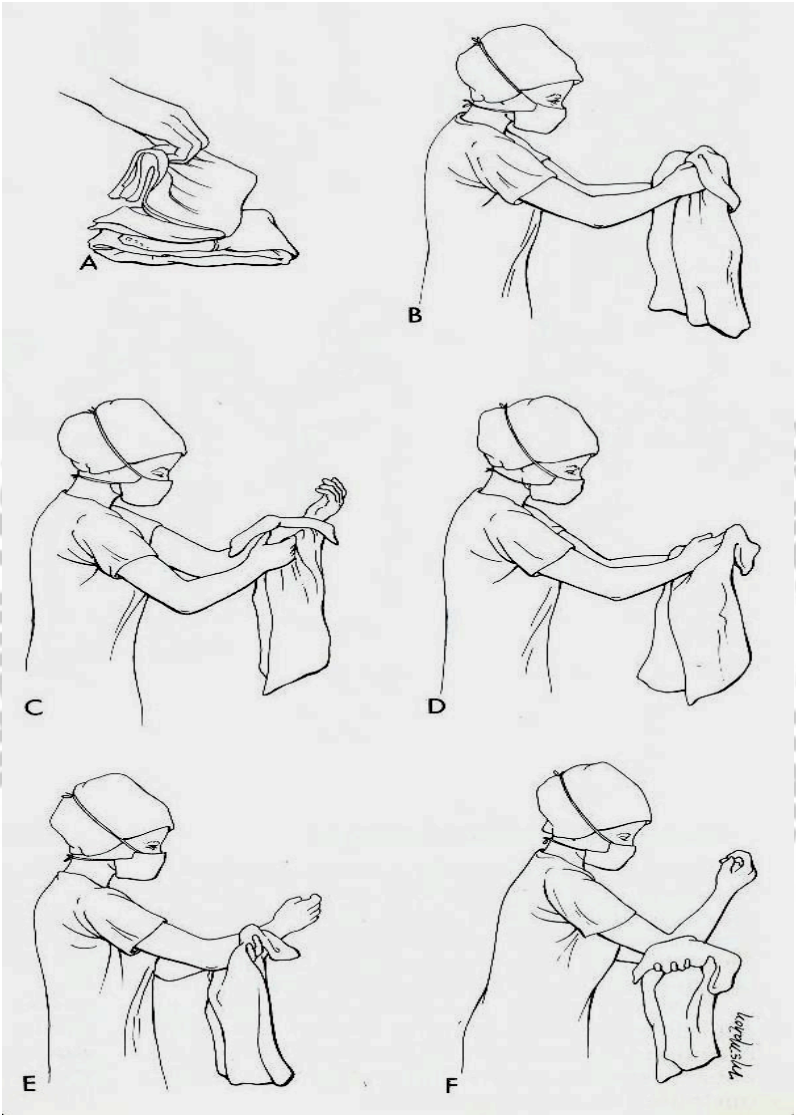


Fig. 3-2. (A to F) Steps of drying the hands and arms

Procedure of Drying Hands

1. Pick up a sterile towel from the open package put on the table, being careful not to drip water on the gown beneath it (Fig 3-2 A).
2. Use one end of the full-length opened towel only to dry one hand. Use a blotting motion as you dry (Fig 3-2 B).
3. Rotate the arm as you proceed to dry it, working from wrist to elbow. Do not allow the towel to contact the scrub suite (Fig 3-2 C)
4. Once the arm is dried, bring the dry hand to the opposite end of the towel and begin drying the other hand (Fig 3-2 D).
5. Dry the hand and arm using the blotting rotating motion (Fig 3-2 E).
6. Proceed to the elbow. Discard the towel into its proper place (Fig 3-2 A).

3.5. Gowning and Gloving

The sterile gown is put on immediately after the surgical scrub. The sterile gloves are donned immediately after gowning.

Purpose

A sterile gown and gloves are worn to exclude skin as a possible contaminant and to create a barrier between the sterile and nonsterile areas.

General Considerations

1. The scrub person gowns and gloves himself/herself and then may gown and glove the surgeon and his assistants.
2. Gown packages preferably are opened on a separate table from other packages to avoid any chance of contamination from dripping water.
3. Avoid splashing water on scrub attire during the surgical scrub because moisture may contaminate the sterile gown.
4. The circulator will assist by pulling the gown up over the shoulders and tying it.

Gowning

- The purpose of wearing sterile gown is in order to provide sterile field
- There are two methods of sterile gowning:-
    - Gowning self and
    - Gowning another
- As the gown is donned:

- The practitioners must ensure that they touch the inside of the gown only and that both arms are inserted into the sleeves of the gown together.
- The circulating person should assist the scrubbed person by securing the gown's back ties.

Fig. 3-3. Scrub person, putting on gown, gently shake out folds, then slips arms into sleeves without touching sterile outside of gown with bare hands.

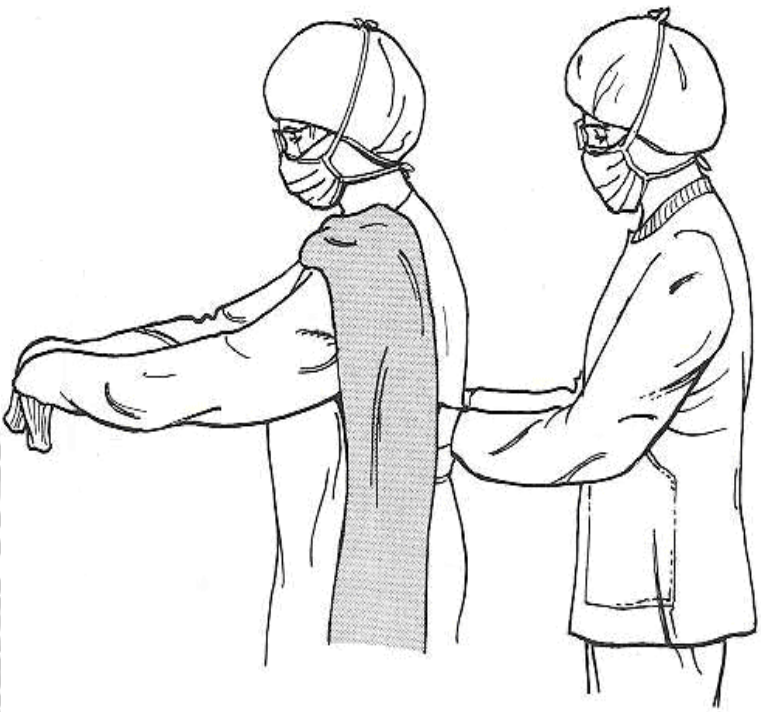


Fig. 3-4. Circulator nurse, pulling gown on scrub person without touching the outside of the gown.

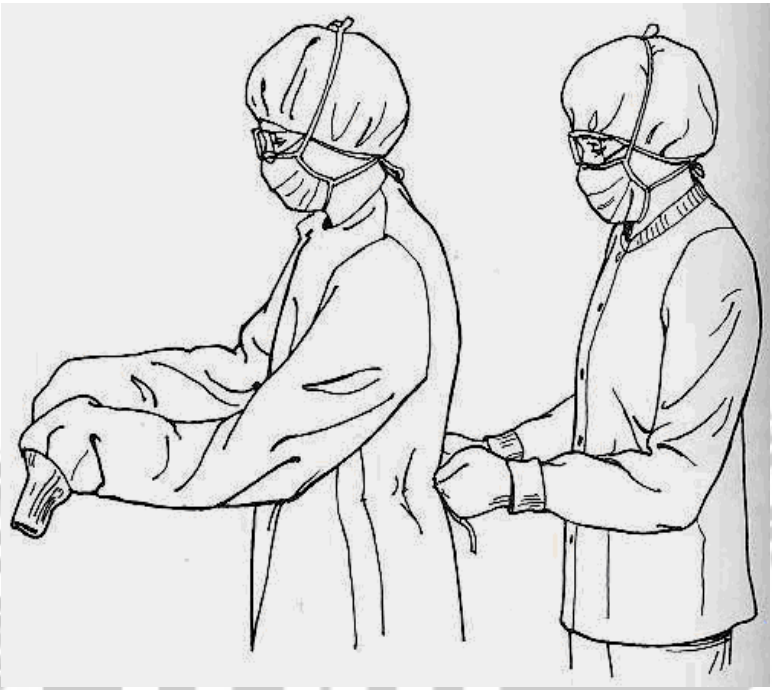


Fig. 3-5. Circulator nurse completes pulling on scrub person's gown, secures ties on inside of back, and closes fastener at neck.

Gloves and Gloving

This is the process of wearing gloves. Hand hygiene coupled with the use of protective gloves, is a key component in minimizing the spread of disease-producing microorganisms and maintaining an infection-free environment. In addition, understanding when sterile or high-level disinfected gloves are required and, equally important, ***when they are not*****,** can

reduce costs, while maintaining safety for both patient and caregiver.

- Sterile gloves may be put on in two ways:
  - By the closed gloving technique or
  - By the open gloving technique

Types of gloves available in Ethiopia

- Sterile or high-level disinfected surgical gloves
- Clean examination gloves, and
- Utility gloves

Wear gloves:

- When there is a reasonable chance of hands coming in contact with blood or other body fluids, mucous membranes or nonintact skin.
- Before performing invasive medical procedures (e.g., inserting a urinary catheter);
- Before handling contaminated waste items or touch contaminated surfaces

General principles for gloves use

- All staff should wear appropriate gloves prior to contact with blood, body fluids, secretions or excretions from any client/patient.
- A separate pair of gloves must be used for each client/ patient to avoid cross contamination.

- Wearing gloves does not replace the need for handwashing.

A. Closed Technique

1. Lay the glove palm down over the cuff of the gown. The fingers of the glove face toward you Fig. 3-6 A.
2. Working through the gown sleeve, grasp the cuff of the glove and bring it over the open cuff of the sleeve Fig. 3-6 B and C.
3. Unroll the glove cuff so that it covers the sleeve cuff Fig. 3-6 D and E.
4. Proceed with the opposite hand, using the same technique Fig. 3-6 F, G, H and I.
5. Never allow the bare hand to contact the gown cuff edge or outside glove.

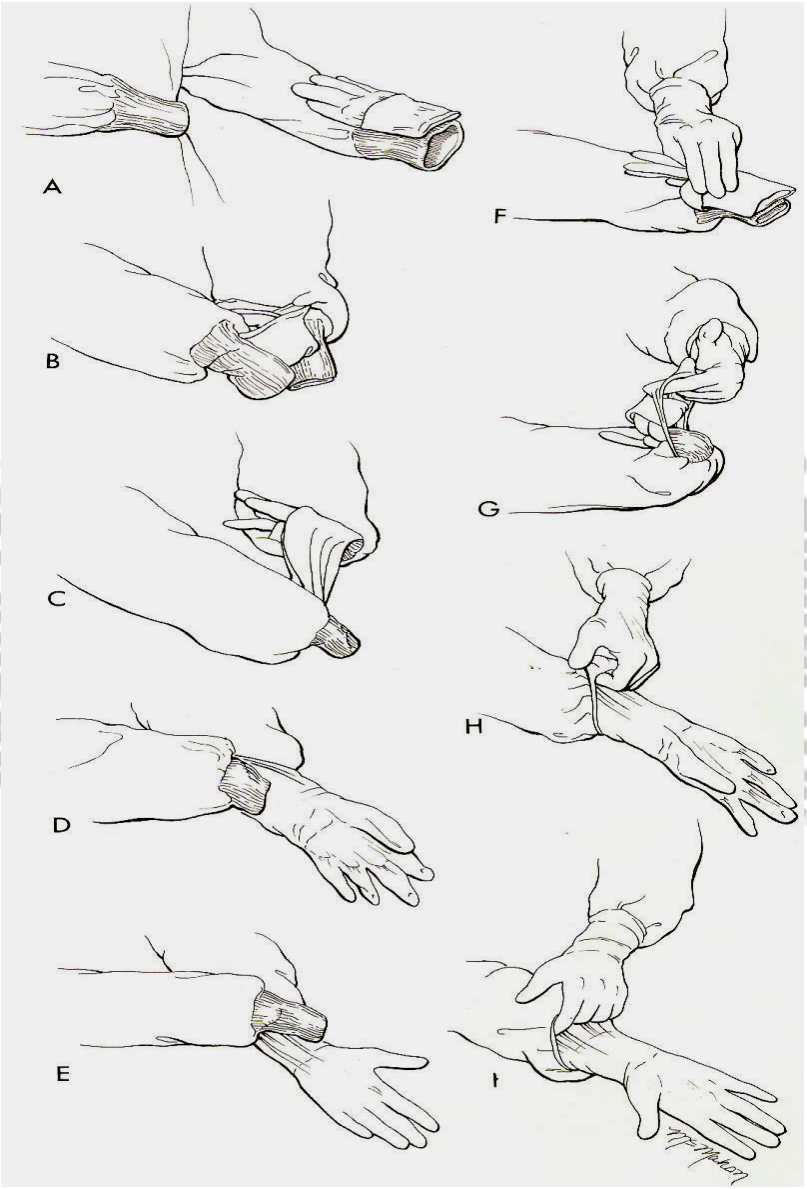


Fig. 3-6. (A to I) Closed technique self-gloving.

B. Open Technique

1. Pick up the glove by its inside cuff with one hand. Do not touch the glove wrapper with the bare hand
2. Slide the glove onto the opposite hand. Leave the cuff down
3. Using the practically gloved hand, slide the fingers into the outer side of the opposite glove cuff.
4. Slide the hand into the glove and unroll the cuff. Do not touch the bare arm as the cuff is unrolled.
5. With the gloved hand, slide the fingers under the outside edge of the opposite cuff and unroll it gently, using the same technique.

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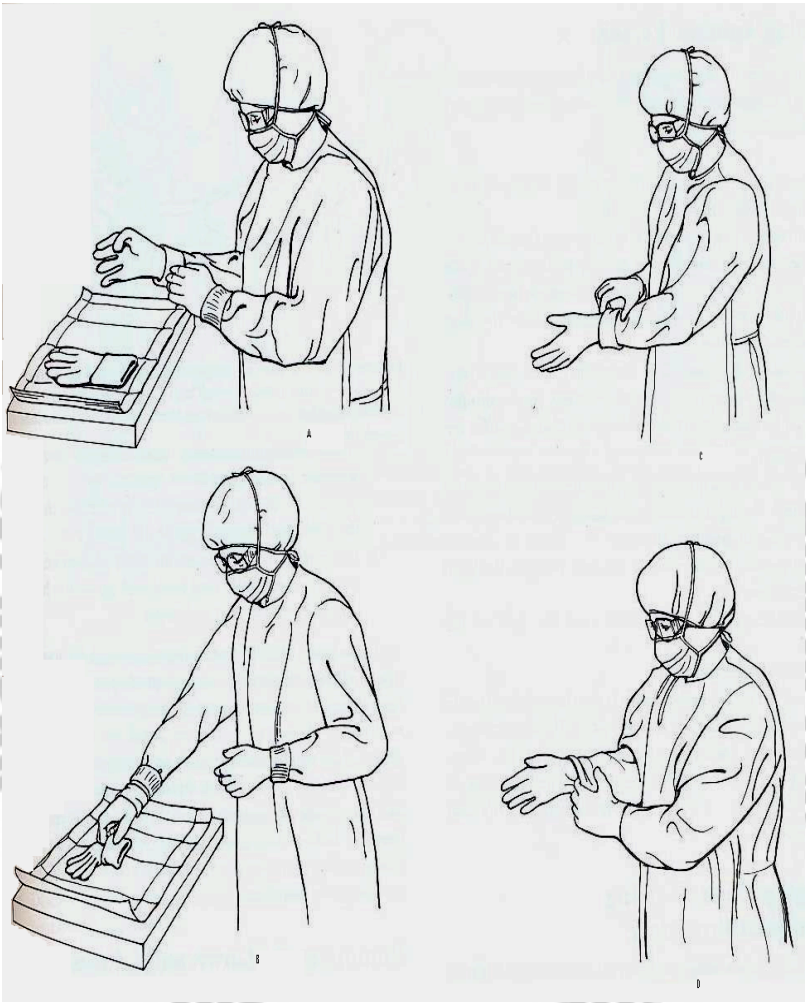

Fig. 3-7. (A to D) the open technique of putting on sterile gloves.

3.6. Techniques of Removing the Gown and Gloves

The gown is always removed before the gloves at the end of the surgical procedure.

Removing the Gown

The gown is removed as follows:

1. Grasp the right shoulder of the loosened gown with the left hand and pull the gown downward from the shoulder and off the right arm turning the sleeves inside out (Fig.3 – 7 A)
2. Turn the outside of the gown away from the body with flexed elbows (Fig. 3 – 7 B)
3. Grasp the left shoulder with the right hand and remove the gown entirely, pulling it off inside out (Fig. 3 - 7, C)
4. Discard the gown in a laundry hamper or in a trash receptacle (if disposable)

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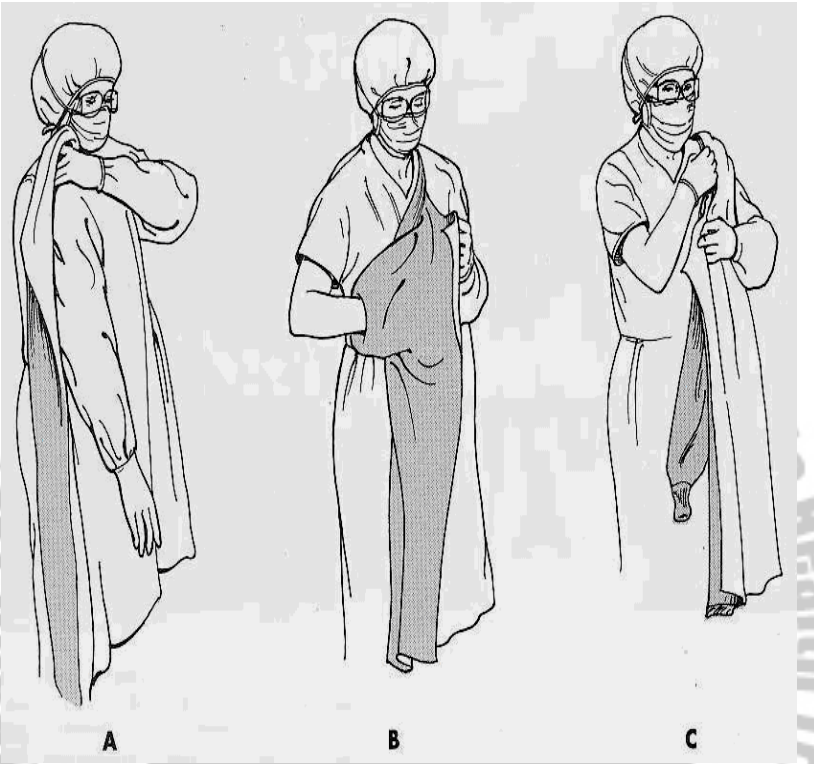

Fig. 3-8. (A to C) sequence of scrub person removing soiled gown at the end of a surgical procedure. Clean arms and scrub suite are protected from contaminated outside of gown.

Removing the Gloves

The cuffs of the gloves usually turn down as the gown is pulled off the arms. A glove-to-glove, then skin-to-skin technique is used to protect the clean hands from the contaminated outside of the gloves. The gloves should be

removed so that the bare skin does not come into contact with the outside of the soiled gloves.

Procedure

1. Grasp the cuff of the left glove with the gloved fingers of the right hand and pull it off inside out.
2. Slip the ungloved fingers of the left hand under the cuff of the right glove and slip it off inside out.
3. Discard the gloves in an appropriate receptacle.
4. Wash hands.

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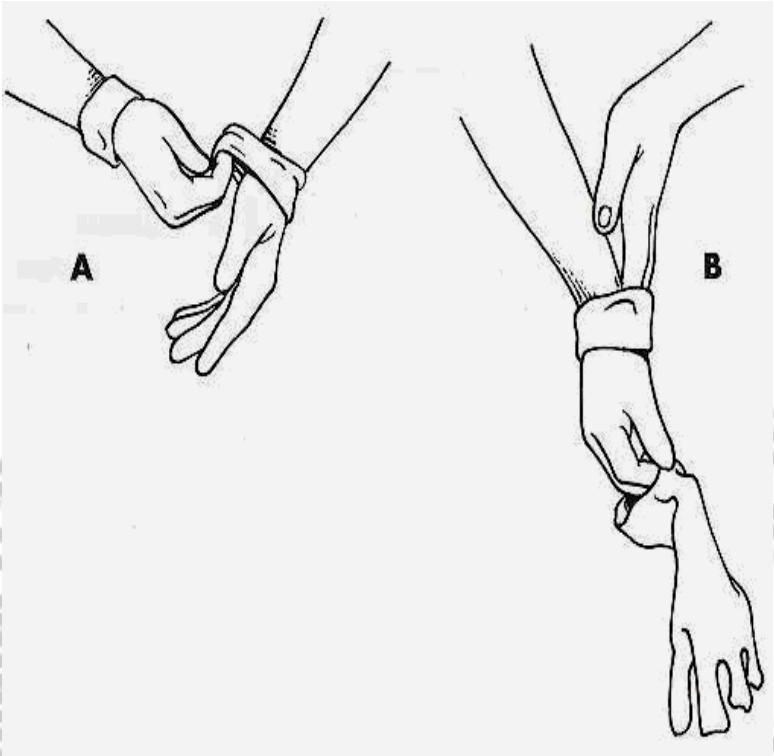

Fig. 3-9. (A and B) sequence of scrub person removing soiled gloves at the end of the surgical procedure. Firstly glove-to-glove technique (A), then skin-to-skin technique (B) is used to protect clean hands from contaminated outside of gloves.

3.7. Distribution of Sterile Goods

Sterile goods are packaged so as to allow personnel to unwrap the item without contaminating it.

Methods of Distribution

Sterile items are packaged so as to allow personnel to unwrap the item without contaminating it. There are three popular methods of distribution.

A. Large linen packs
- Place in the center of the back table and unfolded using the prescribed technique
- Pull layers towards the person opening the pack so that the hand and arm do not cross over the sterile area
- Handle only the edge of the linen
- Follow the same procedure for the final fold.

B. Small packages are opened by grasping the corners of the wrapper and bringing them back over the hand.

C. A third method of distribution is the **peel-back** wrapper/ package. Supplies are contained within the package, which is peeled apart to expose the sterile item (3.10). Solutions such as sterile saline or water are poured into basins carefully so as to avoid splashing.

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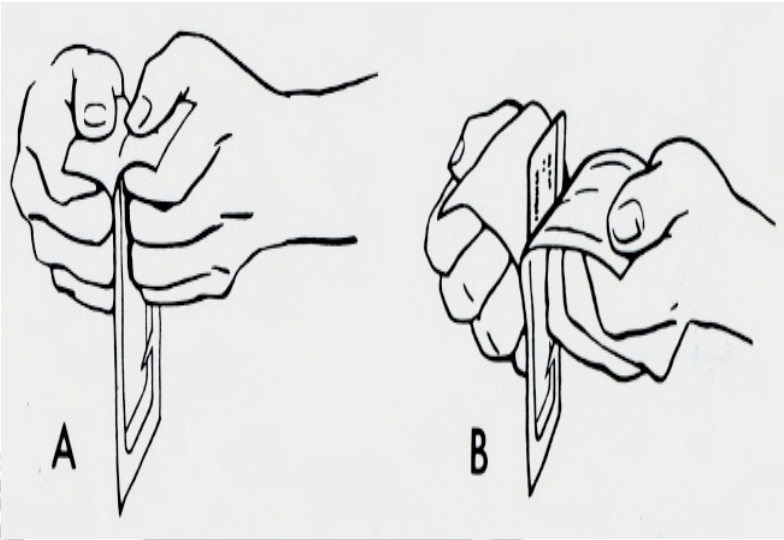

Fig. 3-10. (A and B) a peel-back package

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Fig. 3-11. Scrub person taking contents from suture packet opened and held by circulator. Scrub person avoids touching unsterile outer wrapper.

Fig. 3-12. Flipping a packet of suture to the sterile field.

3.8. Cleaning the operating room and instruments

Cleaning is the process that physically removes all visible dust, soil, blood or other body fluids from inanimate objects including the OR floor and walls to reduce risks of disease transmission in the OR.

Cleaning can be made in daily (at the beginning of the day's activity, in between the cases, and at the end of the day) as

well as on weekly basis. Areas to be considered are walls, floors, ceilings, storage shelves, all furniture and equipment in the OR including the operating bed/table.

Following a surgical case, after the patient has left the OR, the nurse gathers all of the instruments (including soiled and not used) and terminally decontaminate in the washer (terminal decontamination).

1. All linen is placed in the linen hamper.
2. Disposable items in the trash
3. Large equipment is wiped with a disinfectant and placed in its usual storage
4. The floors are cleaned with disinfectant
5. The stationary equipment (operating table, electrosurgical power unit, etc) are all wiped clean with disinfectant.
6. Any visible soil is washed with disinfectant.

3.9. Questions for Study and Review

1. Why is special surgery/OR attire necessary?
2. Describe surgical scrub.

3. Identify the components of personal protective equipment.
4. Demonstrate how to perform surgical scrubbing
5. Demonstrate how to dry the hands and the arms properly.
6. Mention at least six rules of asepsis.
7. Mention the types of gloves available in Ethiopia.
8. Show the techniques of removing gown and gloves after the procedure.

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CHAPTER FOUR
STERILIZATION

4.1. Learning Objectives

After the completion of this chapter, the learner will be able to:

1. Define the term sterilization
2. List three methods of sterilization
3. Describe the process for preparing an item for sterilization
4. Identify the primary hazards associated with each type of sterilization
5. Discuss monitoring the sterilization process

4.2. Introduction

Procedures for sterilizing equipment and supplies are based largely on principles of microbiology. There are two common methods by which items can be sterilized (physical and chemical).

Sterilization is the process by which all pathogenic and nonpathogenic microorganisms, including spores, are killed. It is the only process that ensures that an item is free from all microbes. Sterilization can be achieved with physical or chemical methods. Physical methods generally rely on moist or dry heat. Chemical methods on the other hand, use gaseous or liquid chemicals.

