PLANNING & MANAGEMENT OF OT SERVICES

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- A- HISTORY
- B- PLANNING OF OT SERVICES
- C- MANAGEMENT OF OT SERVICES

A-HISTORY OF SURGERY

Mesopotamia

- **Witch doctors ("*ashipu*") worked with physical healers ("*asu*") in a mix of magic, religious imprecations, administration of plasters, and surgical procedures.**

- **Practiced surgeons became revered teachers who drained infections, controlled bleeding, performed amputations and trephinations, and accepted liability for failed operations.**

- **The Law Code of Hammurabi (c. 1700 BC) called for a surgeon's hand to be cut off if the life of a person of high social order was lost as a result.**

Trephine-300 BC

HISTORY OF OT

Egypt

- **While the Babylonians were magicians and generalists, the Egyptian physician-surgeons became specialists, some concentrating on the head, others eyes, yet others on the abdomen.**

- **They had extensive knowledge of anatomy, and performed dissections as well as mummification. They performed trephinations as early as 8000 BC.**

- **Egyptian surgical instruments were some of the most sophisticated to be found until well after the middle Ages.**

HISTORY OF OT

- **The development of surgery occurred in different regions at different times, in China, India, South America, Mesopotamia, Persia, Arabia and finally Europe.**
- **The early surgeons were priests, magicians, physicians or barber-tradesmen who understood anatomy and were comfortable with the common practices of amputation and trephination.**

Battlefield surgeon

- A surgeon "*who knows how to cut out darts and relieve the smarting of wounds by soothing unguents was to armies more in value than many other heroes.*"
- The word 'physician' was probably coined by Homer. The name derives from the Ionian dialect spoken in the Greek colonies of the eastern Aegean meaning "Extractor of arrows."

Scrapping the skull after removing the arrow

INDIA

- **Sushruta , now referred to as the "Father of Surgery"** in the Indian tradition, worked and taught along the Ganges River in India around **600 BC.**
- His many volumes of surgical descriptions, known as the ***Sushruta Samhita***, were the basis of Indian surgical practice for many centuries after.
- He was the first to establish **a surgical practical laboratory, or workshop, using clay objects and various fruits to mimic human surgical situations**

Rome: The birth of the operating tent

- **The modern operating room has descended from the Roman military tent and hospital system** that was perfected to a degree not matched again until the time of Napoleon.

- **The first Roman Medical Corps** was formed **by Emperor Augustus (1000 BC)**

- Medical professionals were required to train at the new **Army Medical School and could not practice unless they passed stringent examinations.**

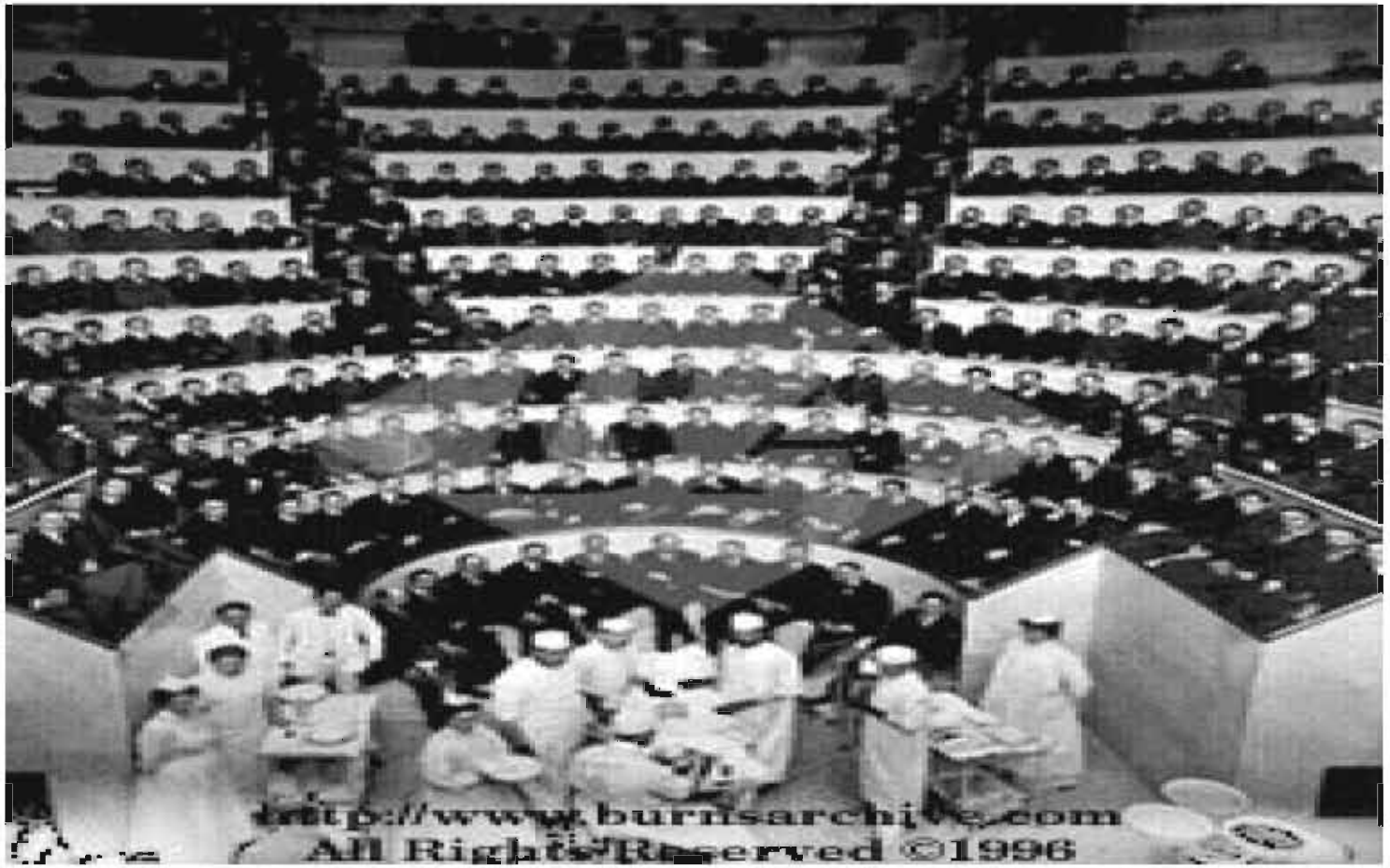
ROMAN MILITARY SURGEON - MEDICUS VULNERARIUS (WOUND DOCTOR)

