



NURSING

For All Nursing Exams

Volume - 5



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CHAPTER

Emergency, ICU & Operation Theater

Basics of Operation Theatre (OT)

Principles of Asepsis & Antisepsis

Asepsis = absence of disease-causing microorganisms.

Antisepsis = reduction/destroying of microbes on living tissue (skin, mucosa) using antiseptics.

Two types of asepsis

- **Medical (Clean) Asepsis** — reduce microorganism number (hand hygiene, clean techniques).
- **Surgical (Strict) Asepsis** — absence of microorganisms (used in OT, invasive procedures).

Basic principles

1. Hand hygiene before and after patient contact.
2. Use of sterile gloves, gowns, masks in sterile field.
3. Sterile instruments only contact sterile surfaces.
4. Maintain sterile field — do not turn back on sterile field or reach over it.
5. Minimize traffic in OT; keep doors closed.
6. Proper disposal of sharps and contaminated items.
7. Environmental cleaning and controlled ventilation.

Mnemonic: “CLEAN OT”

C — Coverage (drape)

L — Limited traffic

E — Equipment sterilized

A — Aseptic technique

N — No-touch technique

O — Organized table layout

T — Trash and sharps disposal

Sterilization & Disinfection

- **Sterilization:** complete destruction of all microorganisms including spores.
- **Disinfection:** elimination of many or all pathogenic microorganisms except bacterial spores.
- **Antiseptic:** chemical used on skin/tissue.
- **Sanitization:** lowering microbial numbers to safe level.

Levels of disinfection

- **High-level:** kills all organisms except high numbers of spores (e.g., glutaraldehyde exposure for long time).
- **Intermediate-level:** kills mycobacteria, most viruses, bacteria (e.g., 0.5% sodium hypochlorite).
- **Low-level:** removes vegetative bacteria, some viruses (e.g., alcohol wipes).

Methods

Method	Principle	Common OT use
Autoclave (steam)	Moist heat under pressure (121°C, 15 psi, 15–20 min)	Sterilize instruments, gowns, glassware
Dry heat (hot air oven)	Oxidation at high temp (160°C, 1 hr)	Sharp instruments, glassware
Ethylene oxide (ETO) gas	Alkylation of DNA/proteins (low temp)	Heat-sensitive plastics, scopes

Glutaraldehyde (Cidex)	Chemical sterilant/disinfectant	Immersion of endoscopes, laryngoscopes
Formalin fumigation	Formaldehyde gas — airborne sterilization	Room fumigation (historical/occasional)
Radiation (gamma/UV)	DNA damage	Disposable syringes, some plastics (industrial)
Chlorine compounds (bleach)	Oxidizing disinfectant	Surface disinfection, spills
Alcohol (70%)	Denatures proteins, dissolves lipids	Skin antiseptics (not spores)
Hydrogen peroxide	Oxidation	Wound irrigation, surfaces

High-yield facts

- Autoclave: 121°C, 15 psi, 15–20 min (typical). Biological indicator: *Bacillus stearothermophilus* spores.
- Hot air oven: 160°C for 1 hr (for glass/metal).
- ETO used for heat-sensitive items; requires aeration (to remove gas).
- 2% glutaraldehyde — immersion for at least 20 min for high-level disinfection; longer for sterilization.

Autoclave, ETO, Fumigation, Chemical Methods

Autoclave (Moist Heat Sterilization)

- **Precheck:** Clean instruments, pack loosely, ensure correct indicators (chemical tape), load properly (steam circulation).
- **Cycles:** Standard — 121°C, 15 psi, 15–20 minutes (depends on load).
- **Indicators:** Chemical tape change color + biological spore test weekly (*Bacillus stearothermophilus*).
- **Storage after autoclave:** Keep packs dry, store on clean shelves, use FIFO.



Before autoclaving—stripes not visible



After autoclaving—stripes are visible

Nurse responsibilities

- Check the sterilizer chart and autoclave log.
- Ensure packs are dry before removal.
- Place indicator tape and fill the autoclave record.
- Report failed indicators or wet packs.

Ethylene Oxide (ETO)

- **Use for:** Heat and moisture-sensitive items (rubber/plastics, scopes).
- **Precautions:** Toxic, flammable — aeration required post-sterilization (up to 24 hrs). Staff must follow safety protocols (gas monitoring).
- **Nurse role:** Label items “ETO sterilized” with date/time and required aeration period.



Fumigation (Formaldehyde)

- Used for terminal OT fumigation when required. Performed by trained personnel.
- **Nursing role:** Ensure room cleared, post warning signs, re-entry only after aeration.

Chemical methods (immersion)

- **Glutaraldehyde (2%):** high-level disinfection for endoscopes. Need fresh solution (change per manufacturer), immersion time observed. Use PPE — gloves, eye protection.
- **Chlorine solutions (bleach 1%):** surface disinfection, blood spills.
- **Alcohol 70%:** skin antisepsis, small surface disinfection (not for large spills or spores).



OT Design & Zones (Sterile, Clean, Protective)

Good OT layout minimizes infection risk and improves workflow.

Typical OT zones

1. **Unrestricted (Public) zone**
 - ✓ Outside area: reception, changing rooms, charting. Staff may be in regular attire.
2. **Semi-restricted (Clean) zone**
 - ✓ Scrub rooms, corridors; surgical attire (scrubs, caps) required.
3. **Restricted (Sterile) zone**
 - ✓ Operating rooms and sterile core; full aseptic attire and masks required. Only essential personnel allowed.