4.3. Methods of Sterilization

Chemical Methods

Ethylene oxide (EO or ETO) gas is used to sterilize items that are sensitive to heat or moisture. EO must have direct contact with microorganisms on or in the items to be sterilized. EO is highly flammable and explosive in air and therefore, must be used in an explosion-proof sterilizing chamber in a controlled environment. When handled properly, EO is reliable and safe for sterilization, but the toxic emission and residues of EO present health hazards to healthcare providers and patients. Its effectiveness depends on four parameters which include:

- Concentration of EO gas,
- Temperature,
- Humidity, and
- Time (duration of gas exposure)

Gluteraldehyde 2% and formaldehyde 8% can also be used as a chemical sterilizer (refer Figure 5-1).

Physical Methods

Heat is a dependable physical agent for the destruction of all forms of microbial life, including spores. It may be used moist or dry. The most reliable and commonly used method of sterilization is *steam under pressure.*

A. Moist heat (steam under pressure) or ***autoclave***

This method is the least expensive, most efficient, and least time-consuming method and is the method of first choice, whenever possible. For the steam process to achieve sterility,

the time, temperature, pressure, and moisture must be present in correct proportions. An imbalance in these components can result in failure of the process.

The minimum time for the entire cycle in the autoclave sterilizer is 25 to 30 minutes at 121 to 132 degrees Celsius (refer Figure 4.1).

However, it is possible, but not recommended to speed up the process in the autoclave sterilizer by:

- Increasing the temperature,
- Decreasing the time, and
- Processing the item unwrapped.

This method is called ***flash/high-speed pressure*** sterilization. Because the delicate balance among processing time, temperature, pressure, and moisture are changed, the probability that sterility will be achieved is reduced.

For this reason, flash sterilization should be used only in an emergency (e.g., a surgical instrument has been dropped, no alternative exists, and the instrument is needed immediately).

Advantages of Steam Sterilization

- It is the easiest, safest, and surest method of on-site sterilization
- Steam is the fastest method; its total time cycle is the shortest
- Steam is the least expensive and most easily supplied agent.

- Most sterilizers have automatic controls and recording devices that eliminate the human factor from the sterilization process
- Steam leaves no harmful residue. Many items such as stainless steel instruments withstand repeated processing without damage.

Disadvantages of Steam Sterilization

- Precautions must be used in preparing and packaging items, loading and operating the sterilizer, and drying the load.
- Items need to be clean, free of grease and oil, and not sensitive to heat
- Steam must have direct contact with all areas of an item. It must be able to penetrate packaging material, but the material must be able to maintain sterility
- The timing of the cycle is adjusted for differences in materials and sizes of loads; these variables are subject to human error.

B. Dry Heat

By this method, the items to be sterilized are subjected to heated air in an enclosed oven or container. This method is usually reserved for sterilizing powders, oils, sharps, sponges, and bandages. The major disadvantages of dry heat are that it penetrates materials slowly and unevenly.

4.4. Sterility Indicators and Control Monitors

It is necessary to have a reliable, inexpensive method for checking the effectiveness of a sterilizing process.

- Packages wrapped for sterilization are sealed with indicator tape.
- Tape used on packs to be steam sterilized has temperature sensitive areas that change color when exposed to high temperatures.
- Tape used on packs to be gas sterilized has areas that change color upon exposure to the used (EO). Other indicators, in the form of paper strips or gas vials, are also available for insertion within the package. These indicators are called *process monitors*. It is important to note that these indicators reveal *only* that the pack has undergone a sterilization process. It does not indicate that the item is sterile.

The most efficient method of testing sterility is with *biological controls.*

- A highly resistant, nonpathogenic, spore-forming bacteria, contained in a glass vial or impregnated onto a strip of paper, is placed in the load to be sterilized.
- For steam sterilization, the dry spores of the bacteria Bacillus *stearothermophilus* are used; gas sterilization uses Bacillus *subtilis.*

- The vial or strip is recovered at the end of the sterilization process and cultured. This process is time-consuming and the results may not be known for several days, but it is a very reliable method of testing the efficacy of a sterilization process.

4.5. Shelf Life

The length of time an item can be considered sterile is referred to as the ***shelf life***.

Sterility is event related; it is not time related unless the package contains unstable components such as drugs or chemicals. Storage conditions are established to maintain the integrity of the package. An item is considered sterile on the basis of the following events:

- Handling of the package during transport and storage (i.e., the prevention of contamination and physical damage.)
- Integrity, type, and configuration of packaging material.
- Condition of storage.

Most commercially sterilized products are considered sterile indefinitely or as long as the integrity of the package is maintained. An expiration date put on the label by the manufacturer indicates the maximum time the manufacturer can guarantee product stability and sterility on the basis of test data approved by the FDA.

4.6. Integrity of Packaging Material and Handling

The method of sterilization establishes the type of packaging material that may be used. Shelf life is affected by the:

- Permeability and density of the material,
- Type of closure used, and
- Method by which the package is handled

The following are considerations regarding the integrity of packaging materials:

- An item is no longer considered sterile after an accidental puncture, tear, or rupture of the package
- Squeezing or crushing a package may force air out and draw unsterile air in, thus contaminating the contents.
- The accidental wetting of a package contaminates the contents. It is necessary to avoid the following:
    - Handling the package with moist or wet hands
    - Handling the package with soiled gloves
    - Placing the package on a wet surface
- Commercially packaged, sterilized items are usually considered sterile until the package is opened or damaged or the stability of the product becomes outdated.

Dust Cover

A sealed, airtight plastic bag protects a sterile package from dust, dirt, lint, moisture, and vermin during storage. After sterilization and immediately following aerating or cooling to room temperature, infrequently used items may be sealed in plastic 2 to 3 mil thick. A dust cover will protect the integrity of the package.

Storage Conditions

The maintenance of sterility is related to the event and is not based on time. How sterile packages are handled and stored is as important as how long they can remain sterile.

The following guidelines are helpful in maintaining the sterility of a package during storage:

- Storage areas are clean and free of dust, lint, dirt, and vermin. Routine cleaning procedures are followed for all areas in the perioperative environment.
- All sterile items should be stored under conditions that protect them from the extremes of temperature and humidity.
- Packages should be allowed to cool to room temperature before being put into storage to avoid condensation inside the package.

- Peel pouches should be stored on their sides to minimize the pressure from items stacked on top of them.
- For open shelving, the highest shelf should be at least 18 inches (46 cm) below the ceiling and 8 to 10 inches (20 to 25 cm) above the floor. Closed cupboard are preferred.
- Sterile storage areas should have controlled traffic patterns.

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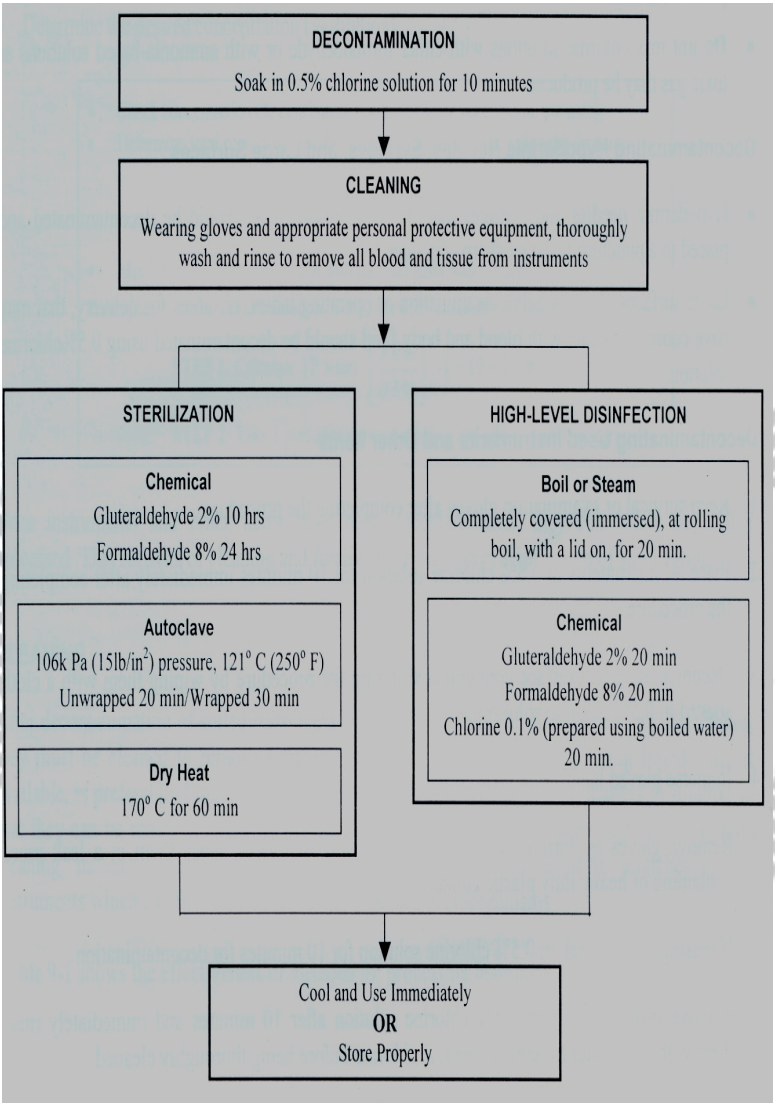

Fig. 4-1. Key Steps in Processing Contaminated Items.

4.7. Questions for Study and Review

1. Define sterilization.
2. Discuss the methods of sterilization.
3. Which method of sterilization is the method of first choice whenever possible?
4. Describe flash/high-speed pressure sterilization.
5. List three advantages of steam sterilization.
6. Mention some of the items that are advised to sterilize by dry heat.
7. How do you test/check the sterilization of a package?

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CHAPTER FIVE

DISINFECTION

5.1. Learning Objectives:

After completing this chapter, the learner will be able to:

1. Define the word disinfection
2. Identify the factors that influence disinfectant effectiveness
3. Mention the guidelines for the use of instrument disinfectants
4. Identify at least three types of disinfectants
5. Discuss the three levels of disinfection
6. Prepare dilute solution from concentrated solution.

5.2. Introduction

Terminal decontamination, disinfection, and sterilization are the procedures carried out for the destruction of pathogens on items at the end of use for patient care during a surgical procedure. Methods and procedures for disinfection vary according to the intended use of the disinfected item. Personal protective equipment should be worn while using chemical disinfecting agents.

Disinfection eliminates pathogenic microorganisms on inanimate objects, with the exception of bacterial spores. This is generally achieved in health care settings by the use of liquid chemicals or boiling.

5.3. Factors that influence the effectiveness of disinfectant

These include the following:

A. ***Nature of the item***. The crevices, joints, and hinges, the more difficult it is to disinfect.
B. ***Number and type of microorganisms present on the object***. The higher the level of the item's contamination, the difficult it is to disinfect. Some microbes are more difficult to kill than others.
C. ***Amount of soil or organic matter present.*** Soil protects microbes and may inactivate the disinfectant solution.
D. ***Contact time.*** Disinfection requires direct contact with the agent for a specific time.
E. ***Concentration of solution.*** The more concentrated the solution has, the greater is its killing capacity. The solution must be used at the concentration specified by the manufacturer to be most effective. Therefore, the manufacturer's dilution instructions must be followed.

5.4. Classification of Patient Care Items

Earle H. Spaulding developed a classification system in 1968 to determine the appropriate processing method to attain the desired level of disinfection required for patient care

items. This system was adopted and later modified by the Centers of Disease Control and Prevention (CDC).

A. Critical items must be sterile because they enter sterile tissue, break the mucosal barrier, or come into contact with the vascular system. Examples include surgical instruments, catheters, needles, implants etc.

B. Semicritical *items* come into contact with nonintact skin and mucous membranes and require high-level disinfection, although they may also be sterilized. Examples include respiratory therapy equipment, anesthesia equipment, bronchoscopes, colonoscopies, gastroscopes, sigmoidoscopes, and cystoscopes.

C. Noncritical *items* are used in contact only with intact skin. Intermediate or low-level disinfection is adequate. Examples include blood pressure cuffs, furniture, linens, bedpans, and eating utensils.

5.5. Levels of Disinfection

Disinfectants vary in their ability to kill microorganisms. The levels of disinfection described are low, intermediate, and high.

High-level disinfectants are effective against:

- All vegetative bacteria,
- Viruses,
- Fungi, and
- Tuberculosis/TB

Most high level disinfectants have a demonstrated level of activity against bacterial spores. High-level disinfectants are used primarily for such semicritical items as:

- Laryngoscopes
- Respiratory therapy and anesthesia equipment
- Flexible fibroptic endoscopes

Intermediate-level disinfectants are more powerful and kill more resistant microorganisms than low-level disinfectants. In addition to vegetative bacteria, fungi, and lipid-involved viruses, they are effective against *Mycobacterium tuberculosis* and nonlipid viruses. They are not effective against resistant bacterial spores. Chlorine, iodophors, phenolics, and alcohol belong to this group.

Low-level disinfectants kill most vegetative bacteria, fungi, and lipid-enveloped viruses, but do not kill spores or nonlipid viruses. They are less active against the *Mycobacterium tuberculosis* and some gram-negative rods, such as *pseudomonas.* These disinfectants are typically used to wipe down items that will contact only intact skin or for environmental surface disinfection.

5.6. Methods of Disinfection

Many products and methods are used to disinfect instruments. A few are described below.

Chemical Disinfectants

Formaldehyde (37% aqueous; 8% alcohol)

- Kills microorganisms by coagulating protein in the cells
- The solution is effective at room temperature
- It has a pungent odor and is irritating to the eyes and nasal passages
- Its vapors can be toxic

Hydrogen Peroxide interacts with cell membranes, enzymes, or nucleic acids to disrupt the life functions of microorganisms.

Alcohol. Ethyl or isopropyl, 70% to 95%, kills microorganisms by coagulation of cell proteins.

Chlorine Compounds kill microorganisms by the oxidation of enzymes.

Glutaraldehyde kills microorganisms by denaturation of protein. It is most commonly used in a 2% solution.

Iodophore, a complex of free iodine with detergent, kills microorganisms through a process of oxidation of essential enzymes.

Physical Disinfectants

Boiling / pasteurization - is a method of thermal disinfection that involves immersion of pre-cleaned items into water heated to approximately 75^{o} to 100^{o}c for 30 min.

Boiling method:

- Cannot be depended on to kill spores
- Is a nontoxic, high-level disinfection process

Guidelines for Boiling

1. Never put fecally contaminated instruments in the boiler
2. Instruments to be boiled should totally be submerged
3. Timing should be counted when the water comes to its full boil
4. Change the water in the boiler every day or every two days since as the water boils it leaves a scum of impurities which will stain the inside of the boiler and spoil the instrument.
5. Boil instruments separately
6. Inspect the boiler from time to time and keep it in good condition.
7. Do necessary repairs before anything goes really wrong.

Guidelines for the Use of Instrument Disinfectants.

- Use the disinfectant in a well-ventilated room
- Make sure that items have been thoroughly cleaned before attempting disinfection.
- Disassemble all removable parts of the item.
- Thoroughly dry the item before placing it in the disinfectant
- Mix the disinfectant as recommended on the label. Improper mixing can lead to injury of the patient, the instrument, and the person working with the solution. Read the directions for specific precautions.
- Completely immerse all parts of the item in the solution, ensuring that all lumens, creases, joints, and channels are in contact with the solution and that no trapped air bubbles are present.
- Do not leave the item in the disinfection solution for an undetermined time. The solution may damage the item and may also become a source of contamination.
- Close the container to prevent evaporation of the solution.
- Thoroughly rinse the item in at least two fresh rinse solutions to insure adequate removal of the disinfectant (use sterile water and then alcohol)
- Thoroughly dry the disinfected item with a sterile towel, and place it in a dry, covered container until ready for use.

Table 5-1. Activity of Disinfectants in Addition to being Bactericidal, Pseudomonacidal, and Fungicidal

Disinfectant	Activity Level	Virucide		Immersion Time	Housekeeping	Hazards
		HIV	HBV†	Tuberculocide		
Chemicals*						
Alcohol, 70%-95%						
Ethyl	Intermediate	Yes	Yes	15 minutes	Yes	Flammable
Isopropyl	Intermediate	Yes	No	15 minutes	Yes	Flammable
Chloride compounds	Low	Yes	Yes	N/A	Yes	
Formaldehyde						
37% aqueous	High‡	Yes	Yes	15 minutes	No	Toxic fumes
8% in alcohol	High‡	Yes	Yes	10 minutes	No	Toxic fumes
Glutaraldehyde, 2%	High§	Yes	Yes	45-90 minutes§	No	Irritating fumes
Iodophors						
450 ppm	Intermediate	Yes	Yes	20 minutes	Yes	
100 ppm	Low	No	No	N/A	Yes	
Mercurial compounds	None	No	No	N/A	No	Bacteriostatic only
Phenolic compounds	Low	Yes	No	20 minutes	Yes	Skin irritant
Quaternary ammonium	Low	Yes	No	N/A	No	
Physical						
Boiling water	Low	Yes	No	N/A	No	
Ultraviolet irradiation	Low	Yes	No	N/A	Air and water	Skin and eye irritant

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5.7. Care of Instruments

Surgical instruments are expensive and represent a major investment. Surgical procedures have become more

complicated and intricate and, as a result, instruments have become more complex, more precise in design, and more delicate in structure. Abuse, misuse, inadequate cleaning or processing, or rough handling can damage and reduce the life expectancy of even the most durable instrument, and the cost of repair or replacement becomes unnecessarily high. Instruments can last for many years if they are handled or maintained properly. Careless handlings of the surgeon's tools (instruments) results in frustration for the surgeon and great financial loss to the department or hospital.

The skills of the surgeon are hampered if he/she is forced to work with inferior equipment such as:

- Scissors that are dull,
- Clamps that won't stay closed over bleeding vessels
- Needle holders that pop open to release the needle into the wound
- Forceps whose teeth don't mesh (fit) together properly.

It is the nurse's responsibility to care for the proper handling and maintenance of the instruments.

Guidelines which help increase the lifespan of instruments and ensure their proper function include:

During surgery:

- Handle instruments gently

- Don’t throw them into basins
- Keep the sharp surfaces of cutting instruments away from other metal surfaces that could dull them.
- Don’t soak them in saline solution
- When feasible, wipe blood to cake and dry on the instrument.
- Use the correct instrument for the job at hand, e.g.,
- Heavy needles will damage delicate needle holders
- Wire sutures must be cut with wire cutters, not suture scissors
- Use towel clips and not hemostats for securing drapes

After surgery:

- Decontaminate/clean instruments as soon as possible. Don't allow blood to dry on them.
- Use accepted techniques when sterilizing instruments.
- Separate sharp or delicate instruments from others when processing.
- Process all instruments from a surgical case, whether or not they have been used.

NB. *Lubrication* of instruments before they are wrapped is important. Lubrication in water - soluble antimicrobial solution prevents hinges and box locks from becoming stiff and protects sharp surfaces of the metal.

5.8. Decontaminating and Cleaning of Instruments

Decontamination is the first step in handling used instruments and supplies. Immediately after use, all instruments should be placed in an approved disinfectant such as 0.5% chlorine solution for 10 minutes to inactivate most organisms, including HBV and HIV (ARON 1990; ASHCSP 1986). It is a process that makes inanimate objects ***safer*** to be handled by staff ***before*** cleaning.

Decontamination is performed in a designated area, not in the OR, immediately after completion of the surgical procedure.

For achieving satisfactory decontamination:

- Make fresh solution every morning, or more often if the solution becomes cloudy.
- Use plastic, non-corrosive container for decontamination. This prevents sharp instruments from getting:
  - Dull due to contact with metal containers
  - Rusted due to chemical reaction that can occur between two different metals when placed in water.
- **Do not** soak metal instruments in water for more than one hour, even if they are electroplated, to prevent rusting.
- **Do not** mix chlorine solutions with either formaldehyde or with ammonia-based solutions as toxic gas may be produced.

Decontaminating Used Instruments and Other Items

- Keep surgical or examination gloves after completing the procedure
- Place all instruments in 0.5% chlorine solution for 10 minutes immediately after completing the procedure
- Decontaminate any surface contaminated during the procedure by wiping them with a cloth soaked in 0.5% chlorine solution
- Immerse gloved hands in 0.5% chlorine solution
- Remove gloves by turning inside out. If disposing of gloves, place them in a leak proof plastic container
- If reusing gloves, soak in 0.5% chlorine solution for 10 minutes
- Remove instruments from 0.5% chlorine solution after 10 minutes and immediately rinse them with sterile cool water to remove residual chlorine before being thoroughly cleaned
- Two buckets can be used in the procedure areas or operating rooms, one filled with 0.5% chlorine solution and the other one with water, so instruments can be placed in the water after 10 minutes to help prevent corrosion

Steps for Making a 0.5% Chlorine Solution for Decontamination

A 0.5% chlorine solution (Barakina/hypochlorite sodium) can be made from readily available liquid or powder chlorine. Liquid chlorine is available under different brand names in different concentration for example “Ghion” available in Ethiopia contains 5% chlorine. Manufacturers of widely used brand Cedex, contains 5% chlorine.

Formula for Making a Dilute Solution from Concentrated Solutions

- Determine the concentration (% concentration) of the chlorine solution
- Determine the desired concentration (% dilution)

- Check concentration (% concentrate) of the chlorine product you are using.
- Determine total parts water needed using the following formula:

$$\text{Total Parts (TP) water} = \left[\frac{\%\ \text{Concentrate}}{\%\ \text{Dilute}}\right] - 1$$

- Mix 1 part concentrated bleach with the total parts water required.

Example: Make a dilute solution (0.5%) from 5% concentrated solution

STEP 1: Calculate TP water: $\left[\frac{5.0\%}{0.5\%}\right] - 1 = 10 - 1 = 9$

STEP 2: Take 1 part concentrated solution and add to 9 parts water.

Once instruments and other items have been decontaminated, they can safely be further processed. This consists of cleaning and finally either high-level disinfection or sterilization.

Cleaning is the removal of all visible dust, soil, and other foreign material from the instruments. The primary ***purpose*** of cleaning is to decrease the amount of organic matter and soil and the associated microorganisms on instruments. Instruments can be cleansed manually or with a machine.

Table 5-2. Effectiveness of Methods for Processing Instruments.

Method	Effectiveness (Kill or remove microorganisms)	End point
Decontamination	Kills HBV and HIV and most microorganisms	10 minute soak
Cleaning (water only)	Up to 50%	Until visibly clean
Cleaning (soap and rinsing with water)	Up to 80%	Until visibly clean
High-Level Disinfection	95% (does not inactivate some endospores)	Boiling, steaming, or chemical for 20 minutes

Sterilization	100%	Autoclave, chemical, or dry heat for recommended time

(**Source:** Infection Prevention Guidelines for Health care Facilities in Ethiopia; MoH, 2005).

5.9. Questions for Study and Review

1. Briefly describe the difference between decontamination and disinfection.
2. List three factors that influence the effectiveness of disinfectants.
3. Explain the three levels of disinfection.
4. What is the difference between physical and chemical disinfection?
5. How do you achieve satisfactory decontamination?

CHAPTER SIX
GENERAL SURGICAL INSTRUMENTATION

6.1. Learning objectives

At the end of this chapter, the learner will be able to:

1. Identify the use and function of each type of surgical instrument
2. Demonstrate the appropriate methods for passing each type of instrument
3. Explain the rationale and methods of decontamination of instruments
4. Demonstrate the assembly and passing of sharp instruments.

6.2. Introduction

Surgical instrumentation is critical to the surgical procedure. The performance of the OR team is enhanced when team members ***know*** each ***instrument*** by ***name,*** how each item is ***safely handled***, and how each is ***used.*** Preparing the instrument for appropriate processing will prolong its use in patient care and decreases the costs for repair and replacement.

6.3. Classifications of Instruments

As an aid in memorizing instrument names, it is helpful to know the basic categories of instruments. They are classified according to their ***function,*** and most fall into one of ***four*** groups.

A. Cu*tting and Dissecting*

Cutting instruments have sharp edges/points. They are used to dissect, incise, separate, penetrate, or excise tissue. These instruments should be kept separate from other instruments, and the sharp edges should be protected during cleaning, sterilizing, and storing. To prevent injury to the handler and damage to the sharp edges, proper precautions are necessary to take during the handling and disposing of all sharps, blades, or scalpels. This group includes: scissors, knives, biopsy punches, scalpels (blades), saws, osteotomes, drills and curettes, needles, chisels, etc.

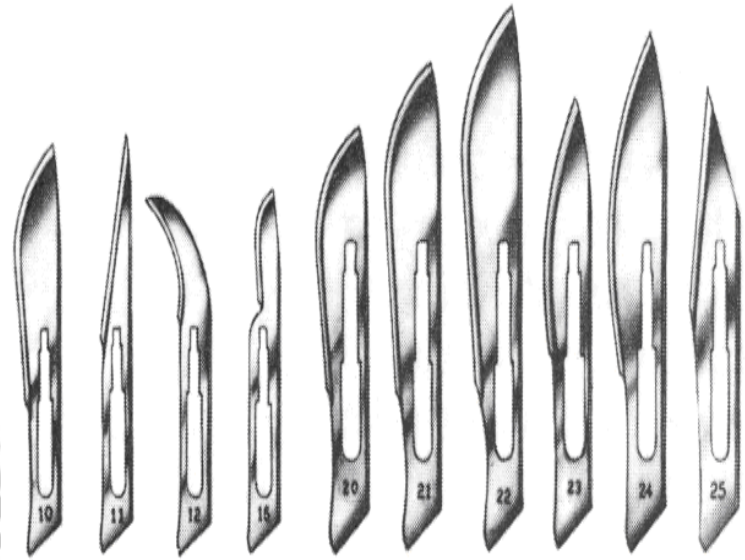

Fig. 6-1. Different size surgical blades (scalpels)

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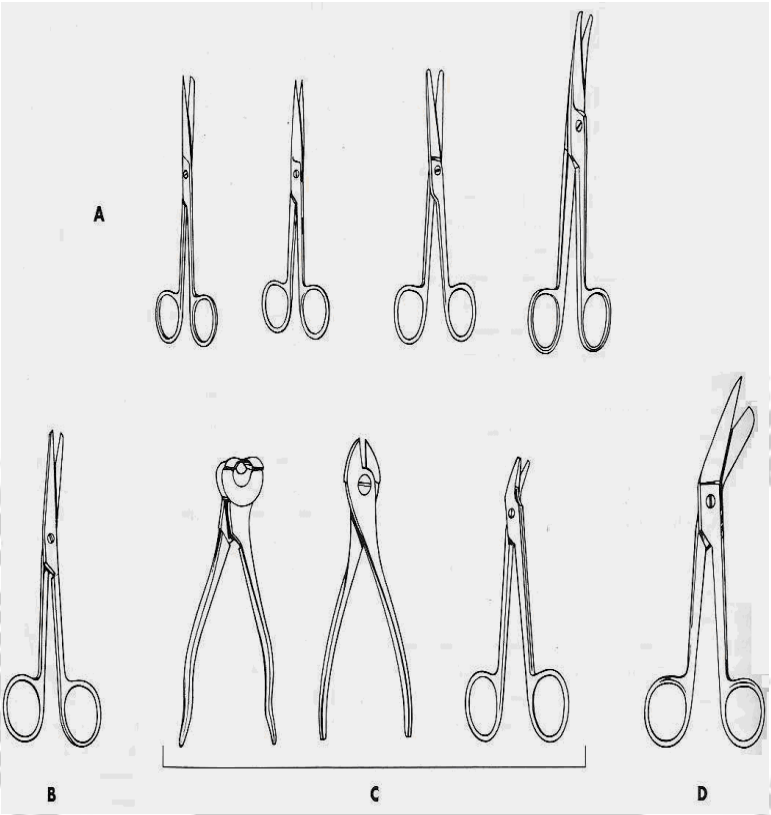

Fig. 6-2. Scissors. A, Tissue scissors. Blades may be straight or curved and either pointed/blunt, pointed/pointed, or blunt/blunt. B, Suture scissors. C, Wire cutters and scissors. D, Dressing/bandage scissors.