- **The *medicus vulnerarius*** was in the field with the soldiers during battle, and managed a system that included **surgery in the field, an ambulance team, and receiving battlefield hospital tent systems located on opposite sides of the field**. The tent system moved with the army.

FIRST SUCCESSFUL GA

- Ether was administered on 16th Oct,1846 by WTG Morton in Massachusetts university

Dr. Rodman Operating- Philadelphia 1902



Photograph of an operating room at Columbia Hospital, circa 1910. Notice the street shoes and the dirty telephone phonebook hanging by the door

MODERN ERA

B- PLANNING

Operating Room Design:

Four Steps for Success

1. **Select the right professionals for the right job**
2. **Do your preoperative exam -*Seek multidisciplinary input***
3. **Look at the Big Picture**
4. ***Plan for the advancement of technology***

STANDARDS-NEW OT

- In USA **standards published by the Department of Health and Human Services.**
- The American Institute of Architects publishes a comprehensive set of guidelines for health care facility design
- The design of new OTs must also take into account recommendations generated by
  - specialty associations &
  - regulatory agencies.
- **BIS-standards for 30,100 & 300 bedded hospitals**

1-Select the right professionals for the right job

- Select an architect and construction manager
  - with considerable health care experience
  - a track record of delivering complex projects on time and
  - within budget.
- Architect,
- Engineer,
- Equipment planner,
- Construction manager, and
- Key equipment vendors should all be included on the team.

2. Do your preoperative exam

- Define the stakeholders and decision makers for the project
- The participation of surgeons, nurses, anesthesiologists is essential to
  - developing and testing design concepts and
  - identifying equipment and service needs &
  - conduct brainstorming sessions with staff to determine best practices, areas for improvements and upgrades, and
  - provisions for future needs.

- ***New construction versus renovation***
  - renovation may have some built-in limitations
- ***What procedures/types of surgery will be performed?***
  - open heart or orthopedic surgery, or multiple surgical procedures?
  - The amount of flexibility and the configuration of ceiling-mounted equipment and workstations will vary depending on the types of procedures performed
- ***Who will be responsible for assessment of new technology?***
  - A preliminary equipment list and budget should be established, including existing, relocated, and new equipment.
  - The budget should include the cost for fixed and moveable medical equipment as well as surgical instruments and supplies.
  - Keep in mind the long-term cost of maintenance and adaptability for future upgrades.
  - What systems and equipment would improve efficiency
- ***Plan site visits and Meet with equipment vendors***
  - Visit existing surgical centers with staff, paying close attention to the equipment and how it is utilized.
  - Meet with equipment vendors and discuss features that improve efficiency

3-Look at the Big Picture

- ***The advent of minimally invasive procedures, interventional procedures, robotics, and image-guided surgery has resulted in a shifting and sharing of responsibilities between departments that were separate entities in the past.***
- ***Consider flow of patients, staff, and materials***
- **Will the preoperative area and recovery have the capacity to handle the increased volume of procedures?**
- **Does central processing have adequate sterilization equipment?**
- **What supplies will be stored in the operating room?**
- **What equipment and supplies are allowed within the operating room.**
- **Some equipment and storage devices generate and harbor dust that is not acceptable for indoor air quality requirements.**

- Review the relationship of the Clean core, Sub- sterile, and Scrub stations with respect to the operating room.
- How will case carts, supplies, and equipment be transported to and from the operating room?
- What is the ideal location for the scrub station and through which door will the staff enter the room after scrubbing?
- Consider whether the patient will enter the room feet first or head first.
- What is the ideal orientation of the patient in relation to the sterile setup area, circulating nurse, surgeon, and anesthesiologist?
- Define the areas within the operating room that will be utilized for documentation, storage, and sterile setup.

4-*Plan for future technology*

- Operating room design must incorporate the
  - necessary space,
  - capacity, and
  - infrastructure to adjust for future trends & advancements in technology.
- Interstitial spaces for structural, mechanical, electrical, and information systems, which need special layouts to allow for system upgrades and modifications.
- With careful planning and innovative design, the cost of these renovations can be dramatically reduced.

- The ceiling and equipment plans must be part of the architectural documentation to ensure coordination with the architectural, mechanical, electrical, and structural disciplines.
- The ceiling plan must include the coordination of
  - Supply air diffusers (Laminar flow),
  - Lighting,
  - Speakers,
  - Cameras,
  - Equipment booms,
  - Display arms, and
  - Anaesth gases & suction ports
  - Electrical ceiling columns.
- The equipment plan must include
  - Robotic equipment,
  - Lasers,
  - Control stations,
  - Storage cabinets,
  - Inventory control cabinets,
  - All wall-mounted equipments,
  - Telemedicine equipments.