Alternative naming: Protective → Clean → Sterile

Design features

- **Separate entry/exit for staff & patients** to reduce cross contamination.
- **Air handling:** Positive pressure in OT relative to corridors; HEPA filtration; 15–20 air changes/hour recommended (exam focus: OT has positive pressure).
- **Temperature & humidity:** OT ~18–22°C; humidity 40–60% (to reduce microbial growth and static).
- **Lighting:** Shadow-free surgical lights.
- **Floors & surfaces:** Smooth, non-porous, easy to clean.
- **Instrument/sterile storage:** Closed cabinets; separate sterile supply room.
- **Waste handling:** Color-coded waste bins (memorize local scheme; common: yellow for infectious, black for general, red for sharps in many countries).

Traffic control (nurse actions)

- Minimize door openings.
- Limit personnel in OT.
- Ensure correct attire before entering (surgical mask, gown, cap, shoe covers).
- No jewelry, no cosmetics in OT.

Sterile Technique — (Scrub & Gowning)

Scrub nurse checklist

1. Remove jewelry, check nails (short, no nail polish).
2. Perform surgical hand scrub (timing: 2–5 minutes depending on policy; scrub from fingertips to elbow).
3. Dry hands with sterile towel without touching non-sterile surfaces.
4. Don sterile gown (closed or open method per protocol).
5. Don sterile gloves — keep hands above waist and within sterile field.

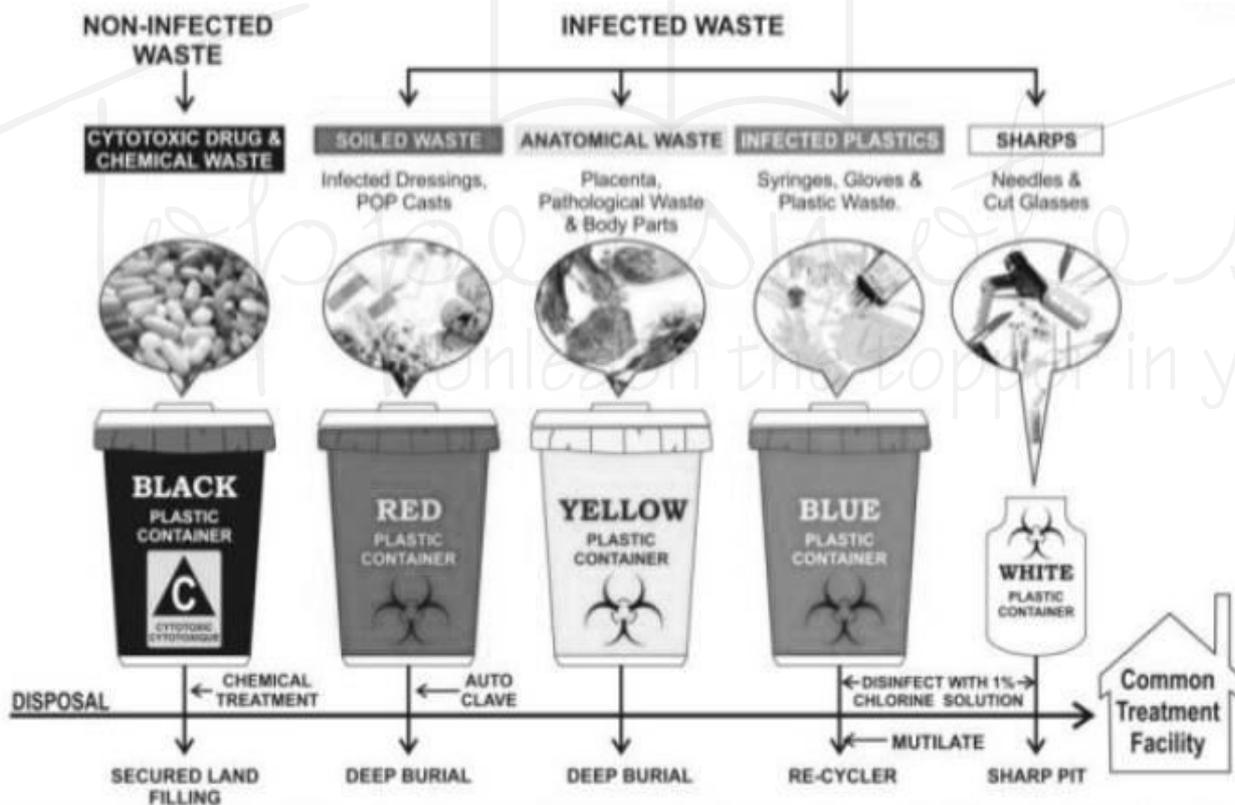
Gowning & Gloving tips

- Keep sterile fields in sight; never turn back to sterile field.
- Sterile edges (1-inch) of pack are considered unsterile — avoid touching.
- When opening sterile packages, open away from body; avoid shaking.

OT Cleaning & Disinfection Routine

- **Between cases:** Clean instruments, wipe surfaces with disinfectant, replace drapes if contaminated, floor spot cleaning.
- **Terminal cleaning (end of day):** Full cleaning of OT, mopping with appropriate disinfectant, wipe all non-disposable surfaces, remove waste, change linen.
- **Spill protocol:** Blood spill — use 1% sodium hypochlorite (bleach) after mechanical removal; follow contact time. Use PPE.