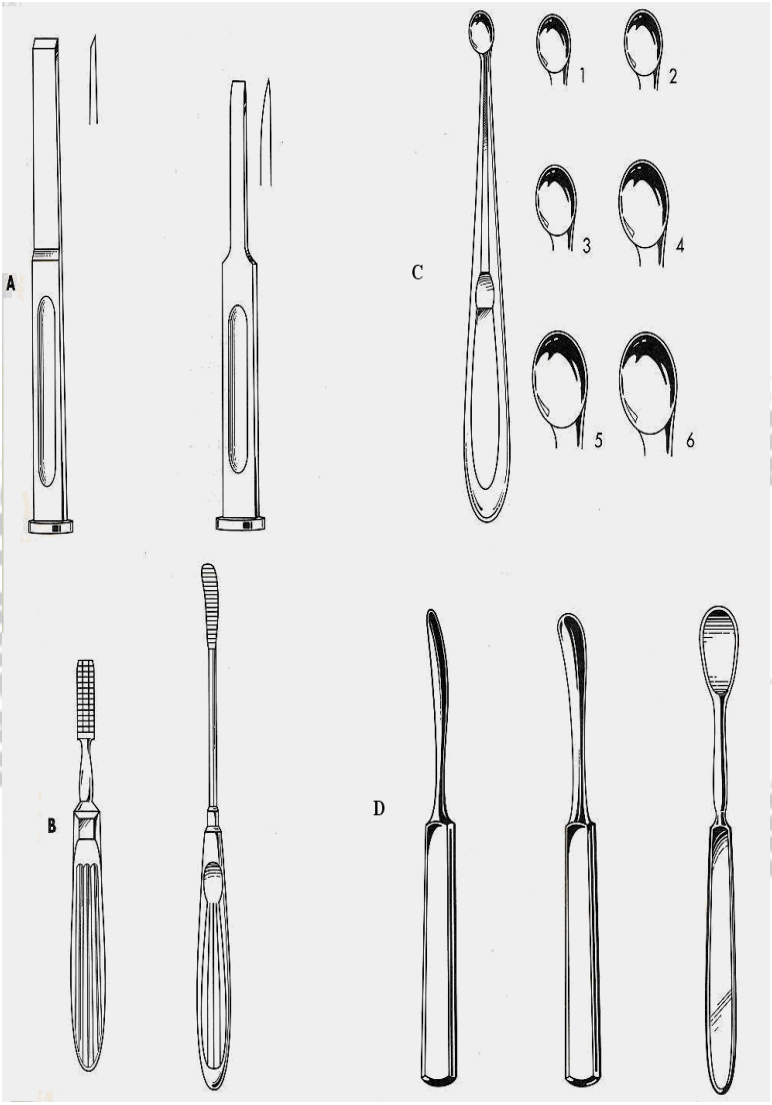

Fig. 6-3. Cutting and dissecting instruments. A, Osteotomes. B, Rasps. C, 1-6 Tissue curates. D, Blunt dissectors, periosteal elevators.

B. ***Grasping and Clamping***

A clamp is an instrument that clasps tissue between its jaws. Clamps are available for use on nearly every type of body tissue, from delicate eye muscle to heavy bone. The most common clamps are the haemostatic clamps, designed to grasp blood vessels, crushing clamps, noncrushing vascular clamps etc.

Grasping instruments are used to hold and manipulate structures. Needle holder, thumb forceps, tissue forceps, Alli's forceps, bone holders, tenaculi (tenaculm, singular) etc. are included in this category.

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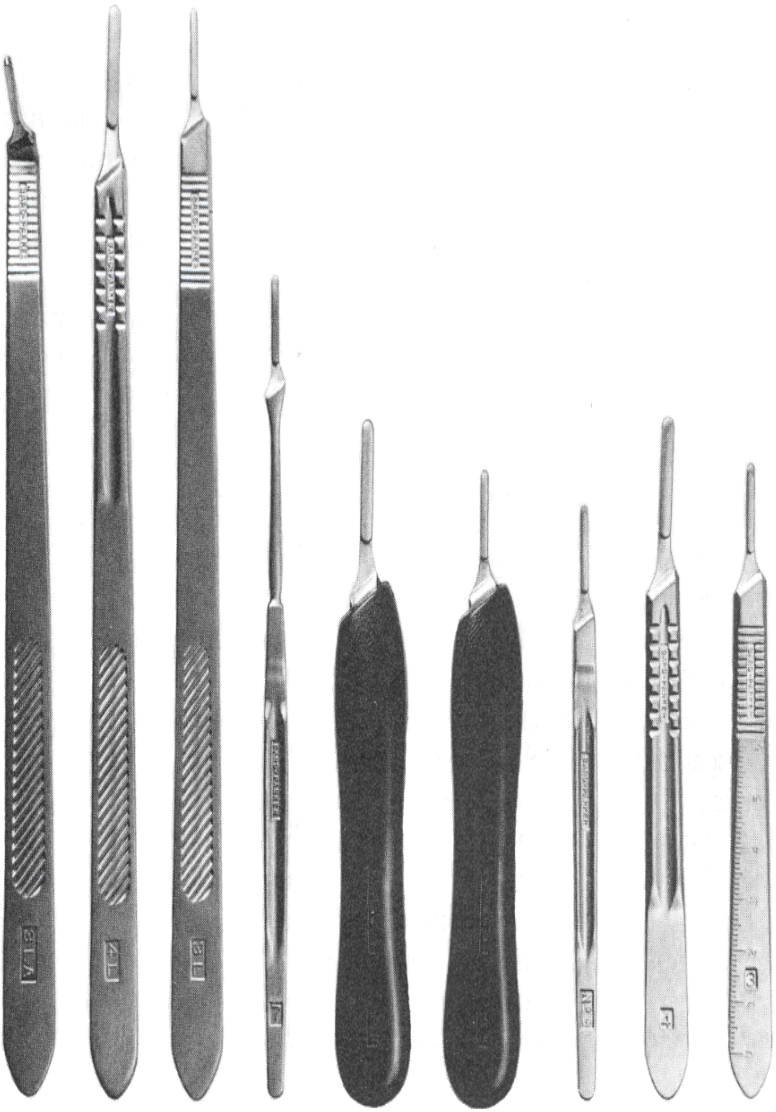

Fig. 6-4. Different types of blade holders (scalpel handles).

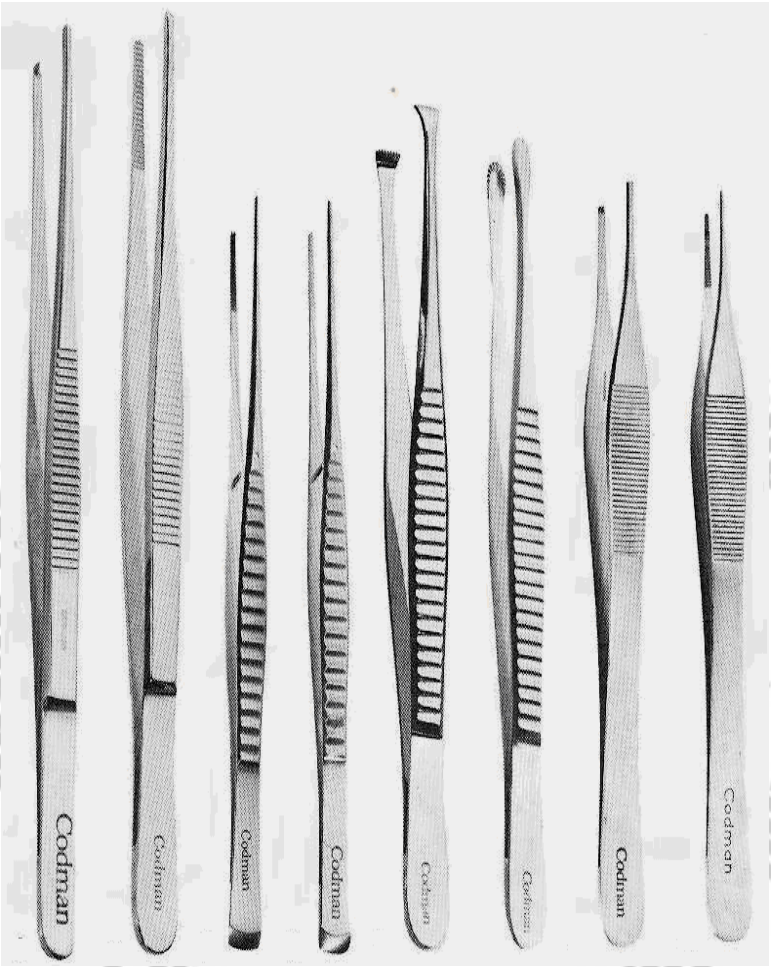

Fig. 6-5. Different types of thumb forceps.

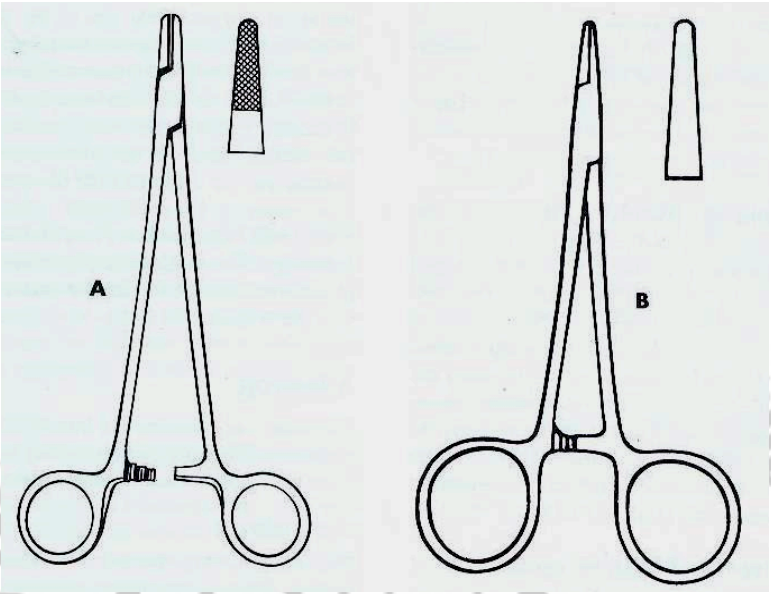

Fig. 6- 6. Needle holders, **(A)** serrated tips, **(B)** nonserrated tips.

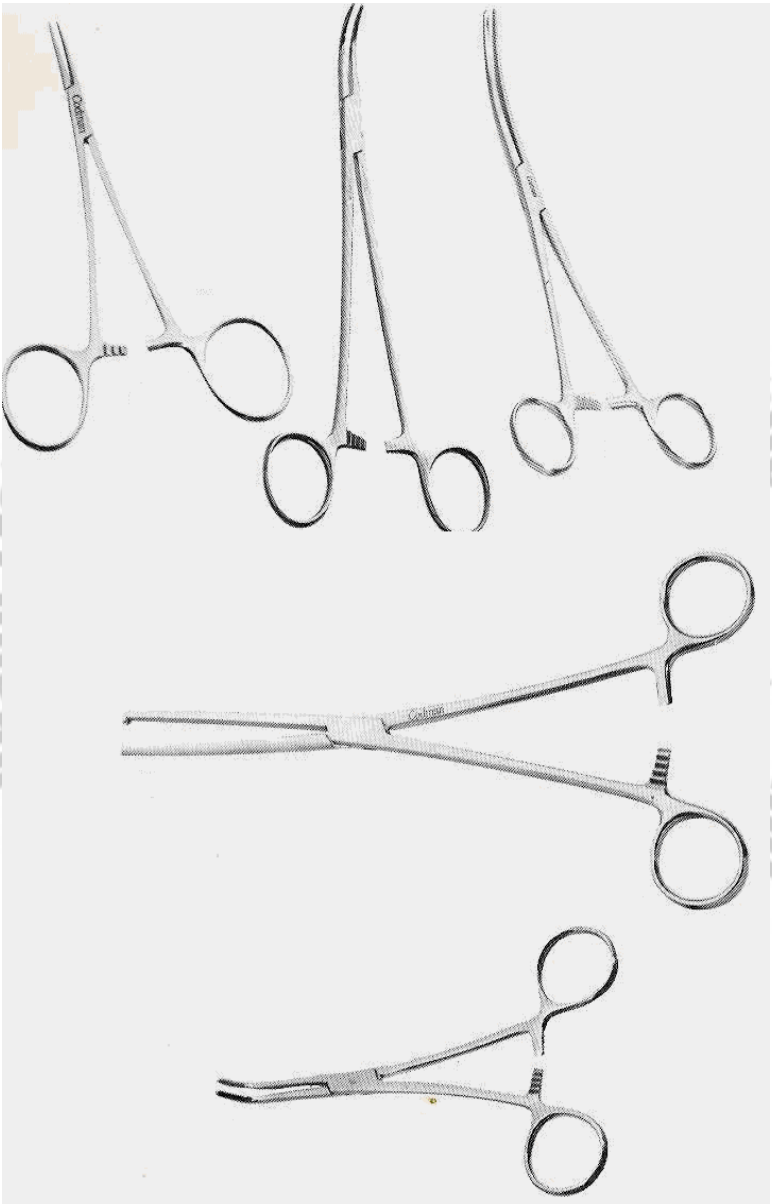

Fig. 6-7. Different types of clamps.

C. Exposing and Retracting

Soft tissues, muscles, and other structures should be pulled aside for exposure of the surgical site.

Exposing and retracting instruments are those that hold tissue or organs away from the area where the surgeon is working. Retractors, like clamps, are available for use in all parts of the body. They may be very shallow, as for skin retraction, or very deep, as for the retraction of abdominal contents. Retractors can be handheld or self - retaining.

Handheld Retractors

- have a blade on their handle
- the blades vary in width and length to correspond to the size and depth of the incision.
- the blades may be dull or sharp
- some retractors have blades at both ends rather than a handle on one end
- are usually used in pairs, and they are held by the first or second assistant.

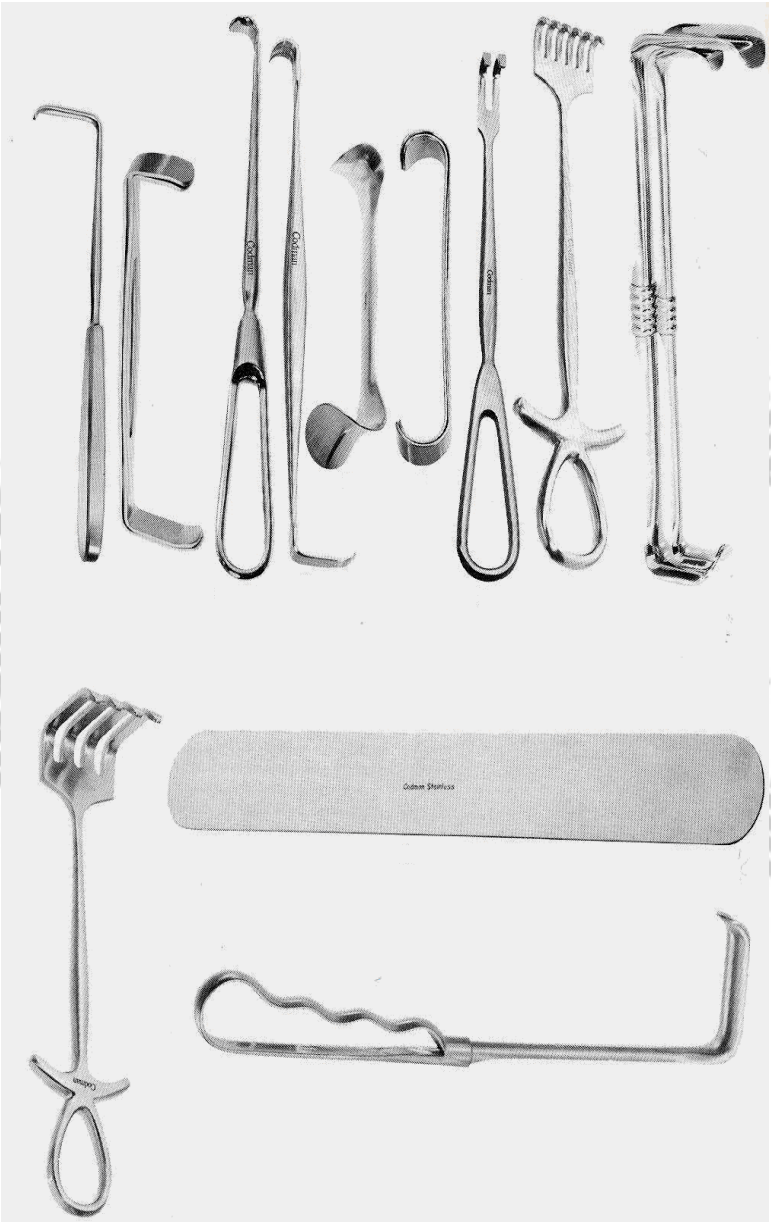

Fig. 6-8. Different types of handheld retractors.

Malleable Retractor is a flat length of low-carbon stainless steel, silver, or silver-plated copper which may be bent to the desired angle and depth for retraction.

***Hooks*.** Single, double, or multiple very fine hooks with sharp points are used to retract delicate structures. Hooks are commonly used to retract skin edges during a wide-flap dissection such as a face lift or mastectomy.

Self-Retaining Retractors

Holding devices with two or more blades can be inserted to spread the edges of an incision and hold them apart.

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Fig. 6-9. Different types of self-retaining retractors**.**

D. Probing and Dilating

A probe is used to explore a structure or to locate an obstruction. Probes are used to explore the depth of a wound or to trace the path of a fistula. Dilators are used to increase/ enlarge the diameter of a lumen, such as the urethra, uterine cervix, or esophagus.

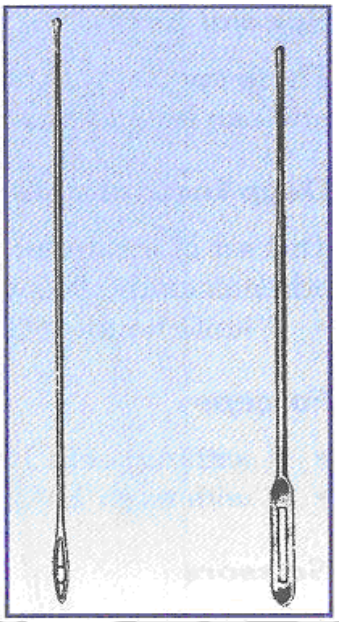


Fig. 6-10. Round probes

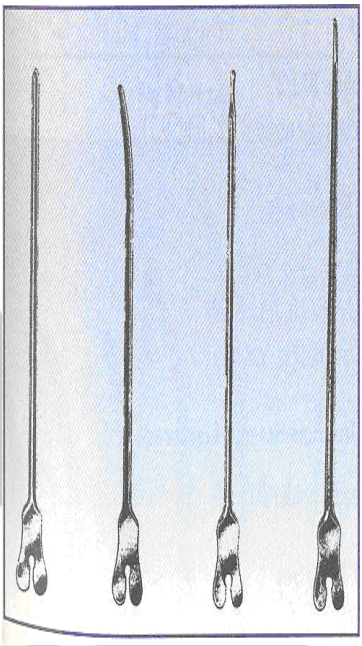


Fig. 6-11. Grooved probes

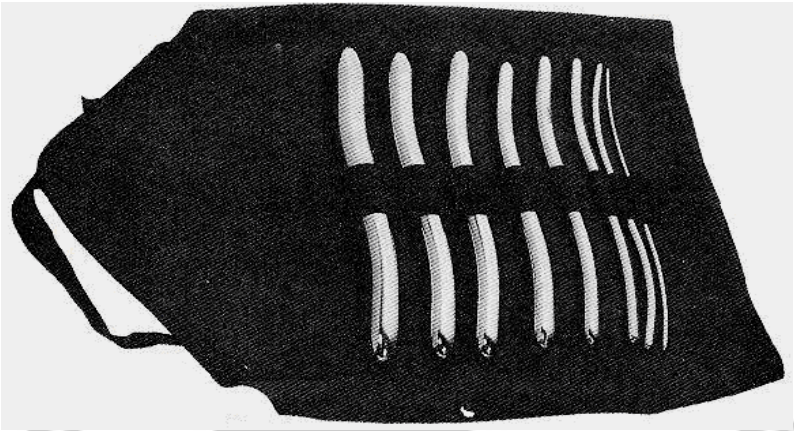


Fig. 6-12. Hegar uterine dilators.

6.4.5. Parts of a Clamp

As shown in the above figures an instrument has identifiable parts.

The points of the instrument are its tips. The tips should approximate tightly when the instrument is closed. (Exceptions-some vascular and intestinal clamps that compress tissue only partially).

The *jaws* of instrument hold tissue securely. Most jaws are serrated.

The *box lock* is the hinge joint of the instrument.

The *shank* is the area between the box lock and the *finger ring.*

The *ratchets* interlock to keep the instrument locked shut when the instrument is closed. These should mesh together smoothly.

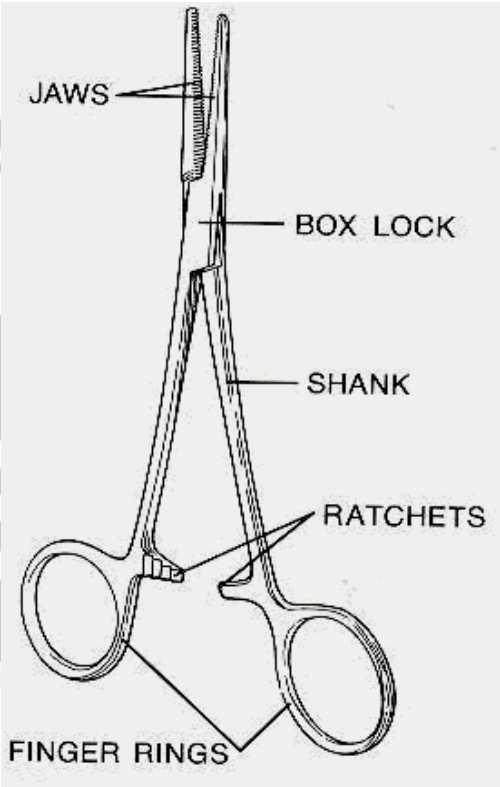


Fig. 6-13. Parts of a clamp

6.5. Use and Handling of Instruments

Most operating rooms use trays of instruments which are prepared, checked and packed by personnel in central supply units.

It is essential that a system is incorporated in the local policy for checking that instruments are decontaminated, in good repair and of an agreed standard, before packing and autoclaving. It is however, possible that some defects may be overlooked; therefore, the scrub person is also responsible in checking surgical instruments prior to the commencement and on the completion of surgical intervention.

The method of cleaning, selection of packing material and method of sterilization of surgical instruments and other items should be undertaken according to the physical properties of the item and the manufacturer's instructions. Instruments which are found to be defective must be removed, labeled and sent for repair or replacement in accordance with local policy. Operating room staff should be aware of the implications of reprocessing surgical instruments as outlined in the Product Liability Act. It is therefore, important that all staff involved in instrument processing have full instruction and understanding of the techniques involved.

6.6. Recommendations for Inclusion in Local Policy

The three main areas for consideration are:

- Care of instruments
- General safeguards
- Storage of instruments

A. Care of Instruments

- Staff involved in the cleaning and packing process of instruments must use standard blood and body substance isolation precautions.
- In order to prevent damage, instruments must only be used for the purpose for which they are designed. Proper selection requires a general understanding of surgical procedures and a knowledge of anatomy.
- In order to prevent corrosions or damage, instruments must not be immersed in saline, hypochlorite, and chemical disinfectants.
- To prevent damage, delicate instruments should be handled with care and separated from other instruments.
- Specialized instruments should be regularly checked by an appropriately trained person. Specialist equipment should be made available to check the integrity of diathermy cables and instruments.

B. General Safeguards

- Regular inspection of all instruments should be made by an appropriately qualified person.

- In order to maintain asepsis, instruments found to be contaminated with dried blood or body tissue prior to surgery must be discarded. If found on a tray of instruments, the whole tray must be discarded and the incident reported to the appropriate person.
- If, on opening a tray of instruments, any areas are damp or drops of moisture are observed, the whole tray must be discarded and the incident reported.
- Each tray of instruments should contain an instrument checklist, which incorporates the information necessary for a recorded program of use.
- The scrub person should ensure that instruments are handled in such a manner as to avoid personal injury, injury to the patient or to other members of the surgical team.
- Special care should be taken with sharp instruments (e.g., scalpels and loaded needle holders). It is strongly recommended that all sharp instruments are transferred between staff ***in a receiver***.
- Instruments must not be allowed to rest directly on the patient, which could cause injury to the patient and damages to the drapes.
- Instruments which have been taken directly from an autoclave into the operating room must be allowed to cool naturally before use.