DESIGN & SIZE OF OT

- **The basic design of today's OT consists** of
- **a quadrangular room with minimum dimensions of 20 x 20 ft**.
- **More often, the dimensions are closer to 30 x 30 ft to accommodate more specialized**
  - **cardiac,**
  - **neurosurgical,**
  - **minimally invasive, or**
  - **orthopedic procedures.**
- **Smaller rooms, however, are generally adequate for minor surgery** and for procedures such as **cystoscopy & eye surgery**.
- **a minimum of 4 feet of clear space be available on each side of the OR table to accommodate emergency personnel and equipment in case of an emergency**

CEILING HEIGHT

- **Ceiling height**
  - **should be at least 10 ft to allow mounting of operating lights, microscopes, and other equipment on the ceiling.**
  - **An additional 1 to 2 ft of ceiling height may be needed if x-ray equipment is to be permanently mounted.**
- ***Plan for ceiling access***

  The increased complexity of ceiling-mounted equipment requires
  - **ease of access for maintenance**
  - **reduces the time required for upgrades.**

Endo-OT for Laparoscopy

OT AIR CONDITIONING-WHY?

- The primary task of the ventilation system in an OT is to
  - provide an acceptable indoor climate for personnel and patients,
  - to remove odor, released anesthetic gases and
  - to reduce the risk of infection in the operating area.
- The greatest amount of bacteria found in OR comes from the surgical team and is a result of their activity during surgery.

AIR CONDITIONING

- Bacterial Infection:
  - Infectious bacteria are transported by air. Droplet or infectious agents of 5 micron or less in size can remain airborne indefinitely.
  - It has been shown that 90 to 95 per cent effective filters remove 99.9 per cent of all bacteria present in hospitals.
- Viral Infection:
  - Many of the air borne viruses are sub- micron in size, thus there is no known method to effectively eliminate 100 per cent of the viable particles.
  - High Efficiency Particulate Air (HEPA) filters 3-5 microns
  - Ultra-Low Penetration (ULPA) filters provide the greatest efficiency currently available.

AIR CONDITIONING

- Outdoor air in comparison to room air
  - is virtually free of bacteria and viruses.
  - Infection control problems frequently involve a bacterial or viral source within the hospital.
- Acceptable indoor air quality can be achieved by

  (a) Contaminant source control.

  (b) Proper ventilation.

  (c) Humidity management.

  (d) Adequate filtration.

SIZE OF AC

AREA TO BE COOLED	CAPACITY (BTU/HR)
100 to 150 square feet	= 5,000
150 to 250 square feet	= 6,000
250 to 300 square feet	= 7,000
300 to 350 square feet	= 8,000
350 to 400 square feet	= 9,000
400 to 450 square feet	= 10,000
450 to 550 square feet	= 12,000
550 to 700 square feet	= 14,000
700 to 1000 square feet	= 18,000

If the room is heavily shaded, reduce needed capacity by 10%

If the room receives a lot of direct sun, increase needed capacity by 10%

Add 600 Btu/Hr for each person in the room if there are more than two people

Thermal Comfort for Surgical Team

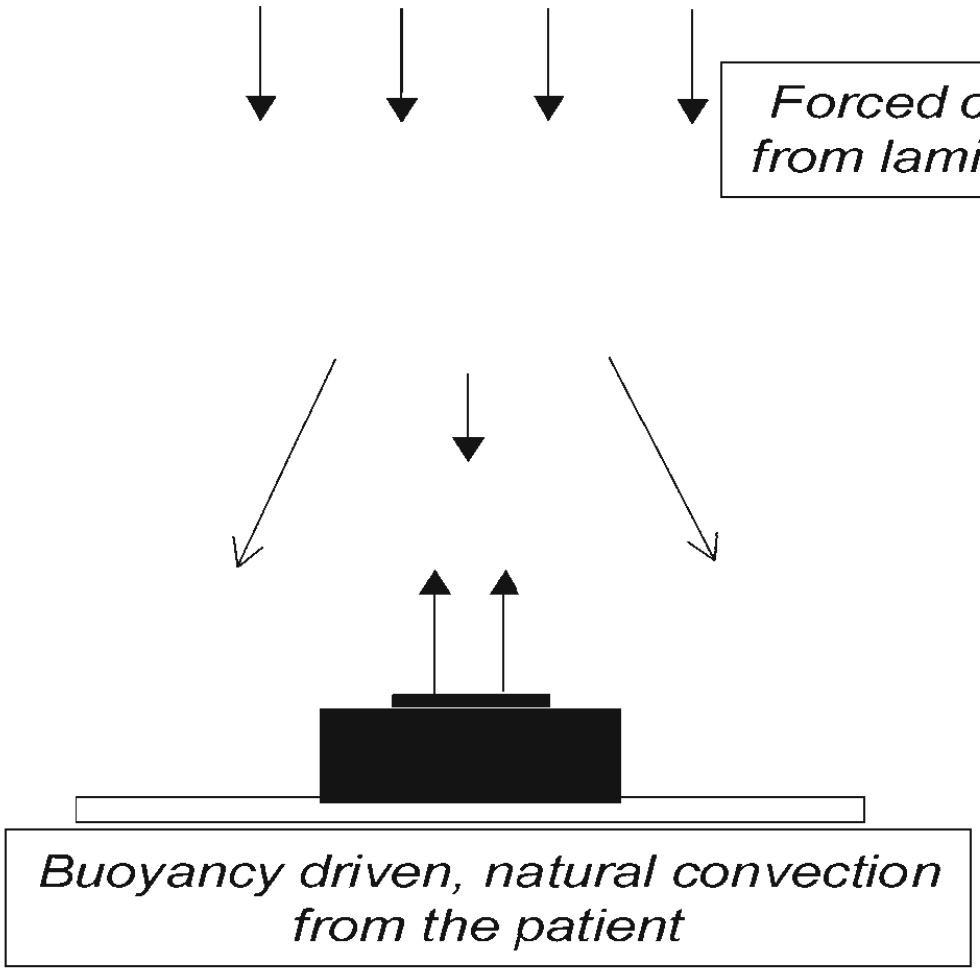
- The total heat production per hour caused by the staff, operation room lighting and equipment may be about 2 KW or 1750 Kcal/h.
- **Temperature in OT**
  - **compromise between the needs of the patient and those of the staff;**
  - **the temperature desired by staff itself is a compromise between the needs of personnel who are dressed in surgical gowns and those who are not.**
  - **In Europe and North America**, OT temperatures range from **18° to 26° C**
  - Generally, **surgeons who are actively working and fully gowned prefer a temperature of 18° C , but anesthesiologists prefer 21.5° C**
- **A higher temperature** is necessary **during operations on infants and burn patients**