Biomedical Waste & Sharps Safety



- **Sharps:** Single-use where possible. Dispose immediately in a puncture-proof sharps container.
- **Needlestick injuries:** Immediately wash area with soap & water, report, apply first aid, follow post-exposure protocol (HBV, HIV risk assessment).
- **Waste segregation:** Color coded (local policy). Learn your institution's color code — commonly: yellow (infectious), red (recyclable contaminated), black (general), sharps (punctureproof).
- **Transport:** Use labeled, leak-proof containers.

Common OT Hazards & Nursing Preventive Actions

- **Infection (SSI):** preoperative skin prep, antibiotic prophylaxis timing, maintain aseptic technique.
- **Fire risk:** sources — oxygen, electrocautery, alcohol-based prep. Prevent: keep oxygen flow low, allow prep to dry, use caution with ignition sources.
- **Electrical hazards:** ensure equipment grounded, check leads.
- **Latex allergy:** use non-latex alternatives when needed.
- **Radiation:** wear lead aprons; keep distance; limit exposure.

Nursing Booster Points

- Autoclave standard: **121°C, 15 psi, 15–20 min.** Biological indicator: *Bacillus stearothermophilus*.
- Hot air oven: **160°C for 1 hour** (or 170°C for 30 min depending on protocol).
- ETO requires **aeration** after sterilization.
- OT temperature around **18°C**; maintain positive pressure and 15–20 air changes/hour.
- Surgical Safety Checklist: **Sign In → Time Out → Sign Out** (WHO).
- Sterile field: keep hands **above waist and in sight**.
- Surgical hand scrub: **fingertips → elbows**; dry with sterile towel.

Quick Revision Qs

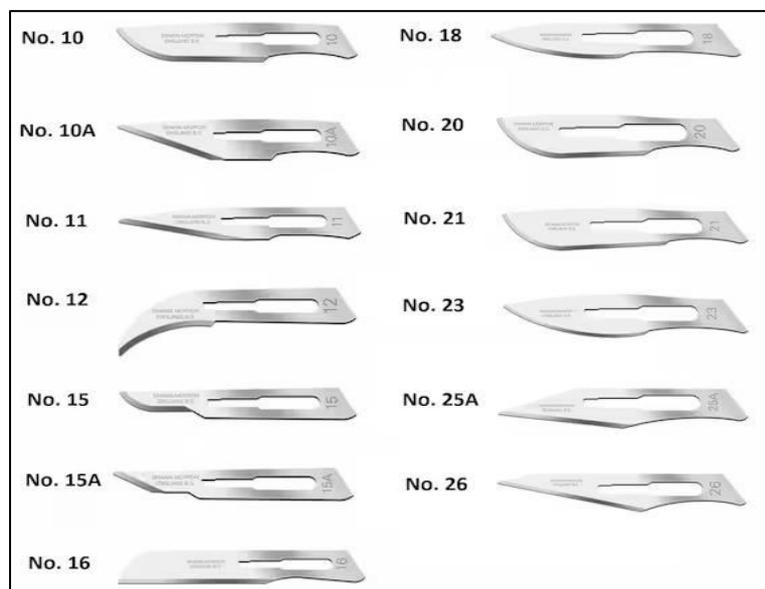
1. Autoclave sterilizes by which principle? — Moist heat under pressure (steam).
2. Recommended autoclave settings? — 121°C, 15 psi, 15–20 min.
3. Biological indicator for steam sterilization? — *Bacillus stearothermophilus*.
4. What zone must full sterile attire be worn? — Restricted/sterile zone (inside OT).
5. Give 3 measures to prevent OT fire. — Allow skin prep to dry, reduce O₂ concentration, avoid pooling of alcohol.
6. Name the 3 steps of WHO surgical safety checklist. — Sign In, Time Out, Sign Out.
7. Most appropriate disinfectant for blood spill? — Sodium hypochlorite (bleach).
8. ETO sterilization is used for? — Heat-sensitive plastics and scopes.

Nursing Checklist Before Surgery (quick)

- Verify patient identity, consent, allergies.
- Ensure NPO status and preop meds given.
- Skin prep done as ordered; hair removal only if required (clippers).
- Check blood products if required are available.
- Confirm instrument & implant availability and sterility indicators.
- Positioning aids & padding ready.
- Suction, cautery, airway equipment checked.
- Count baseline sponges/instruments with scrub nurse.

Surgical Instruments & Supplies

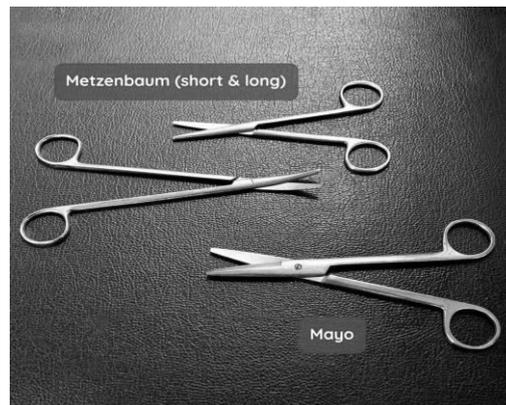
Scalpels :



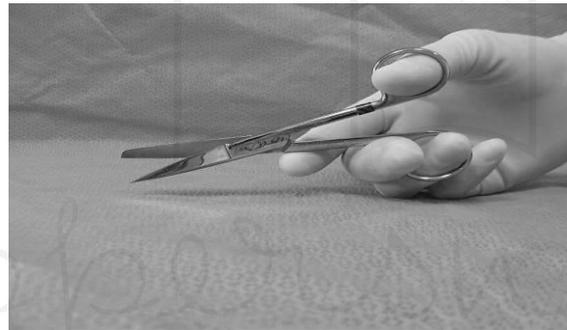
- Fingertip grip with additional guidance from index finger placed on top of the scalpel.



scissors :



- Metzenbaum — fine dissection) Mayo — heavy cutting
- **Use:** skin incision, tissue dissection.