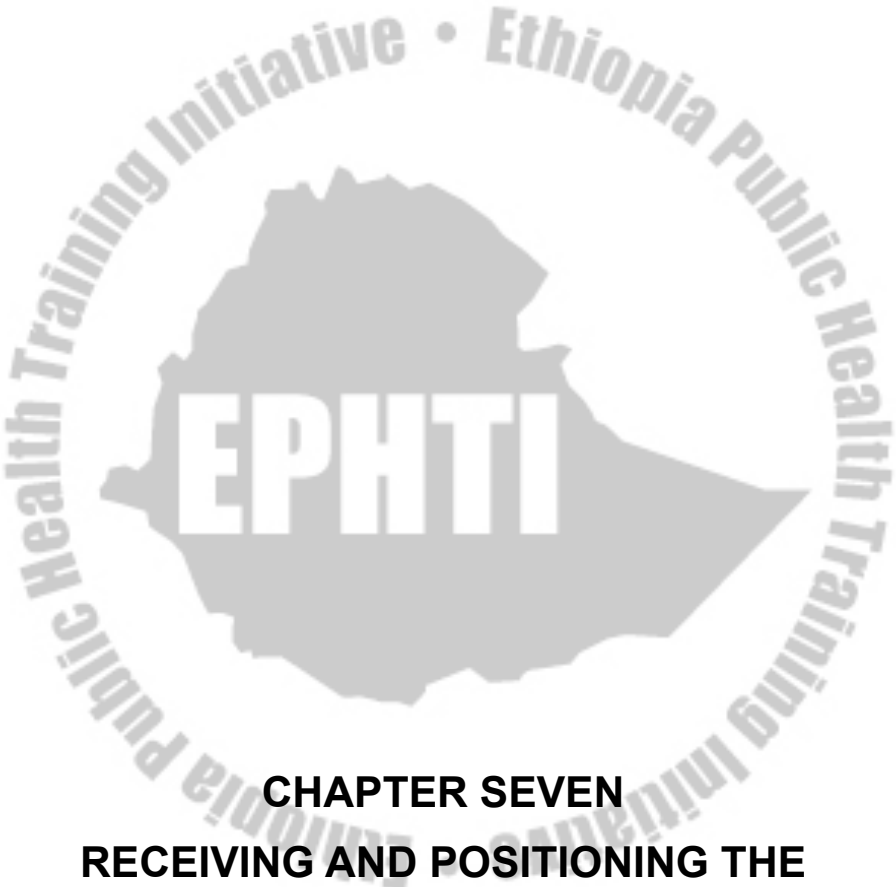
C. Storage of Instruments

- The storage area should be clean, dry and free of dust.
- All storage surfaces should be smooth, nonporous and be easily cleanable.
- Sterile items should be protected from direct sunlight.
- The temperature of the storage areas should range between 22 C and 24 C with a relative humidity of 35% to 68%.
- Perioperative personnel should have the knowledge and skills related to the handling of sterile items.
- Sterile items should be transferred to and from storage areas on clean, specifically designated trolleys.
- All sterile items should have an event related shelf life. The length of time an item can be considered sterile is referred to as the shelf life.

6.7. Questions for Study and Review

1. Identify the different types of surgical instruments.
2. Describe cutting instruments and give two examples.
3. Explain the use of grasping instruments.
4. How do you classify retracting instruments?

5. What is the use of dilators?
6. What are the parts of a clamping instrument?



CHAPTER SEVEN
RECEIVING AND POSITIONING THE PATIENT

7.1. Learning Objectives

After the completion of this chapter, the learner will be able to:

1. Mention some of the responsibilities of the OR team during receiving the surgical patient.
2. Identify the safety hazards associated with moving a patient from one surface to another
3. Describe the effects of positioning on the patient's body systems.
4. Describe the safety measures to consider while positioning, moving and transporting surgical patients.

7.2. Introduction

The patient is the reason for the existence of the health care team. She or he looks to the operating room team to fulfill her or his diverse needs during the pre-, intra-, and postoperative phases of care. The patient is always the focus of attention, not just when she or he is under the operating room (OR) spotlight. The operating room team, therefore, is expected to practice the details mentioned below.

7.3. Receiving the Surgical Patient

Regardless of the physical setting in which a surgical procedure will be performed, each patient should be adequately assessed and prepared so that the impact and potential risks of the surgical intervention are minimized. This involves both physical and emotional preparations.

When we receive the patient:

- Greet the patient by name and introduce yourself and explain the purpose of coming to the OR
- Review the patient's chart for completeness
- Obtain information by asking about the patient's understanding of the surgical procedure
- Check whether all preoperative preparations have been done
- Answer the patient's questions about the surgical procedure
- Encourage the patient and his/her family to discuss their feelings or anxieties regarding the surgical procedure and anticipated results
- Identify any special needs of the patient that will alter the plan for intraoperative care
- Offer the patient psychological reassurance and maintain an attitude of hope. Avoid using phrases such as, "Everything will be all right" or "You are okay." Reinforce the concept that the team will provide good care.
- By fulfilling spiritual and psychosocial needs, the caregiver helps to provide the preoperative patient with as much peace of mind as possible. Understandably, the patient's tension level rises as the time for the surgical procedure approaches.

- The better prepared the patient is emotionally, the smoother his/her postoperative course will be.
- Generally, the impact inherent in any type of surgical intervention can be reconciled when the patient has hope and confidence in the caregivers. Nurses are the central figures in patient care and can do much to relieve fear and provide security.
- Preoperative preparations can influence the outcome of the surgical procedure.

7.4. Positioning the Patient

Each operative position represents an agreement between the surgeon and the anesthesia provider to the patient. The surgeon requires an accessible, stable operative area. The anesthesia provider must have space in which to administer the anesthetic and free flowing intravenous. The result must come well within the rules for maximum safety and comfort to the patient.

Preliminary Considerations

Proper positioning for a surgical procedure is a facet of patient care. This is as important to patient outcome as adequate preoperative preparation and safe anesthesia. Proper positioning requires a knowledge of anatomy and the application of physiologic principles, as well as familiarity with the necessary equipment. Safety is a primary consideration.

Patient positioning is determined by the procedure to be performed, with consideration given to the surgeon's choice of surgical approach and the technique of anesthetic administration. Factors such as age, height, weight, cardiopulmonary status, and preexisting disease (e.g., arthritis) also influence positioning and should be incorporated into the plan of care.

Preoperatively, the patient should be assessed for:

- Alterations in skin integrity
- Joint mobility, and
- The presence of joint or vascular prostheses.

The expected outcome is that the patient will not be harmed by positioning for surgical procedure.

Responsibility for Patient Positioning

The choice of position for a surgical procedure is made by the surgeon in consultation with the anesthesia provider. Adjustments are made as necessary for the administration of anesthetic and for maintenance of the patient's physiology. In essence, patient positioning is a shared responsibility among all team members. The anesthesia provider has the final word on positioning when the patient's physiologic status and monitoring is in question.

Timing of Patient Positioning and Anesthetic Administration

The following states the **time** at which the patient is positioned and/or anesthetized.

- After transfer from the stretcher to the operating bed, the patient is usually placed face up on his/her back (supine).
- The patient may either be anesthetized in this position and then positioned for the surgical procedure or first positioned and then anesthetized.
- If the patient is having a procedure performed while in a face down (prone) position and under general anesthesia, he/she is anesthetized and intubated on the transport stretcher.
- A minimum of four people are required to place the patient safely in the prone position on the operating bed.

Several factors influence the time at which the patient is positioned. Some of these include:

- The site of the surgical procedure
- The age and size of the patient
- The technique of anesthetic administration and
- If the patient is conscious, has pain on moving

Remember that the patient is not positioned or moved until the anesthesia provider indicates it is safe to do so.

Preparation for Positioning

Before the patient is brought to the operating room (OR), the circulating nurse should do the following:

- Review the proposed position by referring to the surgeon's preference in the patient's chart
- Ask for assistance if unsure how to position the patient
- Consult the surgeon as soon as she/he arrives if not sure which position is to be used
- Check the working part of the operating bed before bringing the patient into the room
- Assemble all attachments and protective pads anticipated for the surgical procedure
- Test positioning devices for patient safety. Check for cleanliness
- Review the plan of care for unique needs of the patient

Safety Measures

Injuries to the back, arms, or shoulders as a result of lifting patients or moving equipment are common to the staff working in the OR. Several principles of body mechanics (using the body as a machine) should be observed to minimize physical injury.

Some of these principles include, but are not limited to, the following:

- Keep the body as close as possible to the person or equipment to be lifted or moved while maintaining a straight back.
- Lift with the large muscle groups of the legs and abdominal muscles, not the back.
- Lift with a slow, even motion, keeping pressure off the lumbar (lower back) area.
- Bend forward with hip flexion and hand support.

Safety measures, including the following, are observed while transferring, moving, and positioning patients:

- The patient is properly identified before being transferred to the operating bed and the surgical site is affirmed
- The patient is assessed for mobility status
- The operating bed and transport vehicle are securely locked in position, with the mattress stabilized during transfer to and from the operating bed
- Two persons should assist an awake patient with the transfer by positioning themselves on each side of the patient
- Adequate assistance in lifting unconscious, obese, or weak patients is necessary to prevent injury

- The anesthesia provider guards the head of the anesthetized patient at all times and support it during movement
- The anesthetized patient is not moved without permission of the anesthesia provider. He/she is moved slowly and gently to allow the control of airway and circulatory system during movement
- No body part should extend beyond the edges of the operating bed or contact metal parts or unpadded surfaces
- Body exposure should be minimal to prevent hypothermia and to preserve dignity
- Movement and positioning should not obstruct or dislodge catheters, intravenous (IV) infusion tubing, and drainage materials
- When the patient is on the back (supine), the ankles and legs must not be crossed. Crossing the ankles and legs creates occlusive pressure on blood vessels and nerves and pressure necrosis may occur
- When the patient is on the abdomen (prone), the thorax is relieved of pressure by using chest rolls to facilitate chest expansion with respiration
- When patient is on the side (lateral), a pillow is placed lengthwise between his/her legs to prevent pressure on bony prominences, blood vessels, and nerves

- During articulation of the operating bed, the patient is protected from crush injury at the flex points of the operating bed

Anatomic and physiologic considerations

A patient's tolerance of the stresses of the surgical procedure depends greatly on normal functioning of the vital systems of the body. The patient's physical condition is considered, and proper body alignment is important. Criteria are met for physiologic positioning to prevent injury from pressure, obstruction, or stretching.

Accessibility of the Surgical Site

The surgical procedure and patient condition determine the position in which the patient is placed. To minimize trauma and operating time, the surgeon must have adequate exposure of the surgical site.

Accessibility for Anesthetic Administration

The anesthesia provider should be able to attach monitoring electrodes, administer the anesthetic process and observe its effects, and maintain IV access. The patient's airway is of prime concern and must be patent and accessible at all times.

Individual Positioning Considerations

- If a patient is extremely obese, his/her arms may be placed on armboards.
- Patients with joint problems may need special individualized care because of limited range of motion in their joints.
- A patient who has cardiac problems or is obese may experience orthopnea or dyspnea when lying flat.

Equipment for Positioning

The following are list of special equipment for positioning a surgical patient:

- Shoulder Bridge (Thyroid Elevator)
- Safety Belt (Thigh Strap)
- Anesthesia Screen
- Lift Sheet (Draw Sheet)
- Armboard, double Armboard
- Wrist or Arm Strap
- Shoulder Braces or Supports
- Body Rests and Braces
- Kidney Rests
- Body (Hip) Restraint Strap
- Metal Footboard
- Headrests
- Pressure-minimizing Mattress
- Operating Bed

7.5. Surgical Positioning

The position in which the patient is placed on the operating bed/table depends on the surgical procedure to be performed as well as on the physical condition of the patient.

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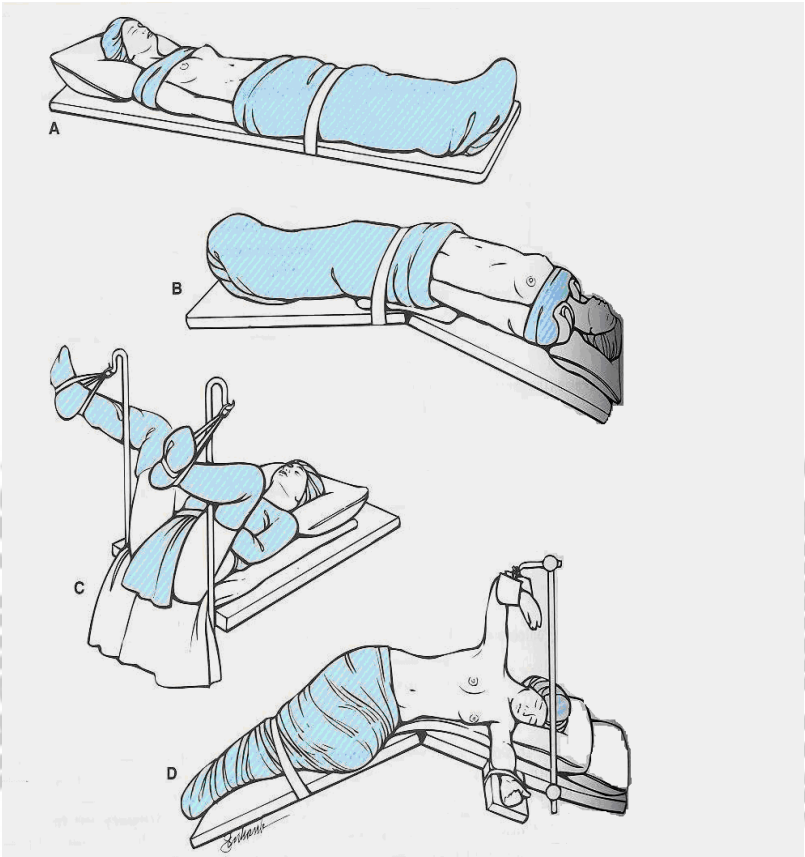
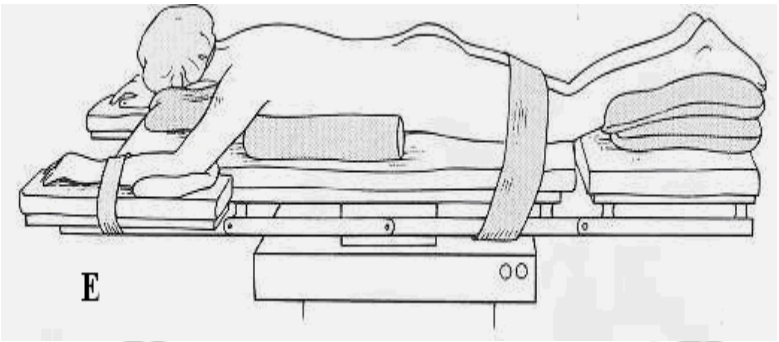

A
B
C
D



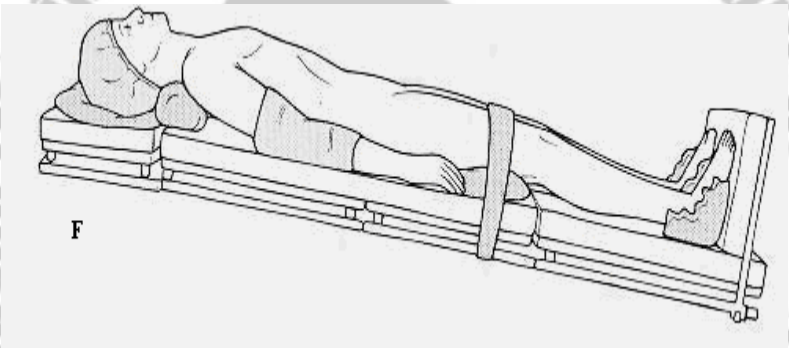


Fig. 7 -1. Positioning on the operating table**; (A)** Supine, **(B)** Trendelenburg, **(C)** Lithotomy, **(D)** modified Sim's/ Kidney position. (**E)** Prone position **(F)** Reverse Trendelenburg position

Factors to consider include the following:

- The patient should be in a comfortable position whether asleep or awake
- The operative area must be adequately exposed

- The vascular supply should not be obstructed by awkward position or undue pressure on a part
- There should be no interference with the patient's respiration as a result of pressure of the arms on the chest or constriction of the neck or chest caused by a gown.
- Nerves must be protected from undue pressure. Improper positioning of the arms, hands, legs, or feet may cause serious injury or paralysis.
- Precautions for patient safety must be observed, particularly with thin, elderly, or obese patients.
- The patient needs *gentle* restraint before induction, in case of excitement.

Many positions are used for surgical procedures; the most commonly used positions are listed below.

A. Dorsal recumbent (supine) position

- The usual position for surgery is flat on the back;
- one arm is at the side of the bed/table, with the hand placed palm down;
- The other is carefully positioned on an armboard for intravenous infusion. (Fig. 7-1, A).

B. Trendelenburg Position

- Usually used for surgery on the lower abdomen and the pelvis to obtain good exposure by displacing the intestines into the upper abdomen
- In this position, the head and body are lowered and the knees are flexed
- The patient is held in position by padded shoulder braces (Fig. 7-1, B)

C. Lithotomy Position

- In this position, the patient is lying on the back with the legs and thighs flexed at right angles.
- The position is maintained by placing the feet in stirrups.
- Nearly all perineal, rectal, and vaginal surgical procedures require this position (Fig. 7-1, C).

D. For Kidney Surgery

The patient is placed on the non-operative side in Sim's position with an air pillow 12.5 to 15 cm thick under the loin, or on a table with a kidney or back lift (Fig. 7-1, D).

E. Prone position. Patient lies on abdomen. Chest rolls under axillae and sides of chest to iliac crests raise body weight from chest to facilitate respiration; pillow under feet protects toes (Fig. 7-1 E)

F. Reverse Trendelenburg position, with soft roll under shoulders for thyroid, neck, or shoulder procedures (Fig. 7-1 F).

G. For Chest and Abdominothoracic Surgery

The position varies with the surgery to be performed. The surgeon and the anesthesia provider place the patient on the operating table/bed in the desired position.

H. Surgery on the Neck

Neck surgery, for example, surgery involving the thyroid, is performed with the patient on the back, the neck extended somewhat by a pillow beneath the shoulders, and the head and chest elevated to reduce venous pressure.

I. Surgery on the Skull and the Brain

Such procedures demand special positions and apparatus, usually adjusted by the surgeon.

Modifications for Individual Patient Needs

As with everything else, the patient's individual needs are met during positioning. Anomalies and physical defects are considered. Whether the patient is unconscious or conscious, the avoidance of unnecessary exposure is an essential consideration for all patients. The patient's position should be observed objectively before skin preparation and draping to

see that it adheres to physiologic principles. Protective devices, positioning aids, and padded areas should be reassessed before draping, because they could have shifted during the skin preparation procedure or during insertion of an indwelling urinary catheter. Careful observation of patient protection and positioning facilitates the expected outcome.

In the patient's record, the nurse should document:

- Any preoperative limitations in the patient's range of motion,
- The condition of the skin before and after the surgical procedure, and
- The position in which the patient was positioned during the surgical procedure, including the use of special equipment.

7.6. Questions for Study and Review

1. List the preliminary considerations during positioning.
2. State the factors that influence the time at which the patient is positioned?

3.Mention at least three most commonly used operative positions.

4.List at least five devices used in positioning the surgical patient on the operating bed.

CHAPTER EIGHT
PREPARATION AND DRAPING OF THE SURGICAL SITE

7.1. Learning Objectives

At the completion of this chapter, the learner will be able to:

1. Identify key elements of preoperative skin preparation of patients.
2. Explain potential problems of inadequate preparation of the surgical site.
3. Discuss the implications of chemical and mechanical actions of prepping the patient.
4. Show how a patient is draped using sterile technique.
5. Demonstrate the process of trimming.

8.2. Introduction

The surgeon, assistants for the surgeon, the scrub nurse, as well as the patient, must have a preoperative surgical scrub. The patient must also be covered with sterile linen leaving the incision site open. While the solutions used for the patient's skin preparation may vary in different hospitals, basic principles remain the same. Likewise, draping materials vary somewhat, but draping principles are universal.

8.3. Skin preparation

Skin preparation (skin prep) begins before the patient arrives in the operating room (OR). It is the removal of as many microorganisms as possible from the operative site and surrounding areas before operation. It is done by trimming, mechanical washing, and chemical disinfection.

Purpose

The purpose of skin preparation is to render the surgical site as free as possible from transient and resident microorganisms, dirt, and skin oil so that the incision can be made through the skin with *minimal danger* of *infection* from this source.

The Trim Preparation

Hair readily supports the growth of microorganisms and therefore, the skin at and around the incision site is trimmed immediately prior to surgery.

Procedure for Trimming

1. Explain the procedure to the patient.
2. Assemble needed supplies before beginning
3. Be sure to have good lighting
4. Trim the hair to its minimum size.
5. Talk with the patient as you work as this helps to reduce anxiety or embarrassment.
6. Wash the trimmed area thoroughly

The Scrub Preparation

After the patient is anesthetized and/or positioned on the operating bed, the skin at the surgical site and an extensive area surrounding it is mechanically cleansed again with an

antiseptic agent immediately before draping. Agents such as iodine, iodophore, alcohol can be used.

Procedure

1. Expose the site and adjust light. Check the trim prep.
2. Don (wear) sterile gloves
3. Place sterile towels at the periphery of the scrub area
4. Starting at the incision site, begin washing in a circular motion.
5. Repeat the process
6. Dry the prep area using the same technique with dry sponges
7. Antiseptic paint is usually applied immediately after the scrub.
8. Scrub and paint solutions should be chemically similar.

Skin preparation for Specific Anatomic Areas

Eye

- Never shave/trim the eyebrows; the eyelashes may be trimmed
- Use soft cotton balls
- Irrigate from the inner to the outer canthus
- Use nonirritating antiseptic agents
- The conjunctival sac is flushed with nontoxic agent (normal saline)

- The ear on the affected side should be plugged with cotton.

Ear

- Clean folds with cotton tipped applicators
- Prevent pooling of solution in the ear canal

Face

- Has several unclean areas (the mouth, nose, and hairline)
- Difficult to avoid contaminating the prep when the usual technique is employed.
- Prep from the center outwards (from hairline)
- Return to the incision site using clean sponges and prep that area last.
- Braid, cap or held back the hair with clips prior to the prep.

Flat surfaces - abdomen

- Follow the prep guidelines
- Use cotton tip applicators to remove dead skin from the umbilicus
- If colostomy is present place a soapy sponge over it. Prep the colostomy last.

Elevated limb

- Place a moisture-proof pad on the operating bed under the elevated extremity to protect the operating bed
- Elevate and support the extremity until sterile drapes are applied
- Begin the prep at the most elevated point, rather than at the incision site.

Breast for biopsy

- Do it very gently
- Prevent spreading of cancer cells

Vagina

- Begin a few centimeters from the vulva
- Extend the prep outwards to include the thighs and lower abdomen
- Sponge sticks are used to prep the vagina itself
- To complete the prep wash the vulva and anus and passing the soapy sponge downward.
- Discard the sponge after it passes the anus
- Repeat several times, always starting with a new sponge

Anus

- Is considered a contaminated area
- Prep the surrounding area first and the anus itself last

Documentation

Details of the preoperative skin condition and preparation should be documented in the patient's intra operative record.

8.4. Drapes and Draping

Drapes are pieces of cloth used to cover areas in order to provide sterile field, protective barrier against contamination and moisture.

Draping, on the other hand, is the process of covering the patient and surrounding areas with sterile linen, leaving only a minimum area of skin exposed at the site of incision.

Purpose of Draping

The purpose of draping is to create and maintain an adequate sterile field during the operative procedure. However, drapes should not be larger than necessary, as they cause the patient to perspire excessively.

Responsibility

- While the surgeon is putting on gown and gloves, the assistant is scrubbing the patient
- The surgeon and his/her assistant(s) usually place the towels and towel clips to outline the site of incision.

Points Concerning Drapes

- When packaged for sterilization, drapes must be properly folded and arranged
- They must be free from holes. If a hole is found in a drape, after it is laid down, the hole must be covered with another piece of linen, or the entire drape should be discarded.
- While it is the responsibility of the person who folds the linen to see it is free from holes, occasionally all the holes may not be detected.

Basic Principles of Draping

- Provide a wide cuff for the hand. This prevents contamination of the hand by the nonsterile surface being draped
- Drapes are nearly always unfolded at the field to avoid moving them around.
- Once placed, drapes should not be moved. Moving a drape after it is placed causes bacteria from unprepared surface to contaminate the draped incisional site (Fig. 8-1). illustrates the placement of drapes over the incisional area and shows the cuff that protects the hand.
- When linen drapes are used, provide adequate barriers against moisture and contamination.

Draping Materials and their Application

Towels

These are usually the basic items in every draping routine. Four towels are placed around the immediate surgical site; this is called "*squaring off*" the site. Four towel clips secure the towels. These clips may penetrate the skin and towels together or simply join the towels. Some surgeons prefer to sew the drapes to the skin.

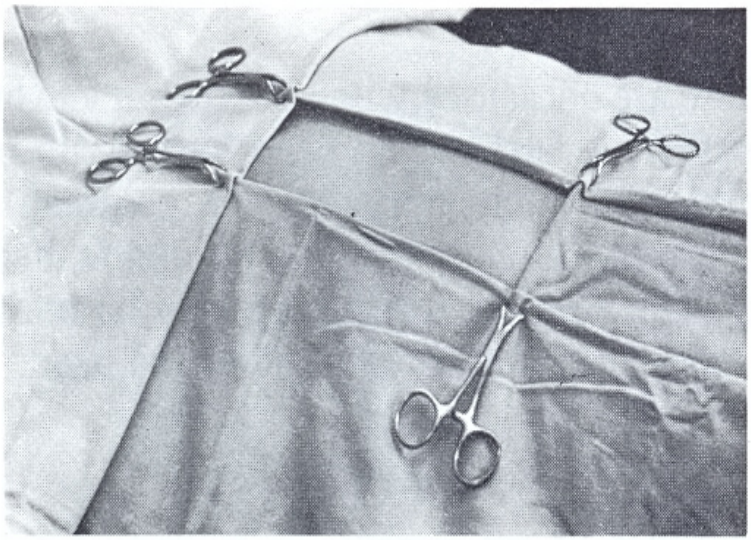


Fig. 8 -1. Draped Patient Four towels secured with towel clips mark the boundary of the incision site (From Nealon, Thomas F.; Fundamental skills in Surgery, 3. ed. Philadelphia, W.B. Saunders, 1979, p. 31).