Operating Room Ventilation

- *ACH-An important parameter*
- To maintain oxygenation for 10 persons in the OT, a volume of about 28 cub.m of air will be required per hour
- The recommended airflow rate in an operating room is 20-25 ACH (air changes per hour) for ceiling heights between 9 ft and 12 ft. #
- Systems that provide laminar (unidirectional) flow regimes with both high and low exhaust represent the best option for an operating room in terms of contamination control.
- The laminar diffuser array size should be set such that it covers at least the area footprint of the table plus a reasonable margin around it.

Memarzadeh and Manning *ASHRAE Transactions* 108(2) (2002)

Direction of Air Flow



Direction of airflow should be from clean to less clean areas.

Dominant driving forces in OR affecting surgical site infection

Air Curtains in OT

- a) Provides a barrier against loss of pressurisation and against entry/ exit of contaminated air in/out of the isolation room when the door to the airlock is opened.
- b) Provides a controlled environment in which equipment and supplies can be transferred from isolation room without contaminating the surrounding areas.

Positive airflow

- Pressure management in the protective operating room environment is designed by a positive airflow out of the cleanest area of the operating room suites.
- Operating rooms have multiple doors, and if any of those doors are open, the pressure differential is eliminated until the door is closed.
- Procedural practice for OT should include closed doors, except for egress, while the surgical site is open.

Modular OT

- They are pre-designed and
- Engineered with guaranteed performance and shorter erection time
- The vertical laminar flow system are designed to reduce the airborne infection to an exceptionally low degree
- Smooth surface, no corners.
- Provide a comfortable environment for the surgical team in terms of thermal, acoustic and lighting.

OT should be built with possible expansion in mind

- It is assumed that all the theatres need not be built at one time i.e.
  - –single phase, and
  - –the subsequent theatres can be built in a planned phasing manner.

Basic design principles

- 1. **Protective zone**: The protective zone is the entrance area for patients, staff and supplies where normal hospital standards of cleanliness apply and where normal everyday clothes can be worn.
- 2. **Clean zone** : In order to pass between the protective zone and the clean zone everything must undergo a system of transfer. This is the main area of the department and all patients, staff and supplies must be clean. A strict cleaning routine applies and everybody must undergo a complete changing routine to enter.
- 3. **Aseptic zone** : The aseptic zone is the inner area where conditions are as near sterile as possible. It applies to two rooms in each suite : the theatre and the theatre supply room. All staff who might handle exposed instruments must be scrubbed and gowned.
- 4. **Disposable zone** : In the disposable zone all exposed instruments (used or unused), pathological specimens, lotions, suction jars and soiled linen are passed from the theatre to a disposal corridor and returned for cleaning, sterilising or any other necessary process.

Wall Finishing in Operation Rooms

- An anticipated life of not less than 10 years
- The ability to withstand damage by mobile equipments
- To be impervious to moisture and unaffected by heat and steam
- To have a smooth matt finish, without crevices.
- The colour should be of light rainbow hues
- To be totally unaffected by colour change or staining
- To be capable of modification for minor alterations.
- Should not cause the build-up of a static electrical charge
- Should be joint less or have joints capable of being sealed.
- The finish interior should look aesthetically pleasing and should not darken with age and cleaning.

SAFETY FIRST

Ensure the safety of both the patient and OT personnel.

Unhindered movement of

- **Patients,**
- **OT personnel, and**
- **Equipment**

  by overcrowding, obstruction from cables, wires, tubes, or ceiling-mounted devices.

Before and during the operation, **critical devices** must be so positioned that they can be readily brought into use for **monitoring and life support**.

The supplies and instruments likely to be needed must be easily available.

SAFETY FIRST

The design of the OT must

- **Facilitate cleaning and disinfection** of the room
- **Efficient turnover of needed equipment and supplies for the next procedure**
- **Adequate storage space** for immediately needed supplies.
- **Adequate storage space for the multitude of equipment and devices required in current surgical practice**.
- **All too often, storage space is inadequate**

Introduction of New Technologies

Bar Coding

- **Properly utilized, technology can greatly facilitate surgical management**. e.g.
- **Bar coding -At patient's first office visit, he or she can be given a bar code, which is entered into a computer.** On the morning of surgery, the computer can give the patient a wake up call at 5:30 A.M. Upon arrival at the surgical center, the patient can be **logged in by bar code**.