- How to handle scissors correctly using the 'tripod' grip.

Forceps:

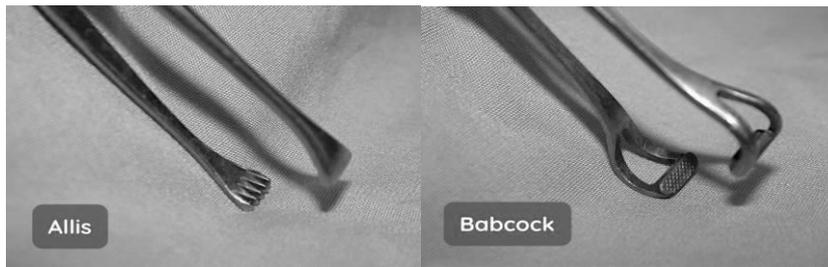
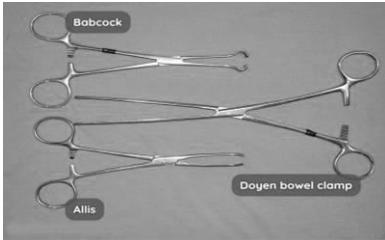
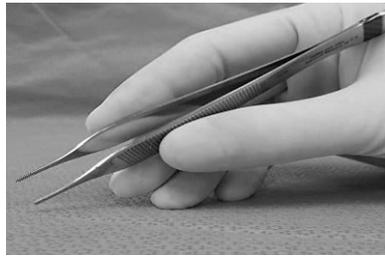
Tissue forceps (Adson, Debakey)



rat-toothed forceps

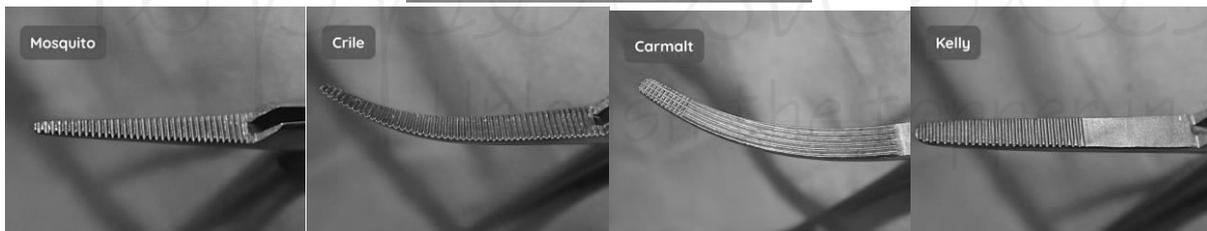
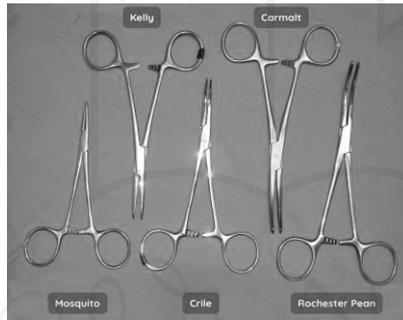


Thumb forceps are manipulated and compressed between the thumb and forefinger and held like a pen



➤ Use: hold tissue, control bleeding.

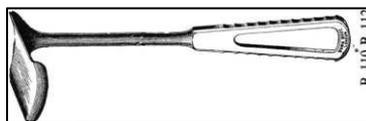
Hemostatic forceps (Kelly, Mosquito, Crile)



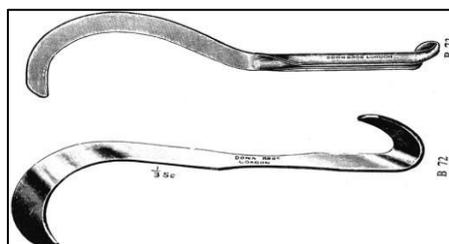
Retracting & exposing

➤ Handheld:

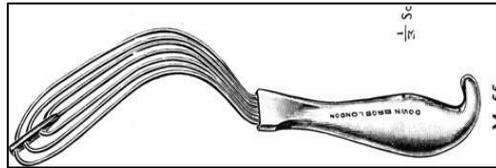
1. The Morris retractor



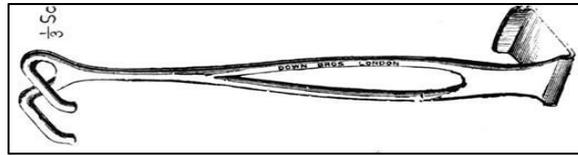
2. The Deaver retractor



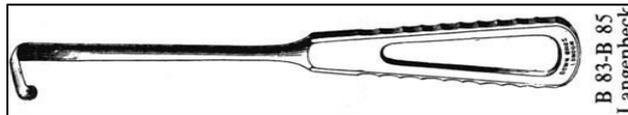
3. The Allison lung retractor



4. The Czerny double-ended retractor

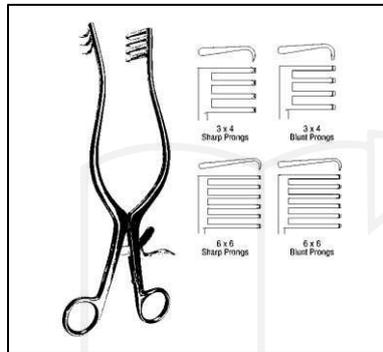


5. The Langenbeck retractor

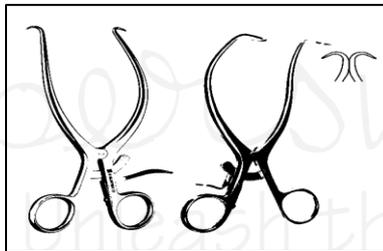


➤ Self-retaining:

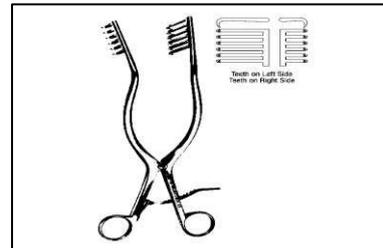
Adson Self Retaining Retractor



Gelpi Self Retaining Retractor



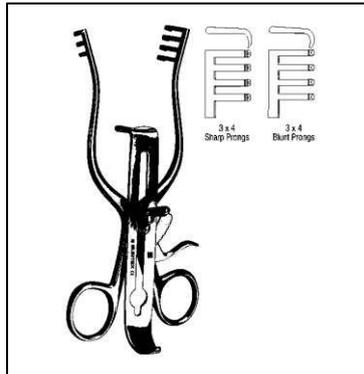
Martin Self Retaining Retractor



Collin Self Retaining Retractor



Henley Self Retaining Retractor



Millin Self Retaining Retractor



Caspar Self Retaining Retractor



Perkins Self Retaining Retractor



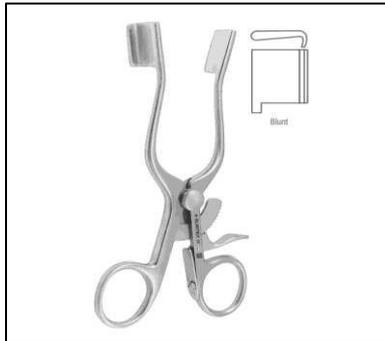
Balfour Self Retaining Retractor



Beckmann Self Retaining Retractor



Weitlaner-Baby Self Retaining Retractor

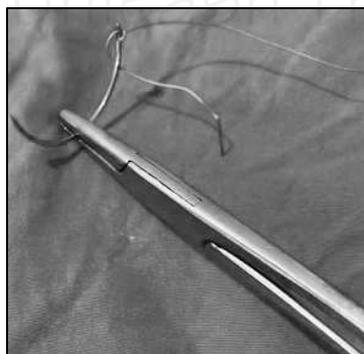


Joll (Friedman) Self Retaining Retractor

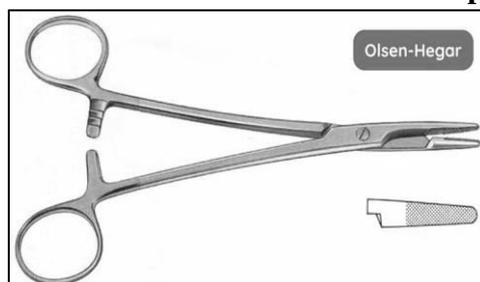


Use: provide exposure; protect edges during procedure.

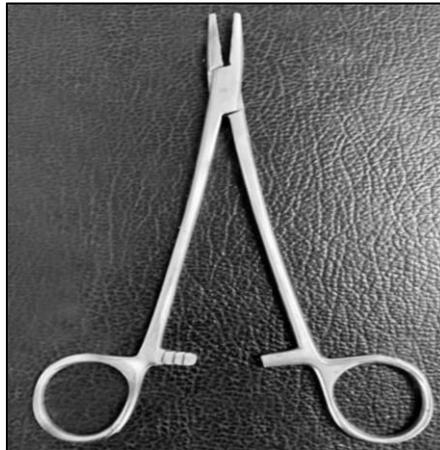
Needle holders



The needle is grasped by the jaws of the needle holders at its mid point.



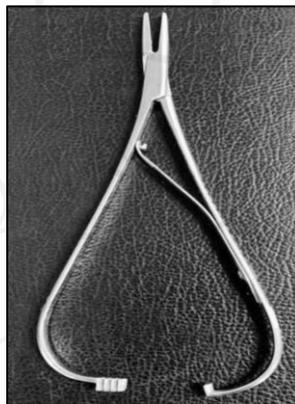
Olsen-Hegar needle holders.



Mayo-Hegar needle holders.



Gillie needle holders.



McPhail needle holders.

Use: hold needle, tie knots.

Clamping & occluding

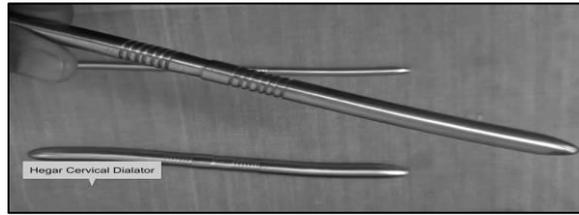


DeBakey-Satinsky Atrauma Bulldog Clamps

Use: occlude vessels.