Plain Sheet

This is also called a minor sheet, top sheet, or bottom sheet. It is a large rectangular sheet that may be placed directly above or below the incisional area. It is used in various ways in the draping routine, according to its size.

Plastic Drape

- This is a commercially prepared item.
- Its function is to provide a sterile barrier over the skin at the incisional site
- Two or three people are needed to place the drape
- The sheet is made of thin plastic that is adherent on one side
- Some surgeons feel that this type of barrier causes a greater proliferation of bacteria since it increases the perspiration and warmth of the skin it covers.
- The surgeon and his/her first assistant hold the drape taut, while the second assistant pulls the paper from the adhesive side.
- The sheet is then lowered onto the patient and smoothed down.

In addition to the above mentioned materials, there are different kinds of procedure sheets designed to fit the needs of a particular surgical position or type of surgery. The sheet may have fenestration (hole) or other access to the incisional

site. The fenestration must usually be larger than the incisional site.

Draping Rules

- Handle drapes as little as possible
- Never flourish drapes. Dust and lint are then released into the air, creating a vehicle for airborne bacteria
- If a drape becomes contaminated or has a hole in it, discard it.
- Never allow gloved hands to come into contact with the patient's prepared skin during the draping process. The gloved hands are sterile, but the skin is not.
- Whenever draping, always provide a cuff for the gloved hand
- Never allow a drape to extend outside the sterile area, unless it is to remain there. The drape must not be adjusted once it is placed. If it is placed incorrectly, it must be discarded and another drape must be used.
- Do not allow the drapes to touch the floor or become tangled in floor equipment.
- If the drape is so large that it touches the floor, the bottom may be taped to form a make shift item.
- Plan ahead. Have the drapes ready before the procedure begins

8.5. Questions for Study and Review

1. Discuss skin preparation.
2. Discuss scrub preparation.
3. Define drape as well as draping.
4. Identify basic principles of draping.
5. Mention two draping materials.
6. List at least five draping rules.

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CHAPTER NINE
SURGICAL CONSCIENCE AND ETHICS

9.1. Learning Objectives

After completing this chapter, the learner will be able to:

1. Discuss surgical Conscience.
2. List areas in operating room work that are affected by surgical conscience and ethics.
3. State situations that can undermine surgical conscience.
4. Describe the role of law in relation to surgical interventions.
5. Mention some of the areas of criminal responsibilities.
6. List six areas of negligence in the healthcare facilities.

9.2. Introduction

Mild infection is potentially a severe one. Also, antibiotics have not supplemented sterile technique. A safety factor should be observed for all patients. Principles must be followed meticulously. None of the personnel should ever be reluctant to admit a possible break in technique even if there is doubt about it.

9.3. Surgical Conscience

A **surgical conscience** may simply be stated as a surgical Golden Rule: Do unto the patient as you would have others do unto you. The caregiver should consider each patient as himself or herself or a loved one. Surgical conscience involves a concept of self-inspection coupled with moral obligation. It incorporates the caregiver's values and attitudes at a conscious level and monitors behavior and decision making in relation to those values. In short, a surgical conscience is the inner voice for conscientious practice of asepsis and sterile technique **at all times.**

One's **attitude** to something is the way that he/she thinks and feels about it and one's attitude to someone is the way that he/she behaves when he/she is dealing with them.

The team member who wanted his/her patient to have the best possible care practices surgical ethics.

- Respect for the patient's religious beliefs must be observed
- Respect the patient as an individual
- Fears and pain should be treated strongly
- Patient needs care and attention
- Respect for the patient's right to privacy

- The patient must not be discussed outside the surgical department
- The patient's condition is a private matter between himself and his caregivers; it is *not* a topic for public discussion or opinion.

Reporting of an incident is a major ethical responsibility in the operating room.

An occurrence such as major breaks in technique, medication error or any event that violates operating room policy is considered as an incident.

Honesty is a major ethical standard. It is more important to admit that a procedure or activity is unfamiliar than to proceed blindly in order to save face. The operating room nurse or any staff member must be honest about his or her own capabilities so that error can be reduced.

Areas affected by surgical conscience

Protection of the patient

Patient protection is an area of surgery that is strongly affected by surgical conscience. The operating room team must be aware of the dangers that exist for the patient. Like a defensive driver, the team must be constantly on the lookout for situations that might be harmful to the patient.

A. Electrical hazards are a major risk in the operating room. Hence,

- Cords that are frayed or plugs that appear defective must not be used.
- Whenever the electrocautery is used, the patient must be grounded in order to prevent shock or burns.
- Equipment that malfunctions must be taken out of service as soon as the defect is discovered.

B. Moving and positioning the patient must be carried out with constant attention to:

- Proper padding and protection of bony surfaces,
- Prominent nerves, and
- Blood vessels.

The unconscious patient cannot safeguard him-/herself and is therefore, in greater need of vigilance on the part of others. Operating team members must see and feel for the patient by being alert at all times. *Side rails* must be raised as soon as the patient is moved to the stretcher or bed, and *restraint* or *safety straps* must be applied on the operating bed.

C. Environmental protection, in the form of warmth and comfort,

- Is essential in patient care.
- Unnecessary exposure of the patient's body should not be allowed.
- Care for the dignity of the patient, regardless of age or condition, should be observed at all times.

D. Protection from psychological insult is the responsibility of everyone in the operating room. The patient must not be allowed to overhear or misinterpret matters discussed that are intended to be confidential or are offensive. The patient must be made to feel that his/her well-being is the primary concern of all those around him/her.

E. Anxiety and ***fear*** accompany nearly every patient in the operating room. Even though preoperative medications are effective in controlling anxiety, they cannot replace the warm touch or understanding voice of a staff member.

F. Unnecessary time spent under anesthesia because of poor planning show poor surgical conscience. Attention to detail before the case begins will prevent loss of time during the case. The operating room team members should anticipate as much as possible the instruments or special equipment that will be needed for the case.

9.4. Aseptic Technique

A second major area affected by surgical conscience is the practice of good aseptic technique. Whenever a break in the technique occurs, the patient is in danger of infection. The practice of aseptic technique is the individual responsibility of each team member. Breaks in technique must be reported immediately, even if this causes a delay during surgery or if admitting an error is personally embarrassing.

Ethics

- Ethical behavior is inseparable from surgical conscience
- The team member who wants her/his patient to have the best possible care practices surgical ethics
- Respect to the patient's religious beliefs must be observed, and respect for the patient as an individual is also very important
- *Fears* and *pain* are very real and should be treated strongly
- Respect for the patient's right to privacy is absolutely mandatory
- The patient must not be discussed outside the operating room where friends and relatives might overhear and misinterpret information

- The patient's condition is a private matter between him-/herself and the healthcare providers. It is not the topic for public discussion.

Reporting of an incident, in the operating room, is a major ethical responsibility. An occurrence such as a major break in technique, medication error, or any event that violates operating room policy is considered an incident.

Honesty, of course, is a major ethical standard. It is more important to admit that a procedure or activity is unfamiliar than to proceed blindly in order to save face. It follows that the operating room nurse or any staff member must be honest about his/her own capabilities so that error can be reduced.

9.5. Situations that undermine surgical conscience

While most graduates of surgery programs and experienced personnel are anxious to provide the best patient care possible and to possess a firm surgical conscience, there are factors that can cause one with a good attitude to become apathy. Every professional in the medical field should be on the lookout for *apathtic* and its causes since it greatly reduces the quality of patient care and safety.

Peer Apathy

When many of those of the operating staff become less attentive to the detail, other staff members may feel, “No one else cares, so why should I? This devastating situation can cause the whole department to lose sight of its primary goal (the patient’s safety and protection).

Stress, fatigue, poor Health

These factors can certainly affect a person’s awareness of his/her responsibilities to the patient. The cause of the situation should be investigated by the staff members concerned, and a solution should be sought.

Personal problems

Any team member who has personal problems is to be preoccupied with it and consequently neglect the patient’s safety to some degree. If practical, a short leave of absence or counseling may be necessary.

Staff relations

It is common for surgery personnel to work better with some surgeons than with others. There are, of course, some surgeons with whom all nursing and other team members are pleased to work with. Regardless of the surgeon, however, attention to patient safety and ethical responsibilities should not change. It must not be the personality of the surgeon that dictates the quality of care given to the patient.

9.6. The Legal Aspects of surgery

Operating room team members need to know more about surgery than merely the procedures and techniques necessary to their profession. It is also important for them to understand how the law affects their day-to-day practice and also how it applies to the accidents and incidents that can occur in their chosen field.

Every country has laws that regulate the activities of healthcare providers including surgeons. These laws limit the practice of medicine/nursing to holders of a license granted only after extensive training and rigorous examinations. These laws, called ***medical practice acts, nursing practice acts, etc.,*** usually define the practice of medicine and nursing as diagnosing and treating disease, cutting and penetrating the human body, and pronouncing death. Practicing medicine and other health and health-related professions without a license is a crime. The law forbids healthcare providers from delegating these rights to unlicensed persons, even those working under direct supervision.

Criminal Responsibilities

- **Exceeding the Scope of Practice**

The medical and nurse practice acts are generally part of the written documents of the country's criminal statutes. The acts

make it a crime for unlicensed person to practice medicine or nursing. The healthcare providers could face criminal charges if something goes wrong that causes the patient to suffer.

- **Patient Property**

Patients occasionally arrive in the operating room with valuables, most commonly wedding rings, bracelets, ear rings, and necklaces. Care should be taken to protect these items from loss or theft. A record of all property taken from the patient should be made, listing the items and either their place of storage or the person to whom they were given. This can prevent both loss and charges of theft.

- **Hospital Property**

The taking of property that is not one's own is considered theft. Damaged instruments and other hospital property should not be removed from the hospital without the specific consent of the operating room supervisor. Many apparently damaged goods can be repaired. It cannot be assumed that these items may be taken without permission. The fact that "everyone does it" is not an excuse.

Negligence

Acts of carelessness are termed negligence. It is legally defined as the failure to exercise the care that a reasonably prudent person would exercise under similar circumstances.

Certain areas in the operating room have proven to be consistent sources of lawsuits. The operating team members must be aware of situations in which carelessness could endanger the patient. In addition to harming the patient, negligence can endanger the hospital by exposing it to lawsuits.

Common Areas of Negligence

A. Side Rails and Supports

All operating room personnel must ensure that:

- Unconscious or sedated patients are protected from falling out of stretchers, tables, or beds.
- Side rails and restraining straps are in place at all times.
- Similarly, supports used for positioning the patient must be placed and padded correctly to avoid injury to the patient.

B. Burns

- Avoid faulty grounding of electrocautory equipment
- Double check patient grounding before starting any surgical case..
- Adjust the temperature of the solution for skin scrub preparation

C. Patient Identification

- There is no excuse for performing surgery on the wrong patient or on the wrong side of the patient.
- All patients must be correctly identified at least twice before surgery commences.
- The patient's chart, I.D. bracelet, and I.D card should all agree.
- Ask the patient to identify himself and, to confirm on which side the operation is to be performed.

D. Loss of Items within the patient

The nurses with the team are responsible for a correct sponge, needle, and instrument count. If the count does not agree, the surgeon must be informed immediately. Documenting the fact in an incident report is extremely important.

E. Medications and solutions

Each one should be identified clearly so that the wrong drug or solution is not administered to the patient inadvertently. Avoid any possibility of error.

F. Explosion

The danger of explosion from in-line oxygen or oxygen stored in tanks exists. Oxygen supports combustion and creates a substantial fire hazards. If there is any doubt about the

integrity of oxygen tanks, valves, or supply lines, report it to the operating room supervisor immediately.

G. Abandonment of the patient

Patients, regardless of their level of sedation, should never be left unattended. Responsibility for a patient should be passed specifically from one person to another. ***Never assume*** that someone will be along shortly to take care of the patient. Pediatric patients are curious to attempt to escape from bed or stretcher or operating room table, watch them. Unconscious patients are in danger of cardiac or respiratory arrest and must be closely watched.

H. Specimen

The preservation and identification of specimens is crucial. The nurse should be sure that each specimen is properly identified, preserved, and labeled.

I. Surgical consent

- Make sure that the patient consents to the surgery or that the surgery did not go beyond the scope of the written or verbal consent. This is done by making sure

that the chart includes the written authorization for the surgery signed by the patient or the patient's guardian.

- Ask the patient on which side the operation is to be performed. If there is no written autorotation or if the patient's oral response differs from that on the written form, inform the surgeon and the operating room supervisor immediately.

Defamation

- Derogatory statements made about one person to another is defamation
- Defamation may not be considered as negligence, but it is still a concern of all medical personnel.
- Operating room personnel occasionally feel that surgery is performed incompetently or consider doctors' skills are questionable.
- These opinions should not be shared with any one outside the OR, unless the health and safety of the patient is in jeopardy.
- Report the facts observed to the OR supervisor without inserting any opinion - for example, state "This morning Dr. X was shaking and had alcohol on his breath, his speech was slurred, and he kept dropping instrument" rather than "Dr. X was drunk".

9.7. Questions for Study and Review

1. What does “surgical conscience” mean to you?
2. What areas of your work are mostly deeply concerned with the utilization of surgical conscience?
3. Discuss ethical responsibility in the operating room.
4. What are some ways in which you can combat apathy in the operating room?
5. What makes the practices of medicine and nursing criminal?
6. Mention at least two areas of criminal responsibility.
7. Define negligence.
8. List four areas of negligence and give examples for each.

CHAPTER TEN
SUTURE MATERIALS AND SUTURES

10.1. Learning Objectives

After completion of this chapter, the learner will be able to:

1. Define suture and suture materials.
2. Discuss the difference between absorbable and non absorbable sutures.
3. Identify the different suture materials.
4. Prepare suture materials properly.
5. Identify the different parts of a needle.
6. List down the types of needles.
7. Mention the types of sutures.

10.2. Introduction

Suture Materials

The noun *suture* is used for any strand of material used for ligating or approximating tissue; it is also synonymous with *stitch*. The verb to suture denotes the act of sewing by bringing tissues together and holding them until healing has taken place. If the material is tied around a blood vessel to occlude the lumen, it is called a *ligature* or tie. A suture attached to a needle for a single stitch for hemostasis is referred to as a stick tie or suture ligature. A free tie is a single strand of material handed to the surgeon or assistant to ligate a vessel. A tie handed to the surgeon in the tip of a forceps is referred to as a tie on a passer.

10.2. Types of Suture Materials

Surgical suture materials are classified as either *absorbable* or n*on absorbable*

Absorbable sutures

Absorbable suture is eventually absorbed by the body as a result of the enzymatic action of body fluids and does not require removal. Absorbable sutures come in polyfilament (braided) and monofilament (unbraided) sutures. Each have various half-lives and strengths. The length of time needed by absorption depends upon the specific type of suture as well as the condition of the tissue. Absorption takes place in from

3 days to 3 months. The most common absorbable sutures include:

A. Surgical Catgut:

- Collagen manufactured from the submucosa of sheep intestine or serosa of beef intestine.
- Used in tissue that heals rapidly.
- Digested by body enzymes and absorbed by tissue so that no permanent foreign body remains.
- The rate of absorption is influenced by the following:
  - Type of tissue
  - Condition of tissue
  - General health status of the patient
  - Type of surgical catgut

Plain Surgical Catgut

- Lose tensile strength quickly, usually in 5 to 10 days
- Used to ligate small vessels and to suture subcutaneous fat
- Not used to suture any layer of tissue likely to be subjected to tension during healing.
- Available in sizes 3 to 6-0.
- Usually used in its natural yellow-tan color, it may be dyed blue or black
- Fast absorbing plain surgical catgut is specially treated to speed absorption and tensile strength loss.

- May be used for epidermal suturing where sutures are needed for no more than a week.
- These sutures are used only externally on skin, not internally, particularly for facial cosmetic surgery.

Chromic Surgical Catgut

- Is treated in a chromium salt solution to resist absorption by tissues
- This treatment changes the color from the yellow-tan shade of plain surgical catgut to a dark shade of brown
- It is used for ligation of larger vessels and for suture of tissues in which nonabsorbable suture materials are not recommended
- Available in sizes 3 to 7-0
- May be dyed blue or black

B. Synthetic Absorbable Sutures

- Are absorbed by a slow hydrolysis process in the presence of tissue fluids.
- They are used for ligating and suturing.
- They are extremely inert and have great tensile strength
- Can be used in nearly all tissues.
- As a disadvantage, it tends to drag through the tissue rather than passing smoothly.

- This action may slow down the sewing process.
- This type of suture also requires special techniques for tying.
- The sutures included in this group are:
  - Polyglycolic acid (**Dexon**) suture
  - Polyglactin 910 (**Vicryl**) suture
  - Polydioxanone (**PDS**) Suture
  - Polyglicaprone (**Monocry**l) suture

Non absorbable Suture

Nonabsorbable suture is either left in the body, where it becomes embedded in scar tissue, or it is removed when healing is complete, as in skin closure. It is used in tissues that heal more slowly than those requiring any type of absorbable suture.

A. Surgical Silk

- An animal product made from the fiber spun by silkworm larvae in making their cocoons
- Widely used non-absorbable suture that is easy to handle and is both supple and strong.
- Can be used in a wide variety of tissues, ranging from ophthalmic to cardiovascular
- Has a multifilament structure and is treated with Teflon or a similar coating to prevent tissue drag and flaking.

B. Surgical Cotton

- Manufactured from the fibers of the cotton plant
- Supple and easy to handle
- Has inferior strength and tendency to flake
- Can be strengthening by dipping it into saline solution prior to use.
- Its application is nearly identical to that of silk.

C. Polyester Suture

- The strongest of all sutures except for surgical steel
- It is usually multifilamented and may be coated with Teflon
- Used in a wide variety of tissues, including facial, cardiovascular, and ophthalmic.

D. Nylon Suture

- Used primarily for skin closure, ophthalmic procedures, and microsurgery.
- Produces minimal tissue reaction
- Has high tensile strength, and resists capillary action
- The major disadvantages of nylon are its elasticity and stiffness, which necessitate the laying of many knots.

E. Polypropylene (Prolene) Suture

- Extruded into a monofilament strand
- The most inert of the synthetic materials and almost as inert as stainless steel

- Easier to handle
- Can be used in the presence of infections
- The material of choice for many plastic surgery and cardiovascular procedures because of its smooth passage through tissues, as well as its strength and inertness
- Frequently used for retention sutures

F. Surgical Steel

- Made of stainless steel and is the most inert type of suture available
- Used mainly in the orthopedic surgery to approximate bone fragments
- Not widely used because of major disadvantages:
  - Extremely difficult to handle
  - Kinks easily and has a “sawing” effect on tissue
  - Because of its springiness it is easily contaminated at the field
  - The sharp ends of the strands can easily puncture a glove, causing contamination and injury to the person handling it.

Suture Sizing and Packaging

The diameter of the suture strand determines its size. Size 0 is smaller than size 1. Size 2-0 (00) is smaller than size 0, and so on. Suture as small as 11-0 and as large as number 7

are available. Stainless steel sutures have an additional size indicator called Brow and Sharp (B & S) gauge. Steel suture may be referred to by either method.

Table 10-1. Stainless Steel Sizing

	Gauge										
B & S	#40	#35	#32	#30	#28	#26	#25	#24	#23	#22	#20
U.S.P.	6-0	5-0	4-0	3-0	2-0	0	1	2	3	4	5

The length of the suture is standardized. Strands are precut (17, 18, or 24 inches) or full length (54 or 60 inches). A continuous reel is also available which allows the surgeon to tie vessels in quick succession. Suture is available in peel-apart packages for convenient and quick distribution. The circulator distributes suture by peeling back the outside wrapper and exposing the inner packet of suture.

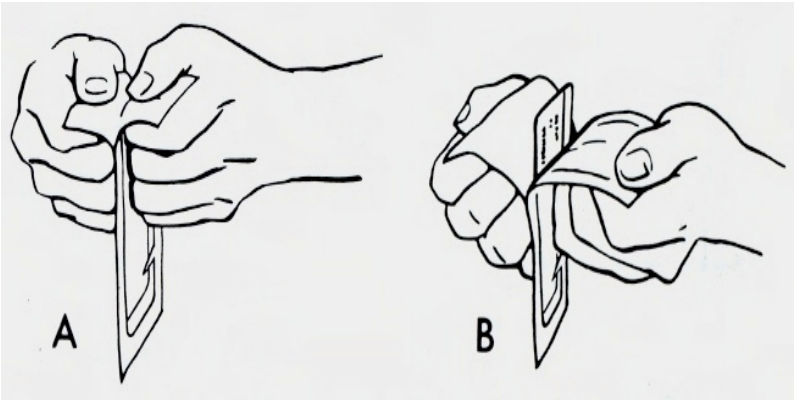

Fig. 10-1. Peel-back suture packet (to open suture packet, grasp the wrapper edges (A) and peel apart (B).

Suture Application

A common question asked by students in surgery is “what suture material is used in what tissue and in what size?” The most common answer is “surgeon’s preference,” although some standards are based on the healing time required of the tissue and on the strength of the tissue. One basic principle is that the suture should be as strong as the tissue it approximates. Good surgical technique also dictates that the smallest possible suture be used, as long as it holds the tissue together.

Factors that influence the choice of suture materials

- Biologic characteristics of the suture material
- Healing characteristics of the tissue
- Location and length of the incision
- Presence or absence of contamination and/or infection
- Patient problems such as obesity, debility, advanced age and diseases
- Physical characteristics of the material such as ease of passing through tissue, knot tying and other personal preference of the surgeon.

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Table 10-2. Lists of Recommended Sutures for Particular Locations in the body.

Location/Use	Material	Size
Blood vessels/ Ligation	Chromic gut	3-0 to 0
	Cotton	3-0 to 0
	Silk	3-0 to 1
	Polyester	5-0 to 0
Blood vessels/ Anastomosis	Silk	7-0 to 2-0
	Polyester	6-0 to 2-0
	Polyethylene	6-0 to 4-0
Biliary system	Chromic gut	3-0 to 0
	Cotton	3-0 to 0
	Silk	3-0 to 0
	Polyester	4-0 to 0
Bone/Approximate	Stainless steel	3-0 to 0
	Polyester	3-0 to 0
	Polyethylene	4-0 to 0
Breast	Chromic gut	3-0 to 0
	Silk	3-0 to 0
	Polyester	3-0 to 0
Bronchus/Ligation	Chromic gut	0 to 1
	Silk	3-0 to 0
	Polyester	3-0 to 0
Cleft palate	Nylon	3-0 to 2-0
	Silk	3-0
	Polyester	3-0, 4-0
Dura mater	Silk	6-0 to 4-0
	Polyester	6-0 to 4-0
Eye/Cataract	Chromic gut	7-0, 6-0
	Silk	9-0 to 4-0
	Nylon	10-0 to 9-0
Eye/Muscle repair	Dacron	5-0
	Chromic gut	6-0 to 4-0
	Plain gut	6-0 to 4-0
	Polyester	5-0
Eye/Lid	Silk	6-0 to 4-0
	Polyester	6-0, 5-0
Fascia	Chromic gut	2-0 to 1
	Silk	2-0 to 0
	Stainless steel	4-0 to 3-0
	Polyester	2-0 to 0
	Cotton	2-0, 0
Heart	Silk	6-0 to 2
	Polyester	5-0 to 0
Hernia/Repair	Chromic gut	3-0 to 1
	Cotton	2-0 to 1
	Silk	3-0 to 0
	Polyester	3-0 to 0
	Stainless steel	5-0 to 3-0
Intestine	Chromic gut	5-0 to 2-0
	Silk	5-0 to 2-0
	Cotton	2-0
Joint capsule	Chromic gut	4-0 to 0
	Cotton	2-0
	Silk	3-0
	Stainless steel	5-0
	Polyester	4-0 to 1
Kidney	Chromic gut	4-0
	Plain gut	4-0
Lip	Chromic gut	5-0
	Plain gut	5-0
Liver	Silk	2-0, 0
	Chromic gut	2-0, 0
Muscle	Plain gut	3-0 to 0
	Chromic gut	3-0 to 0
	Cotton	3-0 to 0
	Silk	3-0 to 0
	Polyester	3-0 to 0
Nerve/Repair	Silk	9-0 to 4-0
	Nylon	9-0 to 4-0
	Polyethylene	6-0 to 4-0
	Stainless steel	9-0, 6-0
	Polyester	7-0 to 5-0
Pancreas	Cotton	3-0
	Silk	3-0
Perineum	Chromic gut	4-0 to 3-0
Peritoneum	Chromic gut	3-0 to 0
	Silk	4-0 to 1
	Cotton	3-0 to 0
	Plain gut	0
	Polyester	3-0 to 2-0
Rectum	Chromic gut	4-0 to 0
Skin	Nylon	6-0 to 2-0
	Polyethylene	5-0 to 3-0
	Silk	6-0 to 2-0
	Polyester	6-0 to 3-0
	Stainless steel	5-0 to 2-0
Skull	Stainless steel	5-0 to 4-0
Stomach/ Anastomosis	Chromic gut	5-0 to 2-0
	Cotton	3-0 to 0
	Silk	3-0 to 0
	Polyester	4-0 to 2-0
Tendon	Stainless steel	5-0 to 3-0
	Polyester	5-0 to 3-0
	Polyethylene	5-0 to 3-0
	Nylon	5-0 to 3-0
Thyroid	Chromic gut	3-0 to 0
	Cotton	3-0 to 0
	Silk	3-0 to 0
	Polyester	3-0 to 0
Tonsil	Plain gut	3-0 to 0
Ureter	Chromic gut	4-0
Urethra	Chromic gut	4-0
Uterus	Chromic gut	2-0 to 0

Preparation and Handling of Suture

Since suture material can be a costly part of the surgical procedure, it must not be wasted or handled carelessly. Strands of suture are protected between the folds of a towel during surgery. The ends should protrude slightly so that they can be picked up easily. Various suture materials require special handling techniques.