  Tracking information Each step in the process can be tracked: how many minutes it took for the patient to get to the OR, how long it took for the anesthesiologist and the resident to interview the patient in the preoperative holding area, and how long it took to position the patient.

  Tracking information can also be **displayed on a video monitor**, so that the **patient's location and current status within the surgical care** process are available on an ongoing basis.

TELEMEDICINE IN OT

- Real-time consultation with experienced specialists
- Archiving of visual data also permits efficient sharing of information with other practitioners
- Audio-visual environment for teaching and learning complex surgical procedures is now well established.

Voice activation system

- In 1998, the first FDA-approved voice activation system, Hermes (Computer Motion, Santa Barbara, Calif.), was introduced in the OT.
- It provides surgeons with direct access and control of surgical devices, via either a handheld pendant or voice commands from the surgeon.
- To operate a device, the surgeon must take approximately 20 minutes to train the recognition system to his or her voice patterns and must wear an audio headset to relay commands to the controller.
- Devices including cameras, light sources, digital image capture and documentation devices, printers, insufflators, OT ambient and surgical lighting systems, operating tables, and electro-cautery can now be controlled by voice activation software
- In the future, more and more devices will be accessible to the surgeon through simple voice commands,
- In near future telesurgical and telementoring capabilities will be an integral part of the system.
- The OT will cease to be an environment of isolation

C - MANAGEMENT OF OT SEVICES

Standard Precautions in OT

- You're supposed to change your mask after every case anyway.
- Change your mask when you sneeze.
- Hand washing prevents more spread of infection than any of the other precautions
- Prevent injuries caused by scalpels and other sharp instruments.
- Personnel should handle specimens as potentially infectious material.
- Personnel who have exudative lesions or weeping dermatitis should refrain from providing direct patient care or handling medical devices used in performing invasive procedures.
- Personnel who participate in invasive procedures are encouraged to voluntarily know their HIV & HBV antibody status and disclose a positive status to the appropriate authority.

CDC's universal precautions

- Transmission-based precautions include airborne, droplet and contact precautions
- designed to prevent transmission of HIV, hepatitis B virus, and other blood borne pathogens.
- These precautions involve the **use of protective barriers**
  - **gloves,**
  - **gowns,**
  - **aprons,**
  - **masks, and**
  - **protective eyewear**

  The current CDC recommendation is to use surgical gowns and drapes that resist liquid penetration and remain effective barriers when wet.

Hand Hygiene

- Surgical hand antisepsis using either an
  - **antimicrobial soap or**
  - **an alcohol-based hand rub with persistent activity** is recommended before donning sterile gloves when performing surgical procedures (evidence level IB).
- **Scrub hands and forearms for the length of time recommended by the manufacturer, usually 2 to 6 minutes** (evidence level IB).
- **Before applying the alcohol solution, prewash hands and forearms with a non-antimicrobial soap, and dry hands and forearms completely.**
- **After application of the alcohol-based product, allow hands and forearms to dry thoroughly before donning sterile gloves.**

Reinforcing Forgotten Standards

- Door handles and
- Telephones
- Lift knobs in OT are often contaminated.

- "How often does anybody wipe down the buttons to the elevator, or the doorknobs?"

Surgical site infection (SSI)

- SSI a is an infection that
  - develops within 30 days after an operation or
  - within one year if an implant was placed and the infection appears to be related to the surgery.
- Post-operative SSIs are the most common healthcare-associated infection in surgical patients, occurring in up to 5% of surgical patients.
- In the United States, between 500,000 and 750,000 SSIs occur annually.
- Patients who develop an SSI require significantly more medical care.
- If an SSI occurs, a patient is 60 percent as likely to spend time in the ICU after surgery than is an uninfected surgical patient, and the development of an SSI increases the hospital length of stay by a median of two weeks.
- The risk continues after discharge:
- SSIs develop in almost 2 percent of patients after discharge, and these patients are 2-5 times as likely to be readmitted to the hospital.

Prevention of SSI

- Adequate skin antisepsis- is a promising way to decrease rates of SSI, because bacteria at the surgical site is a necessary precursor to infection-e.g. iodine & alcohol-based products and chlorhexidine gluconate
- Hand hygiene-proper scrubbing
- Surgical instruments-autoclaved
- Environment management
-
- Supplemental perioperative oxygen (i.e., an FIO2 of **80%** instead of 30%) significantly **reduces postoperative nausea and vomiting and diminishes the decrease in phagocytosis and bacterial killing usually associated with anesthesia and surgery.**
-
- ***Avoidance of Blood Transfusion-***the association between **blood transfusion and increased perioperative infection rates is well documented**.