Probing & dilating

Probes, Hegar dilators, sounds.



Use: locate channels, dilate orifices.

Suction & aspiration

i. Wall suction with regulator (hospital infrastructure).

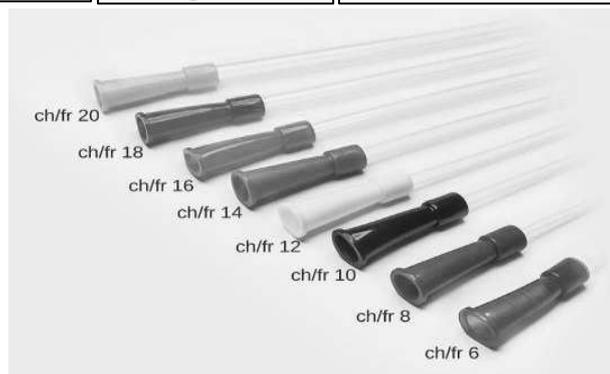


ii. Portable suction units.



iii. Suction tips:

Yankauer (rigid oral), Frazier (neurosurgical), Poole (multiple holes for abdominal irrigation), suction catheters (rubber/suction tubing).



- **Use:** remove blood, secretions.

Specialty instruments

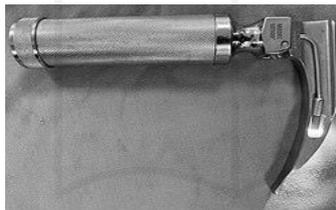
- Orthopedic saws



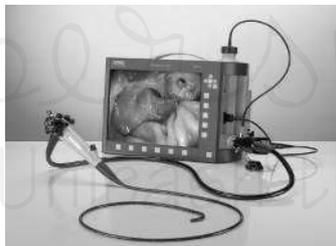
- Kerrison rongeurs



- Laryngoscopes

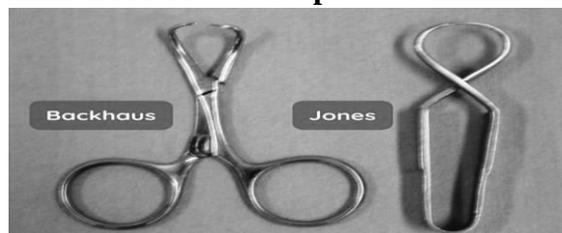


- endoscopes



Towel Clips

The most common type is the Backhaus towel clamp



Suture materials & needles

A. Suture materials — classification

1. Absorbable (internal sutures)

- ✓ Natural: Plain/Chromic catgut (rapidly absorbed; less used now).
- ✓ Synthetic: Vicryl (Polyglactin 910), Polyglycolic acid (Dexon), Poliglecaprone (Monocryl).
- ✓ **Use:** internal tissues, fascia (choice depends on required strength/time).

2. Non-absorbable (external / long-term)

- ✓ Natural: Silk.
- ✓ Synthetic: Nylon (Ethilon), Polypropylene (Prolene), Polyester (Ethibond).
- ✓ **Use:** skin closure (nylon), cardiovascular prosthesis (Prolene), permanent fixation.

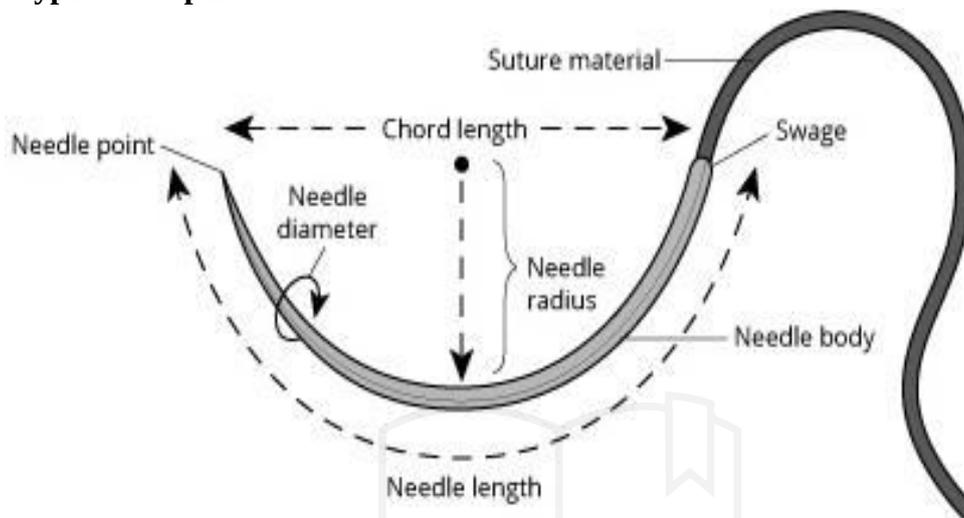
3. Monofilament vs Multifilament

- ✓ Monofilament (nylon, Prolene): less tissue drag, lower infection risk.
- ✓ Multifilament (silk, vicryl braided): better knot security, slightly higher infection risk.

4. Sizing

- ✓ Suture size uses numbers: smaller number = thicker in older systems; modern: 0, 2-0, 3-0, 4-0, 5-0, etc. (e.g., 3-0 for general skin closure; 5-0 for delicate facial skin).