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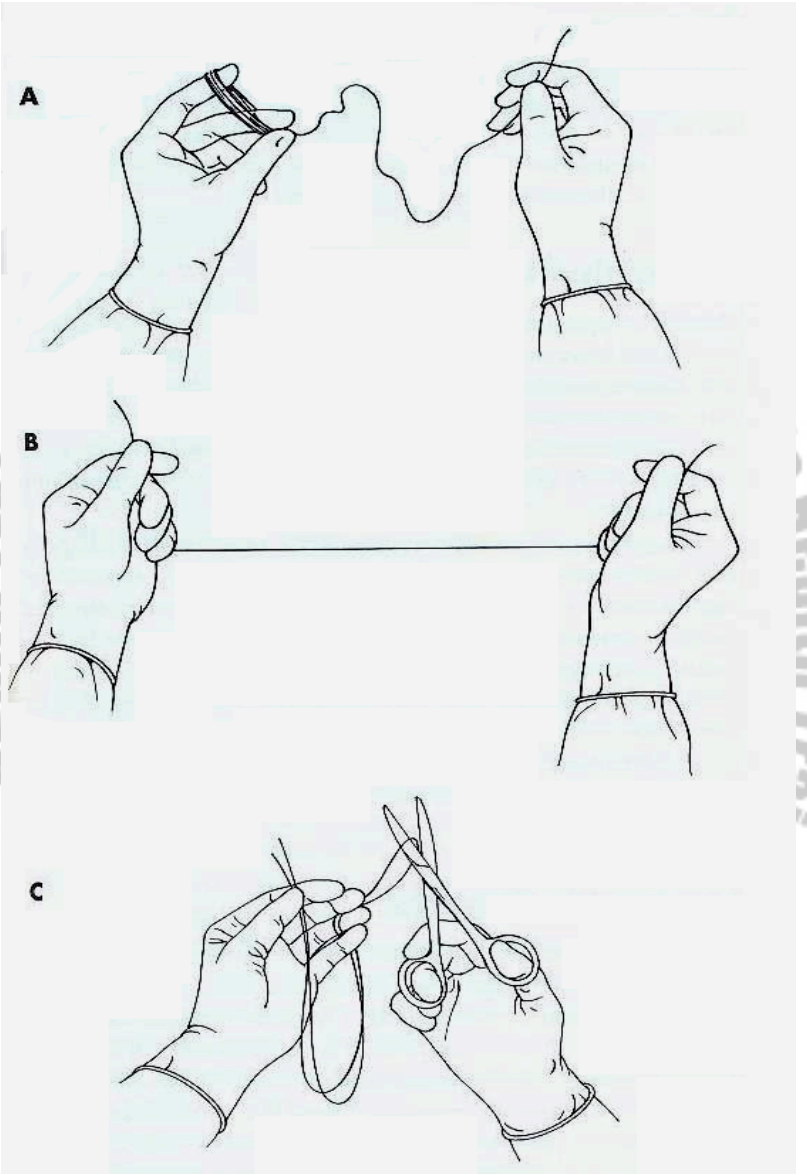

Fig. 10-2. Sequence of preparing half length suture material

10.4. Surgical Needles

Except for simple legating with free ties, surgical needles are needed to safely carry suture material through tissue with the least amount of trauma.

The best surgical needles are made of high-quality tempered steel that is:

- Strong enough so that it does not break easily
- Rigid enough to prevent excessive bending, yet flexible enough to prevent breaking after bending
- Sharp enough to penetrate tissue with minimal resistance (yet it need not be stronger than the tissue it penetrates)
- Approximately the same diameter as the suture material it carries to minimize trauma in passage through tissue
- Appropriate in shape and size for the type, condition, and accessibility of the tissue to be sutured
- Free from corrosion and burrs to prevent infection and tissue trauma.

Many shapes and sizes of surgical needles are available. Surgical needles may be straight like a sewing needle or curved. All surgical needles have three basic components: the *point*, the *body* (or *shaft*), and the *eye*. They are classified according to these three components.

Point of the Needle

Points of surgical needles are honed to the configuration and sharpness desired for specific types of tissue. The basic shapes are cutting, tapered, or blunt (Fig. 10-3).

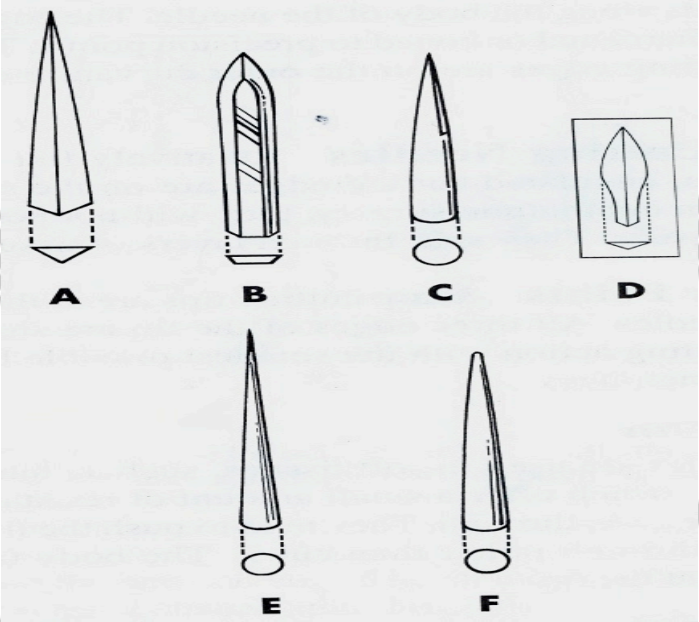

Fig. 10-3. Configurations of Needle points: (A) cutting, (B) side cutting, (C) cutting edges at end of tapered body, (D) trocar point, (E) taper, (F) blunt.

Body of the Needle

The body, or shaft, varies in length shape, and gauge. The nature and location of tissue to be sutured influences the selection of needles with these variable features.

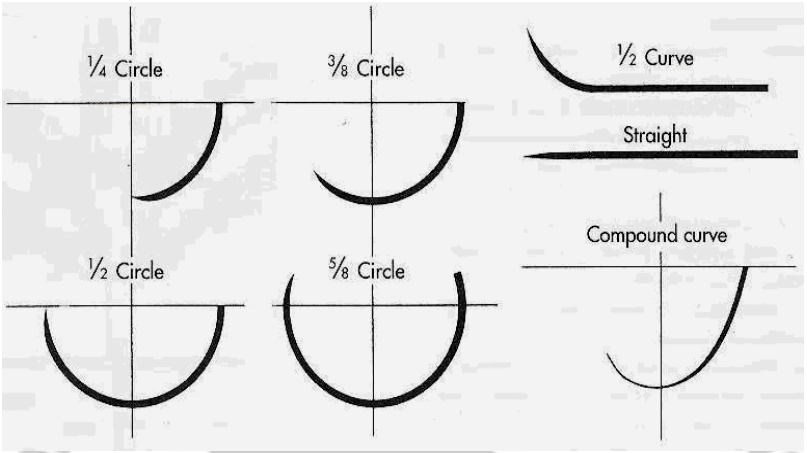

Fig.10-4. Shapes of Needle bodies**.**

Eye of the Needle

The eye is the segment of the needle where the suture strand is attached. Surgical needles are classified as eyed, French eye, or eyeless (also known as swaged or atraumatic).

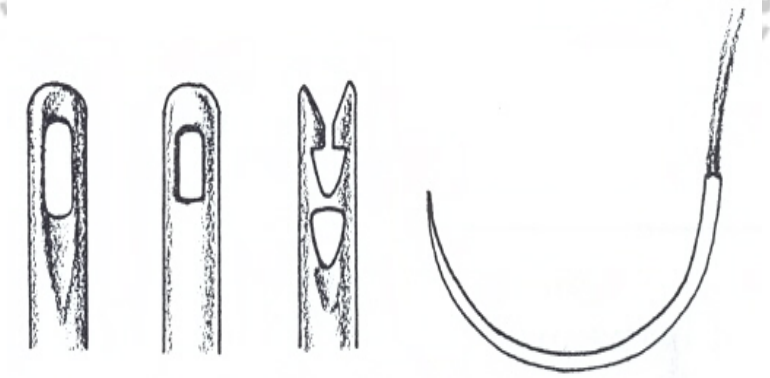

Fig.10-5. Eyes of Needles. Left to right: elliptical, square, French eye, eyeless. (From Nealon, T. F.: Fundamental Skills in Surgery, 3rd ed. Philadelphia, W.B. Saunders, 1979, p. 39)

Handling of eyed and French Eye Needles

Eyed and French eye needles have the following disadvantages for the scrub nurse, surgeon and patient:

- Each needle must be carefully inspected by the scrub nurse before and after use for dull or burred points, corrosions, and defects in the eye
- Care must be taken to avoid puncturing gloves with the needle point when threading
- If the scrub nurse must choose an appropriate needle to thread, the needle should be the same approximate diameter as the suture size requested by the surgeon
- Needles can unthread prematurely. This is an annoyance to the surgeon and prolongs operating time for the patient.

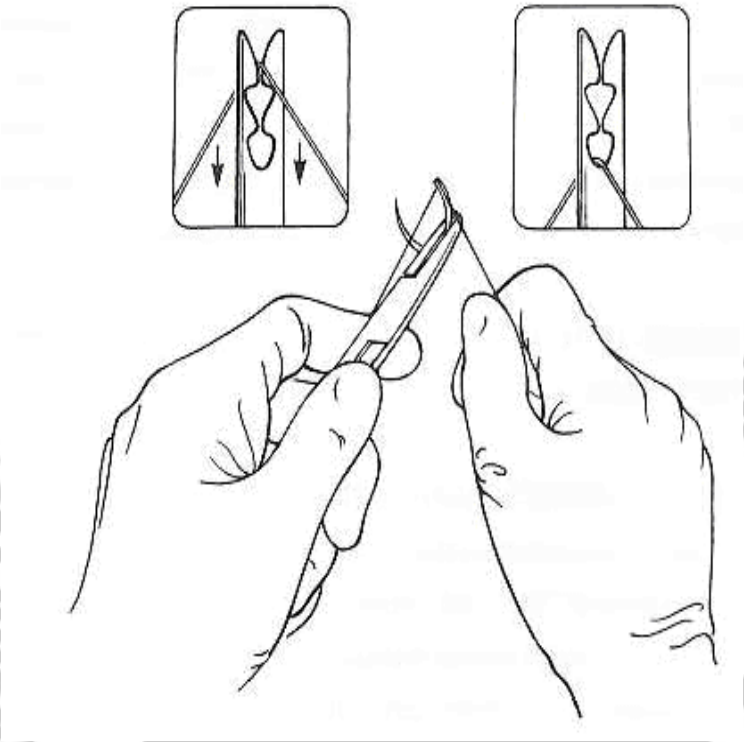

Fig. 10-6. Threading French eye Needles.

Eyeless Needle

- An eyeless needle is a continuous unit with the suture strand.
- The needle is swaged onto the end of the strand in the manufacturing process.
- This eliminates threading at the operating bed and minimizes tissue trauma because a single strand of material is drawn through tissue.

- The diameter of the needle matches the size of the strand as closely as possible.
- The surgeon uses a new sharp needle with every suture strand

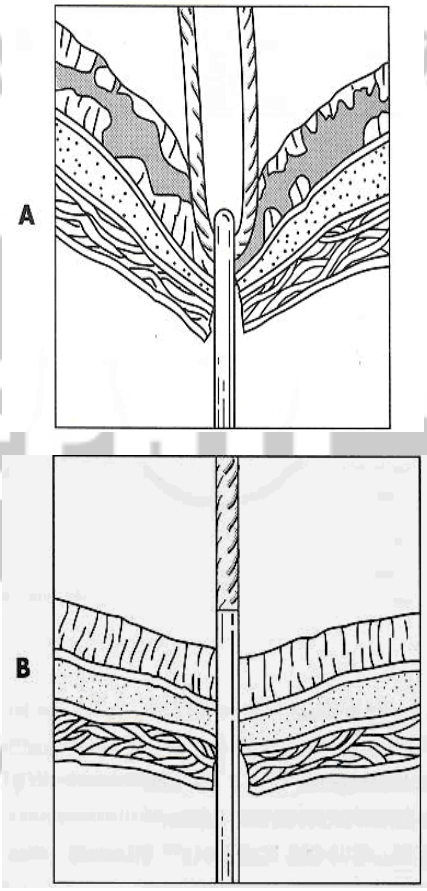

Fig. 10-7. Tissue effects of needle penetration. A, threaded. B, swaged atraumatic (Berry & Kohn's: Operating Room Technique, p. 544).

Placement of the Needle in the Needleholder

Needleholders have specially designed jaws to securely grasp surgical needles without damage if they are used correctly. The scrub nurse should observe the following principles in handling needles and needleholders:

- Select a needleholder with appropriate-size jaws for the size of the needle to be used
- Select an appropriate-length needleholder for the area of tissue to be sutured
- Clamp the body of the needle in an area one fourth to one half of the distance from the eye to the point (see the Figure 11-7 below)
- Never clamp the needleholder over the swaged area since this area is the weakest area of an eyeless needle
- Place the needle securely in the tip of the needleholder jaws and close the needleholder in the first or second ratchet
- Pass the needleholder with the needle point up and directed toward the surgeon's thumb when grasped
- Hand the needleholder to the surgeon so that the suture strand is free and not entangled with the needleholder

- Hold the free end of the suture in one hand while passing the needleholder with the other hand
- Protect the end of the suture material from dragging across the sterile field

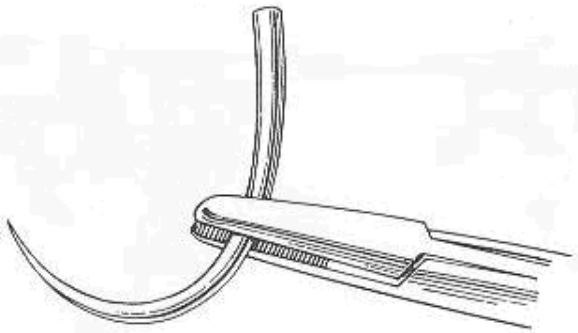

Fig. 10-8. Placement of a needle in the Needle holder

10.5. Methods of Suturing

There are two basic methods of suturing and various ways to utilize the two techniques. The suture is either *running*, utilizing a single continuous suture, or else it is *interrupted.* Interrupted sutures are placed separately and tied separately. Suturing techniques are depicted in Figure 10.9. Examples of suturing techniques that direct the wound edges for specific healing mechanisms include, but are not limited to, the following:

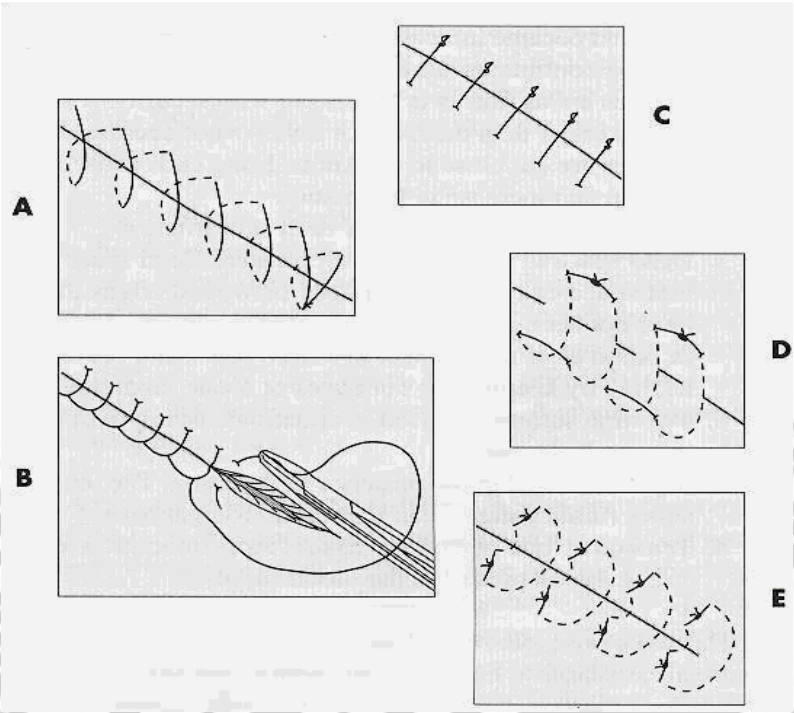

Fig. 10-9. Examples of suturing techniques. **A** and **B:** continuous; **C, D,** and **E:** interrupted.

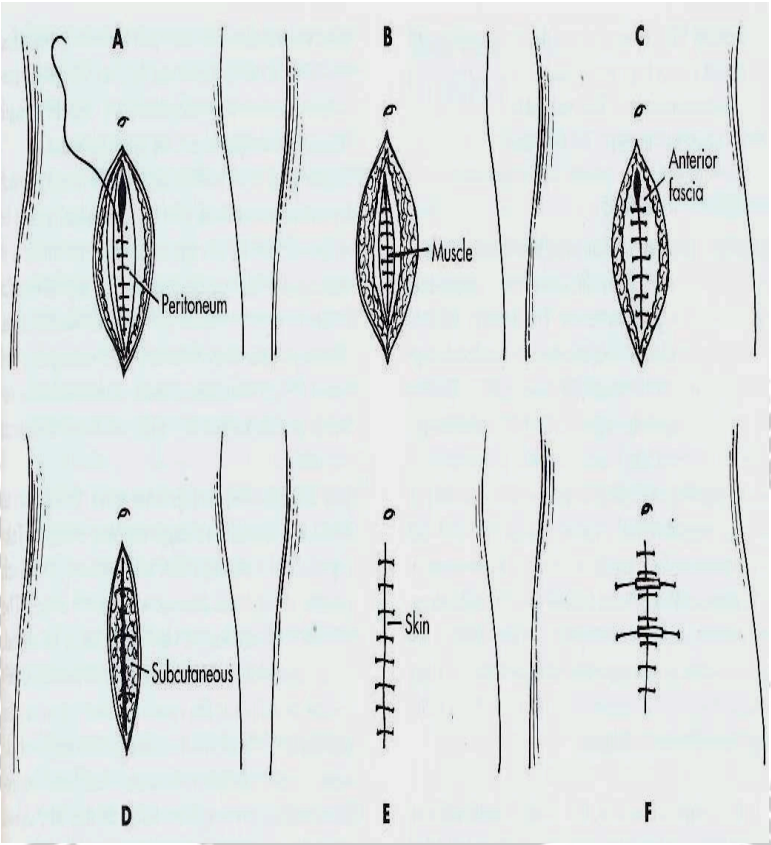

Fig. 10-10. Suturing incised tissue layers**.**

- ***Everting sutures.*** These interrupted (individual stitches) or continuous (running stitch) sutures are used for skin edges.
- **Simple continuous (running).** This suture can be used to close multiple layers with one suture. The

suture is not cut until the full length is incorporated into the tissue (Figure 10-8, A).

- ***Simple interrupted.*** Each individual stitch is placed, tied, and cut in succession from one suture (Figure 10-8, C).
- ***Continuous running/locking;*** also known as a *blanket stitch.* A single suture is passed in and out of the tissue layers and looped through the free end before the needle is passed through the tissue for another stitch. Each new stitch locks the previous stitch in place (Figure 10-8, B).
- ***Horizontal mattress.*** Stitches are placed parallel to wound edges. Each single bite takes the place of two interrupted stitches (Figure 10-8, D).
- ***Vertical mattress.*** This suture uses deep and superficial bites, with each stitch crossing the wound at right angles. It works well for deep wounds. Edges approximate well (Figure 10-8, E).
- ***Inverting sutures.*** These sutures are commonly used for two-layer anastomosis of hollow internal organs, such as the bowel and stomach. Placing two layers prevents passing suture through the lumen of the organ and creating a path for infection. These stitches can be either *interrupted* or *continuous*.

Knot Placement

Each suture placed in tissue usually requires the placement of a knot to secure the ends. Interrupted stitches require individual knots, and therefore placement of each knot can influence how well the wound heals and the cosmetic result. Principles concerning knots and knot tying include the following.

1. The knot should be tied away from:

- Vital structures, such as the eye
- Source of contamination, such as the mouth
- Potential irritants, such as the nares
- Potential sources of increased inflammation, such as the incision line

2. The knot should be tied toward:

- The better blood supply
- The area that provides the best security of the knot
- If possible, where the mark would be less noticeable

Cutting Sutures

Care is taken to prevent excess suture from remaining in the wound. Suture tails are trimmed close to the knot. Considerations for cutting suture include the following:

- Scissors should be stabilized by the index finger on the screw, the blades are angled slightly and slide down to the area just above the knot, and the suture is cut with the tips of the scissors.

- The tips of the scissors must be visible to ensure that other structures are not injured by the cutting motion.
- A hemostat and/or a second suture should be available in the event that the knot is inadvertently cut, releasing the sutured tissue.
- A hemostat may be placed on one of the suture ends to stabilize the suture to be cut.
- When removing a suture, a forceps is used to grasp the suture at the knot. Cut the suture between the knot and the skin. Extract the cut suture with forceps.

Special Suturing Techniques

- **The Retention Suture**

The ***retention suture*** is used on the abdomen to *give added support* to the closure. For this purpose, heavy suture materials usually 2 or 3 nylon are used.

Retention suture (stitch) can be placed - through all layers of tissue or in fascia. Bolster (bumpers) are used to protect the skin and to distribute the tension evenly. Bumpers are made from rubbers or plastics to be inserted over the retention suture to prevent it from cutting into the skin.

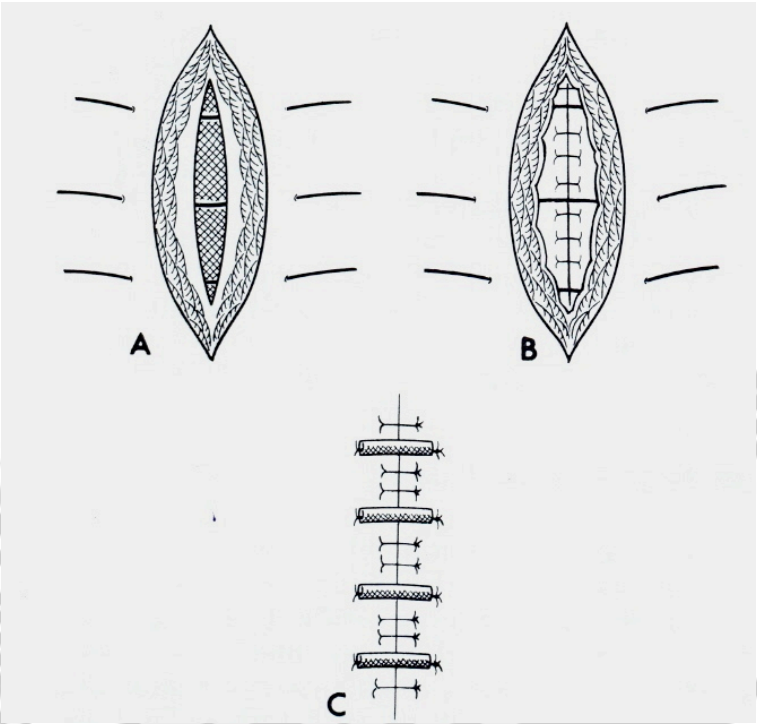

Fig.10-11. A, Retention suture placed through all layers of tissue. **B,** Retention suture placed in fascia**. C,** Bolsters are used to protect the skin**.**

- **The Suture ligature**

The ***suture ligature*** (sometimes called a **"stick tie"**) is used to ligate very large vessels. The suture is passed through the walls of the vessel and surrounding tissue. In this way, the ligature cannot slip off the end of the vessel.

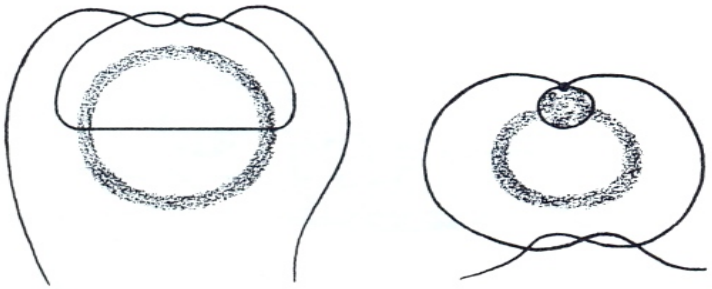

Fig. 10-12. Suture ligature.

- **A Purse-String Suture**

A ***purse-string suture*** is used to approximate the end of a lumen, such as a hernia sac or appendicle stump. The suture is passed around the lumen and tied in *purse-string* fashion.

Fig. 10-13. Purse-string Suture.

Non suture products

Materials other than suture are available for wound closure and ligation of vessels. They include:

- Sterile tapes
- Wound clips
- Ligation clips, and
- Stapling instruments.

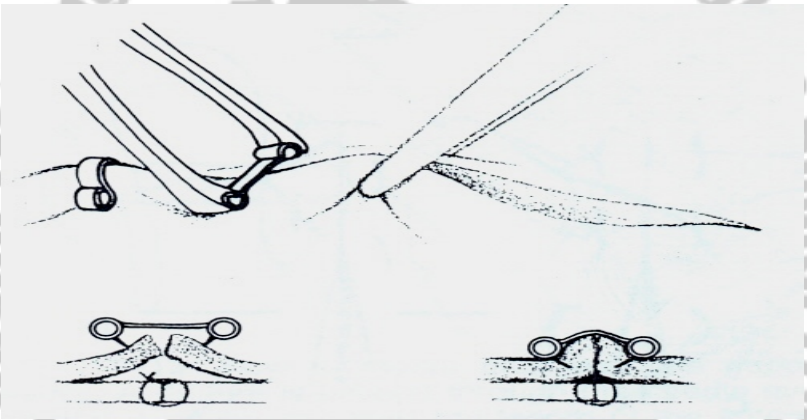

Fig. 10-14. Application of Wound clips**.**

10.6. Questions for Study and Review

1. Define suture and suture materials.
2. Compare and contrast absorbable and non absorbable sutures materials.
3. Explain the purpose of surgical needles.
4. Describe the two basic methods of suturing.
5. Explain a retention suture.
6. Prepare suture materials properly.

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CHAPTER ELEVEN

PRINCIPLES OF ANESTHESIA

11.1. Learning Objectives

After completing this chapter, the learner will be able to:

1. Differentiate between local and general anesthesia.
2. Mention the routes of administering local anesthesia.
3. Identify three methods of administering general anesthesia.
4. Manage the adverse effects of local anesthesia.
5. List two agents used as local anesthesia.
6. Identify the stages of general anesthesia.
7. Mention two agents used for general anesthesia.