Protecting Patients From Microorganisms on HCWs

Especially during the cold and flu season,

- extra safety measures could include greater vigilance in avoiding sick coworkers, the use of sick days when necessary and special attention to standard precautions

OT personnel with exudative lesions or weeping dermatitis on hands should avoid scrubbing & handling instruments

Housekeeping Procedures in OT

Floors and Walls

- **Routine disinfection of the OR floor between clean or clean-contaminated cases is unnecessary.**
- **When visible soiling of surfaces or equipment occurs during an operation, an Environmental Protection Agency (EPA)-approved hospital disinfectant should be used to decontaminate the affected areas before the next operation**

Floors and Walls

- **All equipment and environmental surfaces be cleaned and decontaminated after contact with blood or other potentially infectious materials.**
- **Disinfection after a contaminated or dirty case and after the last case of the day is probably a reasonable practice.**
- **Wet-vacuuming of the floor with an EPA-approved hospital disinfectant should be performed routinely after the last operation of the day or night.**

Dirty case protocol

- **Clean operations –SSI <3%**
- **Clean-contaminated operations-SSI <10%**
- **Contaminated operations }**
- **Dirty or infected operations}** -SSI 40%
- **Numerous authorities have recommended that there be only one standard of cleaning the OR after either clean or dirty cases.**

  because any patient may be a source of contamination caused by unrecognized bacterial or viral infection;

Dirty case protocol

- The other major source of OT contamination is the OT personnel
- Traditionally, dirty cases have been scheduled after all the clean cases of the day.
- However, this restriction reduces the efficiency with which operations can be scheduled and may unnecessarily delay emergency cases.
- There are no data to support special cleaning procedures or closing of an OR after a contaminated or dirty operation has been performed

Sources of surgical site contamination

- Squames are cells that are released from exposed regions of the surgery staff, for example, neck, face, etc., and are the primary transport mechanism for bacteria in the OT.
- Size 25 x 3 to 5 microns thick.
- Approximately 97-122 Squames are shed by each member of surgical team during a typical 2 to 4 hrs procedure (Synder 1996)

Proper clothing of OT team

- The range of microbial recovery from air sampling suggests that the use of barriers will prevent the inadvertent shedding of microbes from exposed areas such as the mouth, neck, face or hair.
- Barriers prevent contamination of drapes and the surgical site.
- Unclean floors and accumulated debris could become an internal source for soil microorganisms if disturbed

BACTERIAL SWAB CULTURE

a) The empty operation theatre should have:

- Less than 35 colony-forming units (CFU) of bacteria/cub.m of air.
- Less than 1 CFU of Clostridium perfingens or Staphylococcus aureus in 30 cub.m.

b) During operation

- Less than 180 CFU/ cub.m of air using ultra clean laminar flow in the theatre.
- Less than 20 CFU/ cub.m at the periphery of the enclosure and
- Less than 10 CFU/ cub.m at the centre.

- Routine swab culture of OT is not indicated

Why Humidity Control ?

- **At relative humidity of about 50 per cent, a very thin invisible film of moisture forms on the operation equipment and other surfaces. This film of moisture conducts static electricity** to earth before a spark producing potential is built up.
- Bacteriological microorganisms ride on dust particles whose attractability to one another is favoured by low relative humidity resulting in increased static energy.
- **Humidity in operation room is believed to contribute to the prevention of dehydration of exposed tissue.**

Humidity Control

- Low relative humidity is suitable for Klebsiella pneumoniae activity.
- High humidity enhances the growth of Pseudomonas aeruginosa.

- Humidity in the OT is generally maintained at between 50% and 60%;

  Humidity greater than 60% may cause condensation on cool surfaces, whereas humidity less than 50% may not suppress static electricity.

Lighting

- A general illumination brightness of up to **200 foot candles (ft-c**) is desirable
- **No glare or undesirable reflection**.
- The amount of light required **during an operation** varies with the surgeon and the operative site.
- Surgeons performing **coronary bypass operations** require a level of **3,500 ft-c.**
- **Heat** may be produced by **infrared light** emitted either directly by the light source or via energy transformation of the illuminated object.
- Most of the infrared light emitted by OT lights can be **eliminated by filters** or by **heat-diverting dichroic reflectors or IR coated bulbs**

CLEANING SCHEDULE OF OT

- Upward facing surfaces should be free from visible dirt
- Clean the floor with soap & water at the end of the day
- Disinfectant should be used after known contamination from a patient
- For routine cleaning mopping with detergent & water is sufficient.
- Washing of walls once a month is adequate
- OT light should be cleaned daily
- No special precautions are required after operation on a patient of Gas gangrene.
- The **OR** ceiling surface or drop-in tiles should be smooth, washable and free of particulate matter than can contaminate the operating room.

Basic Safety Concerns in the OT

i) **Chemical hazards** exist from the use of trace
   - i) **anesthetic gases,**
   - ii) **flammable anesthetic agents,**
   - iii) **various detergents and antimicrobial solutions,**
   - iv) **medications, and**
   - v) **latex products**.

ii) **Physical hazards** include
   - i) **electrical shock and burns,**
   - ii) **exposure to radiation from x-ray equipment, and**
   - iii) **injuries caused by lasers.**

iii) Noise pollution and

iv) **Light hazards from high-intensity illumination**.

The most effective way of minimizing the particular hazards in a given OR is to have an **active in-hospital surveillance program run by a multidisciplinary team that includes surgeons**

Minimization of Hazards to Patient

- **Patient safety begins with proper handling of patients and their tissues, particularly where patients are in direct contact with medical devices.**
- It is imperative that physicians, nurses, and technicians protect patients from injuries caused by
  - **excessive pressure,**
  - **heat,**
  - **abrasion,**
  - **electrical shock,**
  - **chemicals, or**
  - **trauma** during their time in the OR.

Occupational Injuries to Health Care Team

- Work-related musculoskeletal injuries due to
  - excessive lifting,
  - improper posture,
  - collision with devices,
  - electrical or thermal injury,
  - puncture by sharp instruments, or
  - exposure to bodily tissues and fluids.