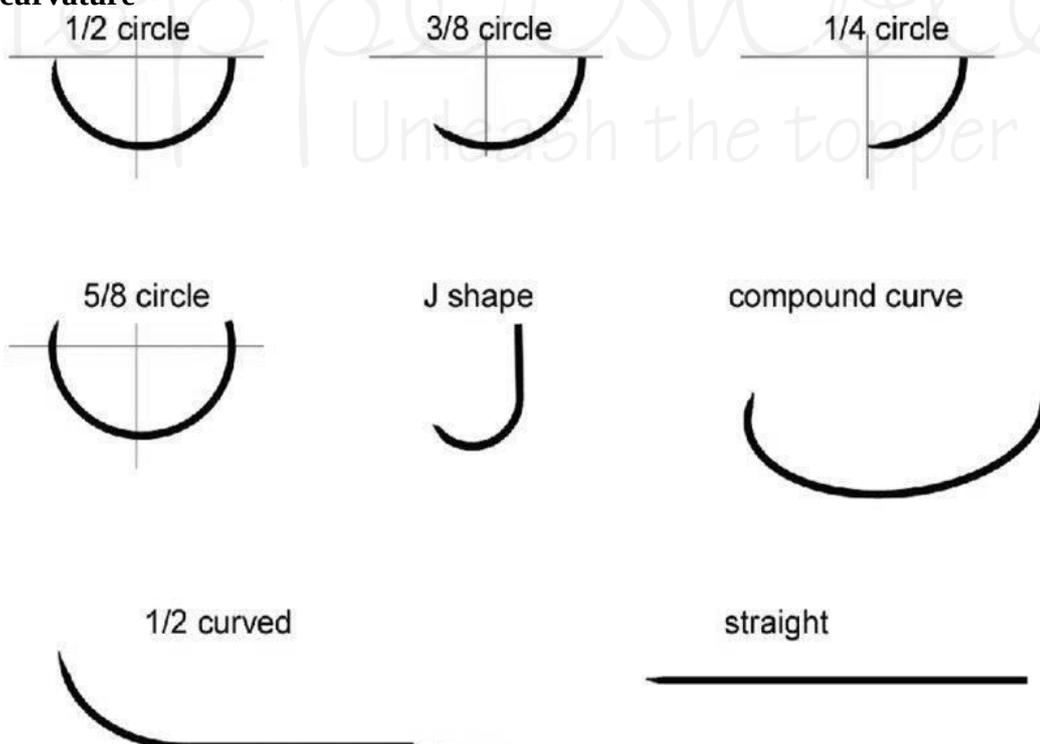
B. Needles — types & shapes



1. Needle point

- ✓ **Cutting (conventional, reverse cutting):** for tough tissue (skin). Reverse cutting reduces risk of cutting through tissue edge.
- ✓ **Taper point:** rounds tissue, pushes fibres aside — for delicate/soft tissue (viscera, subcuticular).
- ✓ **Blunt point:** for friable tissue (liver).

2. Needle curvature



- ✓ 1/4, 3/8, 1/2, 5/8 circle (3/8 common for skin/internal).

- ✓ Straight needles used in open procedures or suturing surface.

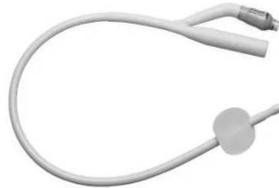
3. Needle length / attachment

- ✓ Swaged (atraumatic) — suture preattached to needle (preferred).
- ✓ Eyed needles (traumatic) — suture threaded through eye.

Catheters, tubes, drains, cannulas — common types & nursing care

Catheters & tubes

➤ **Foley (Indwelling urinary catheter):**



sizes 12–18 Fr commonly for adults

- care: aseptic insertion, secure tubing, maintain closed drainage, bag below bladder level, perineal hygiene, regular catheter care.
- **Condom catheter:** external for male incontinent patients.



➤ **Ryle's tube / Nasogastric tube (NG):**



gastric decompression, feeds; confirm placement (aspirate pH, X-ray if needed).

➤ **ET tube (Endotracheal tube):**



airway management; cuff pressures, oral care, suctioning.

➤ **Tracheostomy tube:**



inner cannula care, cuff care, humidification.

➤ **Central venous catheter / CVP line:**



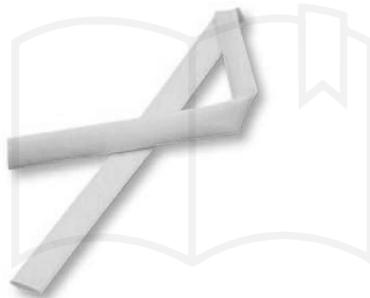
Jugular/subclavian insertion — sterile dressing changes, clamp/lumen care, monitor for infection, measure CVP.

➤ **Chest tube / Intercostal drain (ICD):**



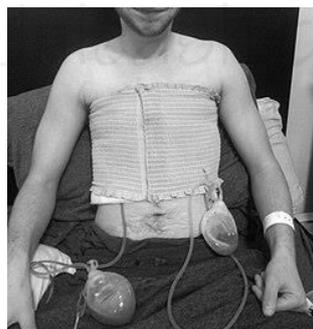
for pneumothorax/effusion — secure dressing, monitor air leak, maintain underwater seal, measure drainage, keep drainage system below chest.

Drains



gravity drainage of superficial wounds.