11.2. Introduction

Anesthesiology is the branch of medicine that is concerned with the administration of *medication* or *anesthetic agent* to relieve pain and support physiologic function during a surgical procedure. The American Board of Anesthesiology has defined anesthesiology as the *practice* of *medicine* dealing with the management of *procedures* for rendering a patient insensible to pain during surgical procedures, and with the support of life functions under the stress of anesthetic and surgical manipulations.

The operating room team members should be aware of the effects of anesthesia on the patient. During several aspects of administration and maintenance of the anesthetic process, the operating room team members should be readily available to assist the anesthesia provider as needed.

An American physician, Oliver Wendell Holmes, devised the term *anesthesia* from the Greek words meaning *negative sensation*.

***Anesthesia*,** the absence of sensation, may be produced in a specific body area or systemically. When the agent given causes unconsciousness, the anesthetic is termed general (general anesthesia) when an agent is directed into a specific area to cause *analgesia*, the absence of pain, it is called conductive or local or regional.

11.3. Types of Anesthesia

Local anesthesia

The agent used during local anesthesia acts on a single nerve, a group of nerves or on superficial nerve endings. During all types of local/regional anesthesia including local infiltration, nerve block, topical, epidural and spinal, the patient remains conscious.

Local infiltration

- The agent is injected intracutaneously and subcutaneously into tissues at and around the incisional site to block peripheral sensory nerve stimuli at their origin. The surgery should not be extensive
- It is used to suture superficial lacerations or for excision of minor lesions
- Addition of Adrenaline (Epinephrine) to the anesthetic agent causes vasoconstriction to slow circulatory uptake and absorption, thus prolonging anesthesia
- Use a calibrated syringe to avoid over dosage
- The patient receiving Adrenaline should be well oxygenated
- Agents with Adrenaline are contraindicated for operative procedures involving fingers and penis
- High levels of local anesthetic are toxic
- Administration of it takes place as part of the *sterile procedure* - use sterile needle and syringe.
- When highly vascularized areas are to be injected, epinephrine is sometimes added to the anesthetic (to minimize local bleeding, prolong the effect of the agent).

Nerve block

- Anesthesia of a large single nerve or nerves

- Injection is done not necessarily at the immediate surgical site
- Commonly used in surgery that is performed on fingers and toes
- The supplying nerve is anesthetized

Topical

- Used to numb superficial nerve endings particularly those of the mucous membranes
- The agent may be–swabbed, sprayed or applied in drops as for eye surgery
- Useful in preparing the patient for endoscopic procedures, such as bronchoscopy and esophagoscopy

Regional Anesthesia

Epidural

- Introduced into the epidural space of the spine
- The agent baths the nerve roots of the spinal cord and the area supplied by these nerves is anesthetized

- The anesthetic is injected outside the spinal canal (no direct contact between spinal fluid and anesthetic).

Caudal

- Type of epidural anesthesia
- Directed into the caudal canal at the sacrum
- Ideal for obstetrics and procedures on the perineum

Spinal

- Introduction of the anesthetic into the *subarachnoid* space at the fourth or fifth lumbar interspace.
- Here the agent does come into contact with the spinal fluid
- Ideal for surgery of the lower pelvis, such as cesarean section or hernia repair; lower extremities. Risk of infection in the spinal canal if the puncture site and/or the plastic tube, etc. is contaminated.

Adverse reactions to local anesthesia

Proper monitoring of blood pressure, pulse rate, and heart rhythm is essential. Monitor the patient every 15 minutes during the procedure. All team members should be aware of the danger signals that accompany an adverse reaction. Adverse reaction occurs when the patient receives overdose, which is by far the most common complication. Relative overdose occurs when the patient receives too much anesthetic too quickly, as when a vein or artery is punctured

during the administration of the anesthetic. The anesthetic travels quickly to the brain and the following symptoms may be observed:

- ***Stimulation*:** patient may become very talkative or anxious, signs of tachycardia thready pulse, convulsion.
- ***Depression*:** patient may appear sleepy and unresponsive, bradycardia, hypo tension.
- **Other signs:** patient may develop cyanosis, sweating feel cold, act restless (signs of shock). Fainting, itching, nausea or sudden headache may also occur.

Treatment of the Reaction

- Discontinue the anesthetic immediately
- Oxygen administration may be needed
- Cardiopulmonary resuscitation is initiated, if necessary.

Table 11-1. Local and Regional Anesthetic Agents

Generic Name	Trade Name(s)	Uses	Concentration	Duration of Effect (Hours)	Maximum Dosage
Amino Amides					
Bupivacaine hydrochloride	Marcaine Sensorcaine	Local infiltration* Regional block* Surgical epidural	0.25% to 0.50%	2 to 3	400 mg
Dibucaine hydrochloride	Nupercaine Percaine Cinchocaine	Local infiltration Peripheral nerves	0.05% to 0.1%	3 to 3½	30 mg
Etidocaine hydrochloride	Duranest	Peripheral nerves Epidural	0.5% to 1%	2 to 3	500 mg
Lidocaine hydrochloride	Xylocaine Lignocaine	Topical Infiltration* Peripheral nerves* Nerve block* Spinal Epidural	2% to 4% 0.5% 1% to 2%	½ to 2	200 mg 500 mg or 7 mg/kg body weight
Mepivacaine hydrochloride	Carbocaine	Infiltration Peripheral nerves Epidural	0.5% to 1% 1% to 2%	½ to 2	500 mg
Prilocaine hydrochloride	Citanest	Infiltration Peripheral nerves Regional block Epidural	1% to 2% 2% to 3%	½ to 2½	600 mg
Amino Esters					
Chloroprocaine hydrochloride	Nesacaine	Infiltration* Peripheral nerves* Nerve block* Epidural	0.5% 2% 2% 2% to 3%	¼ to ½	1000 mg
Cocaine hydrochloride		Topical	4% or 10%	½	200 mg or 4 mg/kg body weight
Procaine hydrochloride	Novocain	Infiltration Peripheral nerves Spinal	0.5% 1% to 2%	¼ to ½	1000 mg or 14 mg/kg body weight
Tetracaine hydrochloride	Cetacaine Pontocaine	Topical Spinal	2% 1%	2 to 4	20 mg

* Epinephrine may be used.

Source: Berry ands Kohn's; Operating Room Technique, p. 429

General Anesthesia

- Causes unconsciousness, provides analgesia and muscle relaxation
- Depending upon the type and amount of agent used, the patient may be slightly or not at all responsive to stimuli.
- A combination of agents is frequently used to achieve the desired level of muscle relaxation and analgesia

There are four stages of general anesthesia. These are induction, excitement, relaxation and danger.

Induction

- The beginning of administration of the initial agent
- Lasts until the patient is unconscious,
- During this phase, the patient retains an exaggerated ***sense of hearing*** until the last moment.
- For this reason it is mandatory that all personnel in the room remain as quiet as possible during induction.

Excitement

- During this phase, the patient is delirious and sensitive to external stimuli
- Involuntary muscle activity and struggle may be seen
- Patient is physiologically unstable

Relaxation

- This phase is the level at which surgery may be performed safely.
- The patient is relaxed, unconscious of pain and is physiologically stable
- Breathing is steady and automatic
- This phase ends at its deepest level with respiratory paralysis.

Danger

This stage begins when the amount of agent causes such severe depression of the central nervous system that the patient is in immediate danger of cardiopulmonary arrest.

Some common general anesthetic agents are described in table 11.2.

Methods of Administering General Anesthesia

Inhalation

The anesthesia machine (gas machine annex 4) is used to administer both compressed gas anesthetics (available in tanks) and volatile liquids that are vaporized within the machine before administration. Since the anesthesia provider controls all gases that enter the patient's lungs, the machine also conveys oxygen in the proper proportion.

The patient receives the anesthetic-oxygen mixture via:

- The endotrecheal tube that is inserted into the trachea or
- From a mask that fits snugly around the nose and mouth.
- In either case, the tube or mask is connected to the machine by a set of hoses through which the gases flow.

Intravenous (IV) and intramuscular (IM) administrations

Injections are also used in general anesthesia. Liquid agents may be administered directly into the blood stream. A cannula is inserted into the vein and a continuous intravenous drip is maintained throughout surgery. The cannula/catheter is attached to flexible IV tubing. Solutions such as saline or dextrose in saline are attached to the tubing to keep access to the vein open at all times. Other agents such antibiotics or muscle relaxants may also be given through the IV cannula.

Some anesthetic agents, such as Ketamine, may be administered intramuscularly. These agents are usually injected by the anesthesia provider about 15 minutes prior to surgery.

Table 11-2. Most Commonly Used General Anesthetic Agents

Generic Name	Trade Name	Administration	Characteristics	Uses
Inhalation Agents				
Nitrous oxide	—	Inhalation	Inorganic gas; slight potency; pleasant fruitlike odor; nonirritating; nonflammable but supports combustion; poor muscle relaxation	Rapid induction and recovery; short procedures when muscle relaxation unimportant; adjunct to potent agents
Halothane	Fluothane	Inhalation	Halogenated volatile liquid; potent; pleasant odor; nonirritating; cardiovascular and respiratory depressant; incomplete muscle relaxation; potentially toxic to liver	Rapid induction; wide spectrum for maintenance; depth of anesthesia easily altered; rapid reversal
Enflurane	Ethrane	Inhalation	Halogenated ether; potent; some muscle relaxation; respiratory depressant	Rapid induction and recovery; wide spectrum for maintenance
Isoflurane	Forane	Inhalation	Halogenated methyl ether; potent; muscle relaxant; profound respiratory depressant; metabolized in liver	Rapid induction and recovery with minimal aftereffects; wide spectrum for maintenance
Intravenous Agents				
Thiopental sodium	Pentothal sodium	Intravenous	Barbiturate; potent; short acting with cumulative effect; rapid uptake by circulatory system; no muscle relaxation; respiratory depressant	Rapid induction and recovery; short procedures when muscle relaxation not needed; basal anesthetic
Methohexital sodiuim	Brevital	Intravenous	Barbiturate; potent; circulatory and respiratory depressant	Rapid induction; brief anesthesia
Propofol	Diprivan	Intravenous	Alkylphenol; potent short-acting sedative-hypnotic; cardiovascular depressant	Rapid induction and recovery; short procedures alone; prolonged anesthesia in combination with inhalation agents or opioids
Ketamine hydrochloride	Ketaject, Ketalar	Intravenous, intramuscular	Dissociative drug; profound amnesia and analgesia; may cause psychologic problems during emergence	Rapid induction; short procedures when muscle relaxation not needed; children and young adults
Fentanyl	Sublimaze	Intravenous	Opioid; potent narcotic; metabolizes slowly; respiratory depressant	High-dose narcotic anesthesia in combination with oxygen
Sufentanil citrate	Sufenta	Intravenous	Opioid; potent narcotic, respiratory depressant	Premedication; high-dose narcotic anesthesia in combination with oxygen
Fentanyl and droperidol	Innovar	Intravenous	Combination narcotic and tranquilizer; potent; long acting	Neuroleptanalgesia
Diazepam	Valium	Intravenous, intramuscular	Benzodiazepine; tranquilizer; produces amnesia, sedation, and muscle relaxation	Premedication; awake intubation; induction
Midazolam	Versed	Intravenous, intramuscular	Benzodiazepine; sedative; short-acting amnesic; central nervous system and respiratory depressant	Premedication; conscious sedation; induction in children

Source: **Berry & Kohn's; Operating Room Technique, p. 409.**

11.4. Choice of Anesthesia

Selection of anesthesia is made by the anesthesia provider in consultation with the surgeon and the patient. The primary consideration with any anesthetic is that it should be associated with low morbidity and mortality. Choosing the safest agent and technique is a decision predicated on thorough knowledge, sound judgment, and evaluation of each individual situation.

The anesthesia provider uses the lowest concentration of anesthetic agent compatible with patient analgesia, relaxation, and facilitation of the surgical procedure.

An ideal anesthetic agent or technique suitable for all patients does not exist, but the one selected should include the following characteristics:

- Provides maximum safety for the patient
- Provides optimal operating conditions for the surgeon
- Provides patient comfort
- Has a low index of toxicity
- Provides potent, predictable analgesia extending into the postoperative period
- Produces adequate muscle relaxation
- Provides amnesia
- Has a rapid onset and easy reversibility
- Produces minimum side effects

The patient's ability to tolerate stress and adverse effects of anesthesia and the surgical procedure depends on:

- Respiration,
- Circulation, and
- Functions of the liver, kidneys, endocrine system, and central nervous system.

The following factors are important:

- Age and size/weight of the body
- Physical, mental, and emotional status of the patient
- Presence of complicating systemic disease or concurrent drug therapy
- Presence of infection at the site of the surgical procedure
- Previous anesthesia experience
- Anticipated procedure
- Position required for the procedure
- Type and expected length of the procedure
- Local or systemic toxicity of the agent
- Expertise of the anesthesia provider
- Preference of the surgeon and patient

11.5. Pre medication

Pre medication is administered to the patient approximately one hour before surgery. These medications are used in order to relax the patient and provide smooth induction. It is also important that mucous membranes be dry to prevent

aspiration of mouth secretions into the lungs. The four common classes of pre medications and their effects are listed below:

1. Barbiturates (Nembutal, Secobarbital)

- Produces a hypnotic effect
- Acting as sedatives

2. Opiates *(*Metapon, Demerol, Morphine)

- Produces narcosis
- Act as analgesia

3. Belladonna Derivatives *(*Atropine, scopolamine)

- Inhibit mucous secretion

4. Tranquilizers (valium, vistaril, chlorpromazine)

These relax and allay apprehension and allow for smooth induction.

The patient who has received preoperative medications should be watched for signs of respiratory or circulatory depression. Any unusual reaction to the medication should be reported to the anesthesia provider immediately.

6. Questions for Study and Review

1. What is the difference between anesthesia and analgesia?
2. Define local anesthesia.
3. Mention three different kinds of local anesthesia.
4. What effect does epinephrine has on the surgical site?
5. Discuss the various ways a patient might react adversely to the local anesthesia.
6. What is the maximum safe dosage of xylocaine?
7. What are the various methods in which a general anesthesia might be administered?
8. Identify the four stages of general anesthesia.
9. List four types of preoperative medications and give an example of each.

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CHAPTER TWELVE

HAZARDS IN THE OPERATING ROOM

12.1. Learning Objectives

After the completion of this chapter, the learner will be able to:

1. Identify the main dangers in the operating room.
2. Explain the factors that increase the hazards in the OR.
3. Differentiate between physical and chemical hazards.
4. Discuss malignant hyperthermia.
5. Define anaphylactic reaction.

12.2. Introduction

Historically, the operating room (OR) has been a place full of hazards for both the patient and the care giver. The primary dangers include, but are not limited to fire, chemical exposure to anesthetic agents and direct exposure to biologic materials.

12.3. Environmental Hazards

The perioperative environment poses many hazards for both patients and personnel. The potential for physical injury from electric shock, burns, fire, explosion, exposure to blood-borne pathogens, and inhalation of toxic substances is ever present. Therefore, it is important that staff have knowledge of the hazards involved in **equipment use**, the causes of **accidental injury** and the **source of health risks**.

All individuals have a personal responsibility to ensure a safe environment for themselves and others. Faulty equipment or

improper usage increases the hazards of potential risk factors.

Classification of Hazards

Injuries can be caused by:

- Using faulty equipment
- Using equipment improperly
- Exposing oneself or others to toxic or irritating agents, or
- Coming into contact with harmful agents

Hazards in the OR environment can be classified as follows:

- ***Physical:*** including back injury, fall, noise pollution, irradiation, electricity and fire
- ***Chemical:*** including anesthetic gases, toxic fumes from gases and liquids, cytotoxic drugs and cleaning agents
- ***Biologic:*** including the patient (as a host for or source of pathogenic microorganisms), infectious waste, cuts or needle-stick injuries, surgical plume and latex sensitivity

Regulation of Hazards

Standards, guidelines and recommended practices have been developed by many professional associations, governmental and nongovernmental agencies such as Ministry of Health (MoH), World Health Organization (WHO), CDC, FDA, and the likes. The policies and procedures of the health care facility should be developed and enforced in

compliance with local, state and federal regulations so that the risks can be minimized to the standards, guidelines and recommended practices.

The appropriate use of electronic devices is a prime concern of health care providers and industry personnel who seek safer patient care.

Grounding

The grounding of all electrical equipment is essential for safety and the prevention of stray current leakage. Grounding systems are designed to discharge any harmful electricity directly to the ground without including the patient in the circuit. This prevents the inadvertent passage of electric current through the patient, thereby preventing shock or burn.

Fire and Explosion

Fire should be a matter of prime concern in the OR. Fires in an oxygen-enriched atmosphere are fundamentally different in character than those occurring in normal atmosphere. The fire severity potential should be regarded as serious, with the potential for extensive damage and endangerment to lives of patients and care givers. The presence of flammable and combustible liquids, vapors and gases in an oxygen-enriched atmosphere can result in the ultrarapid combustion of surrounding materials with explosive violence.

A fire or explosion is the result of a combination of three factors, these are:

- A flammable gas, vapor, or liquid (e.g., alcohol, ether, …)
- A source of ignition (e.g., electrosurgery, static electricity, …)
- Oxygen (pure or in air) or some other substances that provide oxygen, such as nitrous oxide gas

12.4. Catastrophic Events in the operating Room

Unanticipated intraoperative events occasionally occur. Although some might be anticipated (e.g., cardiac arrest in an unstable patient, massive blood loss during trauma surgery), others may occur without warning, demanding immediate intervention by all members of the OR team. Two such events are anaphylactic reactions and malignant hyperthermia.

Anaphylactic Reactions

Anaphylaxis is the most severe form of an allergic reaction, manifesting with life-threatening pulmonary and circulatory complications. The initial clinical manifestations of anaphylaxis may be masked by anesthesia. Anesthesia Care Providers (ACPs) administer an array of drugs to patients, such as anesthetics, antibiotics, blood products and plasma expanders, and since any parenterally administered material

can theoretically produce an allergic response, vigilance and rapid intervention are essential. An anaphylactic reaction causes hypotension, tachycardia, bronchospasm and possibly pulmonary edema. Antibiotics and latex are responsible for many perioperative allergic reactions.

Latex allergy has become a particular concern in the perioperative setting, given the use of gloves, catheters, and many other devices containing natural rubber latex (NRL). Reactions to NRL have ranged from urticaria to anaphylaxis with symptoms appearing immediately or at sometime during the surgical procedure. Latex allergy protocols should be set up in each institution so that a latex-safe environment can be provided to susceptible individuals.

Malignant Hyperthermia

Malignant hyperthermia (MH) is a rare metabolic disease characterized by hyperthermia with rigidity of skeletal muscles that can result in death. It occurs in affected people exposed to certain anesthetic agents. When it does occur, it is usually during general anesthesia, but it may manifest in the recovery period as well. The fundamental defect is hypermetabolism of skeletal muscle resulting from altered control of intracellular calcium, leading to muscle contracture,

hyperthermia, hypoxemia, lactic acidosis, and hemodynamic and cardiac alterations.

Tachycardia, tachypnea, hypercabia and ventricular arrhythmias are generally seen, but are nonspecific to malignant hyperthermia. MH is generally diagnosed after all other causes of hypermetabolism are ruled out. The rise in body temperature is not an early sign of MH. Unless promptly detected with rapid initiation of appropriate intervention, MH can result in cardiac arrest and death. The definitive treatment of MH is prompt administration of dantrolene (Dantrium), which slows metabolism, along with symptomatic support to correct hemodynamic instability, acidosis, hypoxemia, and elevated temperature. A treatment protocol is available from the Malignant Hyperthermia Association and is usually displayed in the OR.

12.5. Questions for Study and Review

1. List four primary dangers for both the patient and the care giver in the operating room.
2. In order to minimize the potential hazards in the OR, what knowledges are expected from the OR team?
3. Identify the three hazard classifications that could happen in the OR environment.
4. What is the purpose of grounding in the electric system of the OR?

5. Discuss malignant hyperthermia.
6. Define anaphylactic reaction.

CHAPTER THIRTEEN
IMMEDIATE POSTOPERATIVE PATIENT CARE

13.1. Learning Objectives

After studying this chapter, the learner will be able to:

1. State the most common causes of death within 24 hours of postoperative period.

2. Identify areas of competences for a nurse working in the recovery room (RR).
3. List some major responsibilities of the recovery room nurse.
4. Mention some patient care equipment required in the recovery room.
5. List main emergency drugs required in the recovery room.

13.2 Introduction

Surgical procedures are performed in many diverse settings, including surgeon's offices, ambulatory surgery centers, and hospital-based surgical suites and specialty units. In general, the selection of the surgical setting is influenced by:

- The anticipated complexity of the procedure
- The patient's health status
- Available technology, and
- Financial resources

Regardless of the surgical setting or procedure, the patient should be observed and monitored postoperatively. The monitoring is performed in a controlled postsurgical or postanesthesia environment before the patient being transferred to a patient care unit or discharged from the facility. The postoperative phase of the surgical patient's perioperative experience begins after the surgical procedure is completed and the patient is admitted to a post-procedural area (usually the recovery room, RR).

13.3. The Recovery Room

Patients who have had all kinds of surgery, from the most minor to the most major, will be admitted to the recovery room (RR) after their operation. It follows therefore, the staff, facilities and equipment for the care of such patients must be available.

The most important requirement is, undoubtedly, the presence of adequate numbers of well-trained nursing and medical staff to observe patients and treat them as necessary. Ideally, it would be desirable to have a nurse for each recovery room bed. For most hospitals, especially in our Country, this would be an intolerable drain on number of nurses.

Causes of death documented within the first 24 hours of anesthetic administration and surgical procedure were:

- Obstruction of airway
- Laryngospasm
- Hemorrhage
- Cardiac arrest, and
- Inappropriate administration of medications

Contributing factors for this include:

- Inadequate postoperative patient care
- Lack of standardized observation parameters, and

- Absence of medical supervision

A member of the medical staff should be constantly available to deal with medical problems arising within the area. This is often a member of the anesthetic staff, but may be one of the surgical staff.

13.4. Postoperative Observation of the Patient

The duration and type of postoperative observation and care will vary according to the following:

- Patient's condition (e.g., alert and oriented vs. unresponsive)
- Need for physiologic support (e.g., ventilator-dependent, vs. awake and extubated)
- Complexity of the surgical procedure (e.g., open laparotomy vs. laparoscopy)
- Type of anesthesia administered (e.g., a general inhalation agent vs. local infiltration)
- Prescribed period for monitoring parameters to evaluate physiologic status (e.g., stable vs. unstable vital signs)

13.5. The Recovery Room Patient Care Personnel

Adequate personnel should be available to monitor patients and to provide appropriate care as needed. The education

and training of a recovery room nurse should include knowledge of the following:

- Airway management techniques, including positioning, chin lift, jaw thrust, suctioning, bagging, and placement of an airway
- Circulatory assessment,
- Neurological condition
- Anesthetic agents and their action
- Medications and their actions
- Most invasive and minimally invasive procedures

The nurses working in the recovery room should demonstrate competence in the following:

- Physical assessment (e.g., heart and lung sounds)
- Recognition of physiologic complications (e.g., airway obstruction, hypothermia, pain, nausea or vomiting, and/or oropharyngeal aspiration)
- Management of physiologic emergences (e.g., airway obstruction, hemorrhage, cardiac arrest)
- Interpretation of monitoring data from electrocardiogram (ECG) and oximetry devices
- Application of cardiopulmonary resuscitation (CPR)

13.6. Admission of the Postoperative Patient to the Recovery Room

As the patient enters the recovery room (RR), his/her immediate physiologic and psychologic status is reported to the recovery room nurse by the accompanying personnel (usually the circulating nurse, assistant surgeon, or anesthesia provider). The recovery room nurse observes the postoperative patient's wound (for bleeding), catheter, drain material, and intravenous infusions (whether they are in place). Then, the nurse monitors the vital signs of the patient as prescribed.

Postoperative Report

The postoperative report provides information from the anesthesia provider, the surgeon (assistant surgeon), and the nurse. Much of the report is delivered verbally, but postoperative orders and pertinent information regarding the patient's condition and intraoperative care are reinforced in writing.

Patient Care Activities

The application of physiologic and psychosocial knowledge, principles of asepsis, and technical knowledge and skills are necessary to promote, restore, and maintain the patient's physiologic processes in a safe, comfortable and effective environment. Particular attention is given to monitoring

oxygenation, ventilation and circulation. Recovery room care includes:

- Maintaining adequate ventilation
- Preventing shock, and
- Alleviating pain

Patients are evaluated continually by appropriate monitoring methods and frequent observations by nurses. Clinical evaluation of each patient's status through listening, watching, and feeling is augmented by electronic monitoring devices if available.

As in all other patient care areas, standard precautions are carried out for the disposal of needles and the handling of any item contaminated by blood and body fluids. Hand washing is essential after each patient contact to prevent cross-contamination.

Family members are notified when a patient is admitted to the recovery room (RR). This lets them know the surgical procedure is complete, which helps to relieve the anxiety experienced during the hours of waiting.

Documentation

Institutional policies and procedures should be followed in documenting the care given in the recovery room. Observations of respiratory and circulatory functions and level

of consciousness are recorded at frequent intervals. Postoperative physiologic and psychologic status are documented at the time of any significant event (e.g., the administration of medication), as well as routinely at 5- to 7-minutes interval for the first hour and at 15- to 30-minutes intervals for the second hour and thereafter.

13.7. Discharge of the Postoperative Patient from the Recovery Room

Most patients remain in the recovery room (RR) for at least one hour or until they have sufficiently recovered from anesthesia and that their vital signs have stabilized and they are capable of reasonable self-care. The patient's condition is scored according to **vital signs, activity level**, and **consciousness.**

After discharge from the recovery room, the patient is transported to a patient care unit (ward) or an intensive care unit (if present) or to home with follow-up appointment. A physician is responsible for the patient's discharge from the recovery room.

13.8. Facilities in the Recovery Room

The recovery room will be divided into an appropriate number of bays (areas), each of which equipped to receive a patient on his/her trolley or bed. The bays should be separated by curtains which can be drawn to provide privacy for nursing and medical procedures and withdrawn to allow easy observation of the patient.

Each bay should be spacious enough to give easy access of staff to the patient and also room for bulky equipment such as a resuscitation trolley or mobile x-ray machine.

There should be an oxygen outlet and at least one, preferably two, vacuum points in each bay. Two vacuum sources are preferable since a patient may require suction to be applied continuously to a surgical drain while suction may also be required at the same time to remove secretions from the airway.