Occupational Injuries to Health Care Team

- OT devices should be positioned in an ergonomically desirable manner, so that unnecessary bending, reaching, lifting, and twisting are minimized
- Placement of cables and tubes across the OT workspace should be avoided if possible.
- The patient and the operating table should be positioned so as to facilitate the surgeons' work while maintaining patient safety.
- Using proper transfer technique and obtaining adequate assistance when moving patients in the OT

Electrosurgical Devices

500 W radio-frequency generator

- When in use, the **electrosurgical unit generates an electrical arc that has been associated with explosions.**
- This risk has been lessened because explosive anesthetic agents like **Ether are no longer used**;
- **Explosion of hydrogen and methane gases in the large bowel is still a real -- but rare -- threat, especially when an operation is performed on an unprepared bowel.**
- **Electrosurgical units interfere with monitoring devices**, most notably the ECG monitor.
- **Interference with cardiac pacemaker** activity also has been reported.

- **Skin burn**
  - Such burns are not often fatal, but they are painful, occasionally require skin grafts, and raise the **possibility of litigation**.
  - The burn site can be at the
    - dispersive electrode,
    - ECG monitoring leads,
    - esophageal or rectal temperature probes, or
    - areas of body in contact with grounded objects.
  - The **dispersive electrode should be firmly attached to a broad area of dry, hairless skin, preferably over a large muscle mass.**

LASER

Some design changes in the OT are necessary to accommodate lasers

- The OT should not have windows, and
- A sign should be posted indicating that a laser is in use.
- The walls and ceiling in the room should be nonreflective.
- Equipment used in the operative field should be nonreflective and nonflammable.
- The concentration of O2 and N2O in the inhaled gases should be reduced to decrease the possibility of fire.
- Personnel should wear goggles of an appropriate type to protect the eyes
- A smoke evacuator should be attached to the laser to improve visualization, reduce objectionable odor, and decrease the potential for papillomavirus infection from the laser smoke plume

Lasers may cause injuries to both patients and staff

- skin burns,
- retinal injuries,
- injuries from endotracheal tube fires,
- pneumothorax, and
- damage to the colon & arteries.

Viewing and Imaging Devices

- **OT microscopes**
  - **Floor-mounted units are the most flexible, whereas built-in microscopes are best employed in rooms dedicated to this type of procedure.**
- **X-ray,**
- **CT scan,**
- **MRI and**
- **USG**

  - Dedicated open radiologic units are usually installed either in the OT proper or immediately adjacent to the OT to permit intraoperative imaging of the selected body area.
  - As image-guided procedures become more commonplace, OT designers will have to accommodate such devices within the OT workplace in a user-friendly manner

EMERGENCY POWER BACK UP

- The operating room should have an emergency power source, *e.g. a generator or battery powered inverter,* with sufficient capacity
  - to operate adequate monitoring,
  - anesthesia,
  - surgical equipment,
  - Cautery, and
  - lighting a minimum of **two hours** *(if more than one operating room is used simultaneously, an adequate emergency power source should be available for each OR).*

A separate Surgical Log

A Surgical Log must include numerical listing of procedures

- Date of surgery
- Patient's name and/or identification number
- Procedures
- Surgeon's name
- Type of anesthesia
- Name of person administering anesthesia
- Name of persons assisting surgeon

ANAESTHESIA SERVICES

PRE-ANESTHETIC CARE

These standards apply to all patients who receive anesthesia or sedation/analgesia;

In extreme emergencies these standards may be modified and if this is the case all circumstances should be documented in the patients record

A physician is responsible for determining the medical status of the patient;

An anesthesia care plan should be appropriately developed and documented; and

The patient or responsible adult should be informed about the anesthesia care plan

Informed consent with signature of witness is a must apart from consent for surgery

Anaesthesiology is not a child's game?

Delivery of Anesthetics

- All anesthetics are delivered by a qualified Anesthesiologist.
- The qualified Anesthesiologist must **have** knowledge in anesthetics and resuscitative techniques appropriate for the type of anesthesia being administered
- Anaesthesia charting is a must
- One case at a time

The anesthetic care plan is based on:

- A review of the medical record available
- Medical history
- Prior anesthetic experiences
- Drug therapies
- Medical examination and assessment of any physical conditions that might affect the decision about the preoperative risk management
- A review of medical test and consultations that might reflect on the anesthesia administration
- An appropriate preoperative medications needed for the conduct of anesthesia
- Providing appropriate preoperative instructions and other preparations as needed

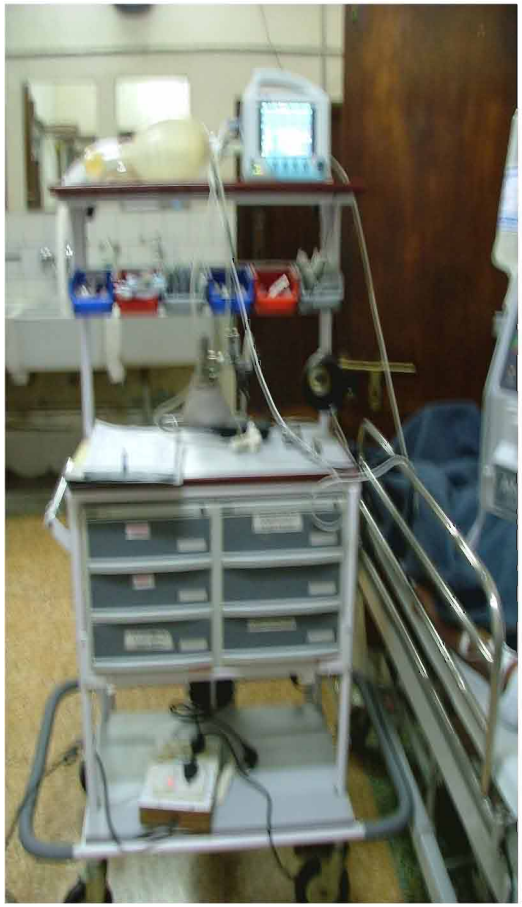
ANESTHESIA MONITORING

- Applicable to all anesthesia though in emergency circumstances life support measures take precedence and may be exceeded based on judgment of the responsible physician.
- Any waived requirements must have an appropriate statement in the patient records to document reason for same.
- The qualified Anaesthetist must be physically present in the operating suite throughout the conduct of all anesthetics.