- **Passive drains:** Penrose (soft rubber)
- **Active (closed suction) drains:**
- Jackson-Pratt (JP)

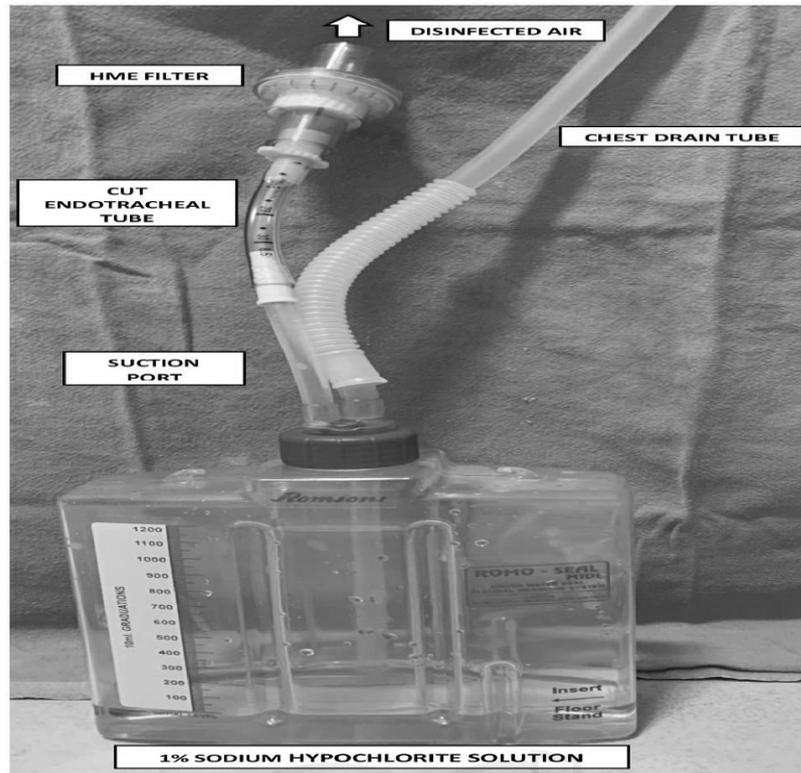


- Hemovac



collect fluid under suction; empty and measure output, maintain suction.

- **Chest drains:** underwater seal, suction if prescribed; watch for bubbling (air leak).



Cannulas

- **IV cannula / peripheral IV:** sizes (gauge): 18G (blood/large volume), 20–22G common for adults, 24G for children/elderly veins.
- **Large bore cannula:** for trauma, fluid resuscitation (14–16G).
- **Butterfly / winged infusion:** short term, children.

Electrocautery / Diathermy & Suction — Principles and safety

Electrocautery (Electrosurgery)



➤ Types

- ✓ **Monopolar diathermy:** current passes from active electrode through patient to grounding/return pad and back to generator. Used for cutting/coagulation over wide field.
- ✓ **Bipolar diathermy:** current flows between two tips of forceps (localised); no return pad needed. Preferred near nervous tissue, in neurosurgery and when pacemaker present.



- **Nursing safety & precautions**

- ✓ Ensure intact **grounding/return pad** placement (monopolar) on well-vascularised, muscular area with good contact; avoid placement over metal implants, bony prominences, hairy skin.
- ✓ **Remove or isolate** flammable prep solutions (alcohol based) and ensure they are fully dry before using diathermy.
- ✓ Keep **oxygen concentrations low** near the surgical field (high O₂ increases fire risk); if supplemental O₂ used, avoid pooling of O₂ under drapes.
- ✓ Avoid metal jewelry, ECG pads with metal, or conductive ointments near active circuit.
- ✓ Check diathermy settings (cut vs coag) and wattage; start low and titrate.
- ✓ Use **bipolar** when working near pacemakers, implants, or when very localised coagulation needed.
- ✓ Ensure **smoke evacuation** — surgical plume contains harmful particles; use suction + smoke evacuator.

Electrocautery vs Electrosurgery

- **Electrocautery** uses direct heat from heated wire (less common).
- **Electrosurgery** uses electrical current to cut/coagulate (common in OT).

Suction apparatus

➤ Types

- ✓ Wall suction with regulator (hospital infrastructure).

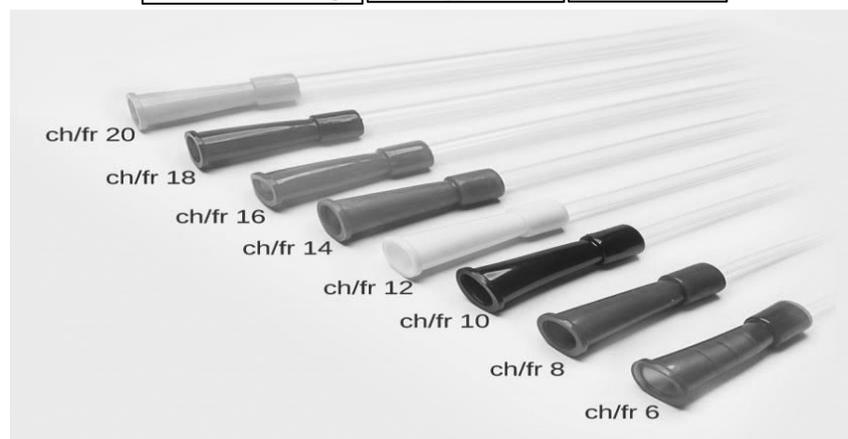


- ✓ Portable suction units.



- ✓ Suction tips:

Yankauer (rigid oral), Frazier (neurosurgical), Poole (multiple holes for abdominal irrigation), suction catheters (rubber/suction tubing).



- **Nursing care**