The other very important facility which each bay requires is an adequate number of electrical outlets. At least six in each bay should be available, since certain patients will require a number of items of electrical apparatus to be in use simultaneously. For example, a patient may require a pulmonary ventilator, an electrocardiograph monitor, a blood warmer, a drip controller, etc. Thus, it is easy to see why a large number of electrical outlets are required.

Many patients coming from the operating room will have intravenous infusions running and some means of supporting drip bottles and bags must be available.

Equipment in the Recovery Room

The variety of equipment required in the recovery room are listed below.

Equipment for airway management

- Oropharyngeal and nasopharyngeal airways
- Tracheal tubes (oral and nasal)
- Laryngoscopes
- Suction catheters and tubing.

Equipment for respiratory support

- Ambubag or similar type of manual device for artificial ventilation
- Automatic ventilators

Equipment for oxygen therapy

- Oxygen flow meters
- Humidifier for oxygen
- Masks and tubing for delivery of oxygen to patient

- 'T' pieces for connection of oxygen tubing to tracheal tubes

Equipment for monitoring

- Electrocardiograph
- Blood pressure apparatus
- Central venous pressure
- Temperature
- Urinary output

Equipment for intravenous infusion

- Supply of intravenous (IV) fluids
- Plasma substitutes
- Refrigerator for storing blood for transfusion
- Intravenous giving sets
- Intravenous cannulae
- Central venous catheters
- Drip controllers or infusion pumps
- Blood warmers
- Pressure infusers (for pressurizing bags of intravenous fluid for rapid transfusion)
- Blood filters

General

- Syringes and needles
- Swabs

- Preparations for cleaning skin prior to injections, etc.
- Forms and appropriate sample tubes for biochemistry, hematology, blood transfusion, bacteriology,
- Requirements for general nursing care, e.g. wound dressing materials, bed linen, pillows, bed pans, sick bowels, etc.

Drugs for resuscitation trolley

There will be a small range of drugs required in acute cardiac or respiratory emergences:

- Sodium bicarbonate solution 8.4%
- Adrenaline 1:1000
- Calcium chloride 10%
- Isoprenaline
- Atropine
- Lignocaine for intravenous use
- Beta-blocking drugs e.g. propranolol
- A cardiac glycoside, e.g. digoxin
- An antihistamine, e.g. promethazine
- A bronchodilator, e.g. aminophylline
- Antinarcotics agents, e.g. naloxone
- Hydrocortisone
- Sterile water for injection when necessary

Drugs in the Recovery Room

In addition to the list of drugs required for acute resuscitation (a full supply of which should be available in addition to emergency supply), a wide range of drugs are required in the recovery area and will include many of those drugs normally used in the surgical wards. Thus, a comprehensive list is impractical here. The most frequently used will be:

- Analgesic drugs such as morphine, pethidine, etc.
- Antibiotics
- Local anesthetic agents
- Insulin for diabetic patients
- Heparin, corticosteroids
- Diuretics and anti-emetics.

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13.9. Questions for Study and Review

1. Mention the factors that influence the selection of surgical setting.
2. When does the postoperative phase of the surgical patient start?
3. Identify the most common causes of death of the postoperative patient within 24 hours of anesthetic administration and surgical procedure.
4. What are the contributing factors for postoperative patient death within 24 hours of anesthetic administration and surgical procedures?
5. Suppose you have planned to conduct an in-service education for staff working in the recovery room. What are some of the contents you intend to teach?
6. Mention some patient care equipment required in the recovery room.

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CHAPTER FOURTEEN
PEDIATRIC SURGERY

14.1. Learning objectives

1. Identify the indications for pediatric surgery.
2. Explain how knowledge has advanced pediatric surgery.
3. Discuss the preoperative preparation of pediatric patients.
4. State intraoperative pediatric patient care considerations.
5. Identify some of the responsibilities of the RR nurse during postoperative pediatric care.

14.2. Introduction

The surgical problems peculiar to children from birth to maturity are not limited to any one area of the body or to any one surgical specialty. Malformation and diseases affect all body parts and therefore, may require the skills of any of the surgical specialists. However, pediatric surgery is a specialty in itself and is not adult surgery scaled down to infant or child size.

14.3. Indications for Pediatric Surgery

Indications for pediatric surgery include:

- Congenital anomalies,
- Acquired disease processes, and

- Trauma

Many of these conditions are treatable or curable by surgical interventions.

Skill is required to perform pediatric surgical procedures regardless of the indication for the procedure. Specialists in all fields develop these skills as a refinement of their specialties. Surgeons who perform pediatric surgery should have knowledge of the embryologic, psychologic, physiologic, and pathologic problems peculiar to the newborn, infant, and child.

Knowledge has advanced pediatric surgery through the following:

- Recognition of differences between pediatric patients and adults.
- Accurate diagnosis and earlier treatment. This facilitates a more favorable outcome.
- Understanding of preoperative preparation of the patient and family.
- Availability of total parenteral nutrition and other measures of supportive care
- Advances in anesthesiology. These include new agents, perfection of techniques of administration,

and an understanding of the responses of pediatric patients to anesthetic agents.

- Refinements in surgical procedures and instrumentation.
- Understanding of postoperative care.

14.4. Considerations in Pediatric Surgery

The nursing process is tailored to meet the unique needs of each pediatric patient. Assessment and nursing diagnosis are based on chronologic, psychologic, and physiologic factors specific to each patient. The plan of care should reflect consideration for ***age*** and reflect interventions modified according to the child's developmental stage.

Preoperative Preparation of Pediatric Patients

The pediatric surgical patient should be considered as a whole person with individual physical and psychosocial needs assessed in relation to the natural stages of development. Equally important are the adjustment and attitude of the parents toward the child, the illness, and the surgical experience. Parents' anxiety about the impending surgical procedure may be transferred to the child. Emotional support of the patient and the parents, as well as parent and child teaching, are important aspects of preoperative preparation to help them cope.

Parents need to be informed of events that will occur and to be taught how to care for their child both pre- and postoperatively.

The following are general considerations:

- Psychologically, it may be better for both the patient and the parents if a congenital anomaly is corrected as soon after birth as possible.
- Separation from parent(s) or a trusted guardian is traumatic for infants over six months of age, toddlers (18 to 30 months of age), and preschool children (30 to 60 months of age).
- Ambulatory surgery, if feasible, is an advantage because the child enters the facility an hour or two before the surgical procedure and returns home following recovery from anesthesia. This minimizes the trauma of separation.
- A preoperative visit by an OR nurse should be planned to get to know the child, confirm appropriate consent, and provide emotional support to the family.
- Parents should be taught to provide postoperative care, especially before and after an ambulatory procedure.

Intraoperative Pediatric Patient Care Considerations

Basic principles of patient care and OR techniques used for adults apply to pediatric surgery. To differentiate this specialty from care of adult patients, a few points specific to pediatric surgery are mentioned as follows:

- Hair is not removed or shaved, except for cranial procedures
- The patient is protected from injury, an infant or child should never be left alone anywhere in the perioperative environment
- Catheters as small as 8 French are available for use as needed in newborn and infants.
- Positioning principles are the same as those described for adults. Correspondingly, smaller supplies and instruments are used
- Sterile drape sheet without a fenestration is often advantageous. The surgeon can cut an opening of the desired size to expose the incision site.
- Sponges are weighed while still wet; blood loss through suction is measured and estimated in the drapes. The surgeon will determine if blood replacement is necessary.
- Adhesive tape is abrasive to tender skin and should be avoided when possible.
- Dressings on the face or neck should be protected from vomitus and food particles, as well as from an infant's or toddler's hands.

Postoperative Pediatric Patient Care

The patient, postoperatively, is taken to the recovery room for observation. Parents are usually permitted in the pediatric recovery room. The patient usually finds comfort in parental presence. The recovery room (RR) nurse receives postprocedural reports from the anesthesia provider as well as from the OR nurse. The RR nurse is responsible for the following activities:

- monitor vital signs
- compare objective findings with baseline data
- evaluate fluid intake and output
- inspect the surgical site
- carry out specific physician's orders pertaining to treatment
- do not leave the pediatric patient unattended at any time
- Instruct the parents in postoperative home care and inform them about signs and symptoms that should be reported to the physician.
- Document each activity performed.

14.5. Questions for study and review

1. What are the indications for pediatric surgery?
2. Explain how knowledge has advanced in pediatric surgery.

3. Discuss the preoperative preparation of pediatric patients.
4. State intraoperative pediatric patient care considerations.
5. List the responsibilities of the RR nurse during postoperative pediatric care.

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GLOSSARY

Absorbable suture - any suture that is absorbed by body tissue.

Analgesia – the absence of pain

Anastomosis – an opening between two normally distinct spaces or organs; used in surgery to refer to the joining of two hollow structures with suture.

Anesthetic – an agent that produces analgesia

Antibiotic – a drug formed from chemical substances produced by a microorganism that kills or inhibits the growth of other microorganisms.

Antiseptic – an agent that is used to reduce the amount or arrest the growth of pathogenic microorganisms on animate (living) surfaces.

Approximate - to bring tissue together by sutures or other means.

Asepsis – absence of microorganisms that cause disease; freedom from infection; exclusion of microorganisms.

Aseptic – free of disease- causing microorganisms.

Atraumatic - refers to the suture - needle combination when the suture is swaged into the needle; can also refer to any suture that causes little tissue trauma.

Attire – Cloths to be worn in the operating room

Autoclave – steam sterilizer

Chromic salts - chemicals used in the treatment of catgut that cause it to resist absorption.

Contaminated – soiled or infected by microorganisms.

Cross-contamination – a process whereby infection or disease is spread from one source to another.

Curette – a spoon-shaped instrument used to scrape tissue from a surface.

Decontamination – process that makes inanimate objects safer to be handled by staff before cleaning.

Defamation – a derogatory statement made by someone about another.

Disinfectant – an agent that kills or inactivates microorganisms on inanimate surfaces.

Ethylene oxide – a gas used in the sterilization of items.

Flaking – the tendency of some suture materials to release tiny particles of the suture in the wound.

Flash autoclave – an autoclave used in surgery to sterilize equipment quickly by steam under pressure.

French eye - a delicate needle whose double eye contains a spring.

Free tie - a term used by the surgeon when he or she requests a length of suture for legation.

Friable - refers to any tissue that is easily torn

General anesthetic – an agent that produces both analgesia and unconsciousness.

Hemostasis – the control of bleeding.

Hemostat – an instrument used to clamp the blood vessel.

Inert - refers to a quality of suture indicating that it causes little or no tissue reaction.

Infection – the invasion of healthy tissue by pathogenic microorganisms.

Ligate - to tie a structure, such as a vessel.

Lumen – the cavity or channel within a tubular structure.

Medical practice acts – laws that regulate the practice of physicians and surgeons.

Microorganism – an organism that is visible only with the aid of a microscope. Causative agents of infections.

Negligence – acts of carelessness.

Nonabsorbable suture – a suture material that resists absorption by the body fluid.

Nurse practice acts – laws that regulate the practice of nursing.

Pathogenic – disease-producing

Purse-string – a type of suture technique whereby the suture is passed in a continuous circle around the lumen of a structure and tied in purse- string fashion.

Reel - a round spool containing one long piece of suture from which the surgeon may cut any desired length of material for legation.

Resident flora – those bacteria that normally reside in or on the tissue of individuals.

Retention suture - hoary nonabsorbable sutures that are placed behind the main skin suture to give greater strength to the closure.

Running stitch - a continuous strand of suture that is used to approximate tissue edges.

Shelf life – the amount of time a sterile, wrapped package remains sterile during its storage.

Sterile – state of being free from all living microorganisms.

Suture ligature (stick tie) - a needle and suture combination used to tie a bleeding vessel and attach it to nearby tissue simultaneously, thus preventing the tie from slipping off the end of the vessel.

Suture – a strand of material used to bring tissues together by sewing.

Swaged - indicates that the suture is attached into the inside of the head of the needle (eyeless needle).

Tensile strength - the amount of force a suture will withstand before breaking.

Terminal decontamination – a process that renders objects and surfaces clean and free of pathogenic microorganisms following surgery.

REFERENCES

1. **Nancymarie, Howard Fortunato: Berry and Kohn's** Operating Room Technique; Ninth edition, Mosby, 2000.
2. **Joanna R. Fuller**: Surgical Technology, Principles and Practice 2nd edition, W.B. Saunders Company Philadelphia 1986.
3. **Barbara M. Soule**: Infections and Nursing Practice,

Prevention and control, Mosby, 1995.

4. **Doris Smith Suddarth**: The Lippincott Manual of Nursing Practice, fifth edition, Lippincott Company, 1991.
5. **Jane Mallett**: The Royal Marsden Hospital Manual of Clinical Nursing Procedure, fifth edition, Blackwell Science, 2000.
6. **MM Kapur**: A Complete Hospital Manual of Instruments and Procedures, First edition, JAYPEE BROTHERS, New Delhi 2005.
7. **Ministry of Health**, Disease Prevention and Control Department: Infection Prevention Guidelines for Healthcare Facilities in Ethiopia, February 2005.
8. **Carol Tayler, Carol Lillis, Prescilla LeMone**: Fundamentals of Nursing, The Art and Science of Nursing Care, third edition, Lippincott, 1997.
9. **Carol Tayler, Carol Lillis, Prescilla LeMone**: Fundamentals of Nursing, The Art and Science of Nursing Care, third edition. Lippincott, 1997
10. **Neolon F.**: Fundamental Skills in Surgery, fourth edition, Philadelphia W. B. Saunders 1994.
11. **Kyle James:** PYE'S Surgical Handicraft, 22. Edition, Oxford Butterworths Heinemann 1991.
12. **C. Barrie Williams**: Basic Practical Surgery, Bristol Johnwright and Saunders 1971.

13. **Lichtiger Monte**: Introduction to the Practice of Anesthesia, Hagerstown, Harper and Row 1974.
14. **Frost Elizabeth A. M.**: Recovery Room Practice, Boston Blackwell Scientific1985.
15. **Berry & Kohn's**: Introduction to Operating Room Technique, New York McGraw-Hill 1966.
16. **Adriani John**: Techniques and Procedures of Anesthesia, third edition, Springfield Charles and Thomas 1964.
17. **Dripps Robert D.:** Introduction to anesthesia, fifth edition, Philadelphia W. B. Saunders Company 1961.
18. **Thornton J. A.**: Techniques of Anesthesia with Management of the Patient and Intensive Care, London Chapman and Hall 1974.
19. **Nash D. F. Elison:** The Principles and Practice of Surgery for Nurse and Allied Professions, London Edward Arnold 1976.
20. **Brunner** and **Suddarth's**: Textbook of Medical – Surgical Nursing; Eighth Edition; Lippincott, Philadelphia, 1996.
21. **NATN:** Principles of Safe Practice in the Perioperative Environment; Revised 1998.
22. **Barbara Kozier** et al, Fundamentals of Nursing: The nature of nursing practice in Canada, 2004.
23. **Zaglaniczny K:** Latex Allergy: are you at risk? AANA J69:413, 2001.

24. **Association of periOperative Registered Nurses:** AORN latex guideline. In standards, recommended practices and guidelines, Debver, 2001, Association of periOperative Registered Nurses.
25. **Redmond MC**: Malignant hyperthermia: perianesthesia recognition, treatment, and care, J Perianesth Nurse 16:4, 2001.

ANNEX

Annex – 1 Check list for a surgical procedure

Checklist to consider when preparing for a surgical procedure

All surgical procedures

- Housekeeping: room cleaned
- Furniture: present and arranged
- Suction: connected and functional
- Operating light and bed: prepositioned and functional

Specific to scheduled procedure

- Correct operating bed in working order
- Basic instrument and basin sets
- Basic drape pack
- Skin preparation setup
- Sterile supplies

Specific to surgical specialty

- Electrosurgical unit (ESU)
- Laser
- Microscope
- Tourniquet
- Endoscope
- Drapes
- Instruments
- Sterile supplies
- Fluoroscopy or x-ray
- Specific implant

Specific to surgeon

- Gloves
- Instruments
- Sutures
- Table medications and solutions
- Personal preferences/preference card

Specific to patient

- Special considerations/plan of care
- Age
- Body build
- Allergies
- Physical limitations/impairments
- Autotransfusion/blood transfusion
- X-ray, CT, or MRI films

Annex – 2

The “Eight P’s” of Operating Room and Sterile Field Setup and management.

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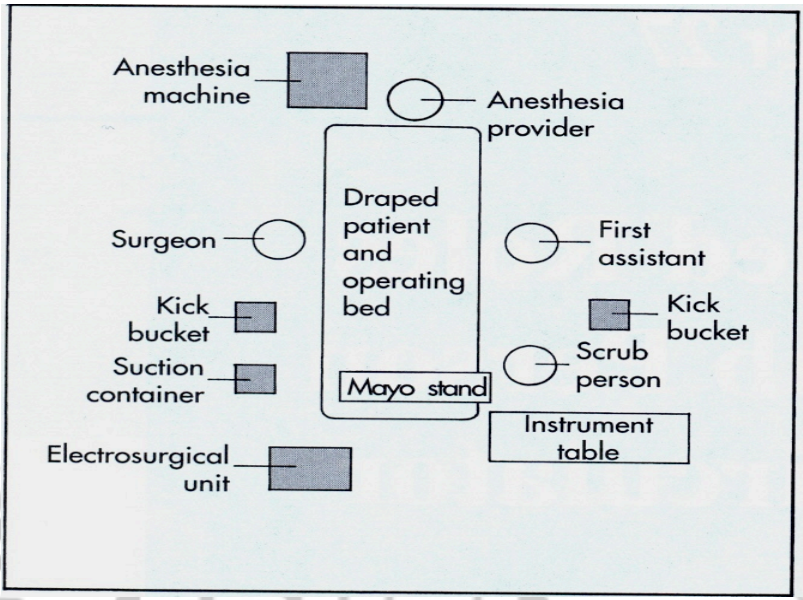
The Eight *P*'s to Consider When Preparing for a Surgical Procedure	Environment Considerations for the Circulator	Sterile Field Considerations for the Scrub Person
Proper Placement		
Items should be placed so they will not need to be moved during the procedure.	Suction canisters, tourniquet, and the ESU need to be stationary. The operating lights should be directed toward the field.	The Mayo stand and instrument table should not be moved during the procedure. Drapes may not be moved on the patient's skin.
Proper Function		
Items should be tested for safety and usefulness before they are needed to prevent delay in the case.	Test the ESU, tourniquet, laser, and other equipment before the patient enters the room.	Test the efficiency of instruments (scissors, needleholders, and clamps) as they are closed and positioned on the field. Replace as needed.
Place It Once		
Items should not be manipulated during the procedure. Energy and attention should not be diverted to resetting the field.	The operating bed should be in the right place for the procedure. The dispersive electrode should not be moved or displaced.	When setting up the field, each item (e.g., a basin) should be placed where it will be used during the procedure with minimal handling.
Point of Contact		
Items used within the field could cause harm or be rendered useless if they do not reach the intended point of contact.	The circulator should evaluate the delivery of items to the sterile field. Some items (e.g., staplers) should be handed; others can be transferred in other ways.	The scrub person should be aware of the passing of instruments and how they are securely placed in the waiting hand of the surgeon or first assistant.
Position of Function		
Items should positioned so they will be useable during the procedure.	The use of a C-arm, laser with articulating arm, or microscope should be preplanned so they may be positioned while the procedure is in progress.	When passing instruments, they should be placed in the surgeon's hand in a useable way. For example, the curve of the instrument should match the curve of the hand.
Point of Use		
Items should be as close to the area of use as possible.	Pour solutions directly into the basins, open and hand sponges or sutures directly to the scrub person as they are needed.	Basins should be placed close to the edge of the table so the circulator can pour without requiring the basin to be repositioned. The ESU pencil holder should be close to the field for safe containment of the tip.
Protected Parts		
Items and surfaces should be rendered safe for the patient and the team.	Cords, cables, and tubing should be secured and appropriately directed away from the field. Pad the operating bed and patient as appropriate. Use safety belts.	Apply jaw liners to instruments during setup. Hand instruments with care to avoid causing injury with the tip or sharp surface. Do not lay items on or rest them against the patient's body.
Perfect Picture		
Items within and around the field should not be at risk for causing harm or becoming damaged. The environment should not be cluttered.	The entire room should appear neat and tidy. The door should be closed, and the temperature and humidity should be appropriate. Forethought to having a clear path for the crash cart or emergency equipment is essential.	The sterile field should remain neat and orderly, with instruments and supplies within easy sight and reach. Consistent setup fosters a sense of comfort and confidence in the scrub role.



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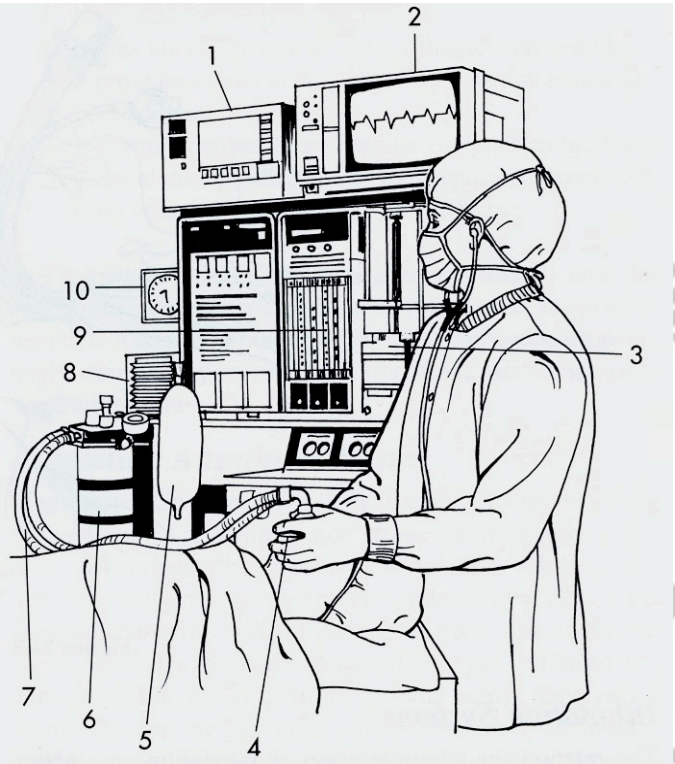
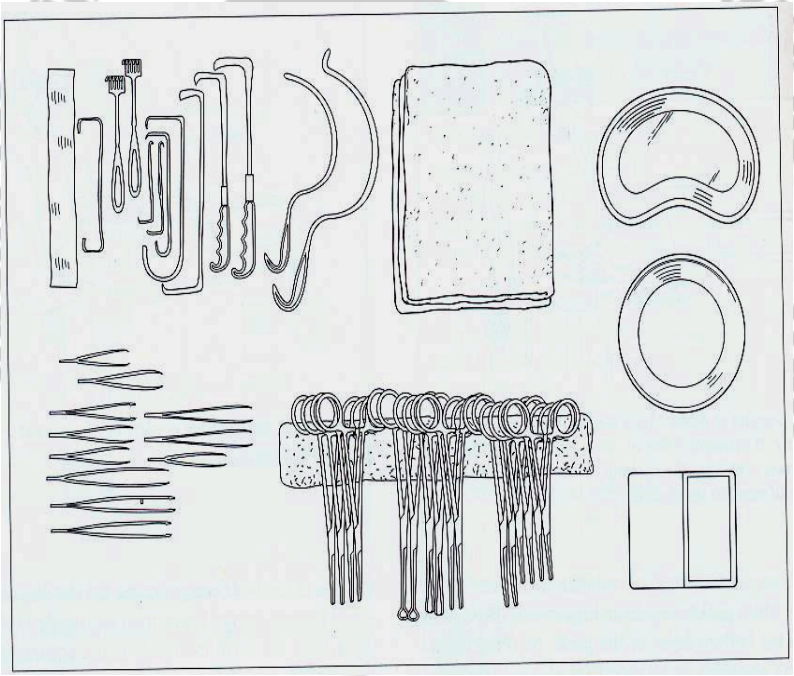
Annex – 3: Arrangement of sterile field, team members, and unsterile equipment (shaded).

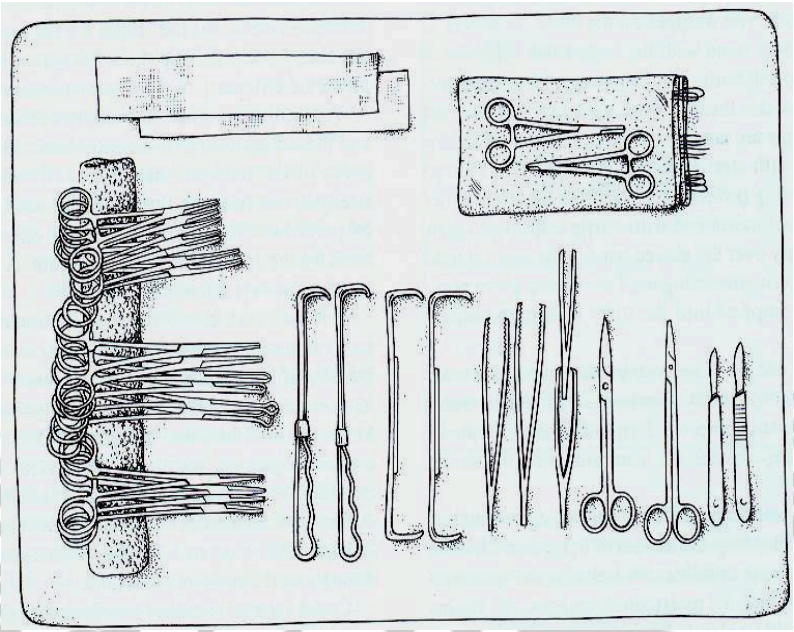


ANNEX – 4 GENERAL ANESTHESIA GAS MACHINE

Anesthesia machine for maintenance of general anesthesia. 1, anesthetic and respiratory gas monitor; 2, physiologic monitor; 3, flow-through vaporizer; 4, face mask; 5, breathing bag; 6, carbon dioxide absorber canister; 7, patient breathing circuit; 8, ventilator; 9, flowmeters for gases; 10, sphygmomanometer for manual blood pressure (Berry & Kohn's Operating Room Technique, p. 405).



Annex – 5: Example of basic instrument table setup. Contents will vary according to the type of surgical procedure.



Annex – 6: Example of setup for Mayo stands.

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