EQUIPMENT AND SUPPLIES FOR ANESTHESIA

- A reliable source of oxygen, adequate for the length of the procedure. Back up should consist of at least one full E type cylinder
- A central source of piped oxygen or adequate no. of cylinders
- There is an adequate source of suction
- An adequate and reliable waste anesthetic scavenging system exists if inhalation anesthetics are used
- Self inflating bags, are capable of delivering positive pressure ventilation with at least 90% oxygen concentration
- Adequate anesthesia machines in operating room are available where inhalation anesthetics are used

EQUIPMENT AND SUPPLIES FOR ANESTHESIA



- **Sufficient electrical outlets, properly grounded are available and connected to emergency power supplies**
- **Adequate illumination for patients, machines and monitoring equipment includes battery powered illuminating systems**
- **Emergency cart is available with defibrillator, necessary drugs and other CPR equipment**
- **There is a reliable means of two-way communication to necessary personnel in other facility locations**
- **Sufficient backup power to last at least 120 minutes**
- **Appropriately sized pediatric medical equipment is available if services are provided to infants/children**

Causes of anaesthesia errors!

PRE-ANAESTHETIC CHECK

- No documentation
- No proper format –missing important inform
- No proper investigations
- No proper drug history / past Anaesth history
- Examination by juniors only !
- Too tired to conduct PAC !
- Failure to communicate with the patient
- Language barrier !

PRE-OPERATIVE PERIOD

CAUSES PRIOR TO INDUCTION

- **FAILURE TO ENSURE IDENTITY OF PATIENT**
- **FAILURE TO CHECK PART TO BE OPERATED**
- **FAILURE TO TAKE PROPER INFORMED CONSENT**
- FAILURE TO PRE CHECK
  - MACHINE & VAPORISERS
  - PATIENT'S PARAMETERS
  - INJECTIONS TRAY / CRASH CART
  - LARYINGOSCOPE & ETT
  - CYLINDERS
  - SUCTION MACHINE
- FAILURE TO KEEP DIFFICULT INTUBATION TROLLY READY
- LACK OF PROPER ASSISTANCE BY TRAINED PARAMEDICS
- WORKING WITH A NEW MACHINE / NEW OT / NEW SURGEON
- POWER FAILURE WITH NO BACK UP

INTRA-OP PERIOD

- **CAUSES DURING INDUCTION**
  - USING UN LABELLED SYRINGES / AMPOULES
  - SYRINGE SWAP / AMPOULE SWAP
  - POOR OR NO ASSISTANCE BY PARAMEDICS –shortage
  - SINGLE ANAESTHETIST –APPREHENSIVE / LACK OF CONFIDENCE / OVERCONFIDENCE
  - POOR PLANNING !
  - POORLY MAINTAINED ANAESTH. MACHINE
  - FAILURE OF LARYNGOSCOPE-POOR / NO LIGHT
  - IMPROPER SELECTION OF ETT
  - WRONGLY FILLED OXYGEN / N2O CYLINDERS !
  - NOT FOLLOWING MANDATORY MONITORING STANDARDS
  - ODD HOURS / FATIGUED ANAESTHETIST COMPELLED TO FINISH LIST

INTRA-OP PERIOD

- **CAUSES DURING MAINTENANCE**
  - FAILURE TO CHECK MONITORS / SILENT THE DEFAULT ALARMS !
  - FAILURE TO MAINTAIN CONTACT WITH PATIENT
  - POOR ANALGESIA UNDER GA
  - TOO LIGHT / TOO DEEP ANAESTHESIA
  - SHARED AIRWAY –ENT SURGERY
  - ODD SURGICAL POSTIONS
  - LEAVING THE TABLE DURING OPERATION !
  - ATTENDING >ONE PATIENT AT A TIME
  - POOR SURGICAL SKILLS !
  - ALLERYGY TO ANTIBIOTICS USED INTRAOP
  - SURGEONS KEEP CHANGING BUT ANAESTHETIST SAME !

POST-OP PERIOD

- **CAUSES DURING EMERGENCE**
  - INCOMPLETE REVERSAL
  - PRE MATURE EXTUBATION -ASPIRATION
  - HEMODYNAMIC INSTABILITY
  - POOR OXYGENATION
  - NO PACU !
  - NO PROPER HANDING OVER OF PATIENT
  - NO MONITORING DURING SHIFTING
  - PREMATURE SHIFTING TO WARD !
  - NO ANAESTHETIST IN POST OP WARD / ICU

Patient monitoring during anesthesia

Oxygenation

- Assessed by O2 analyzer & anesthesia machine with OFWD
- Pulseoximetry –sPO2
- Patient color

Ventilation

- Chest excursion
- Breathing bag with reservoir tube
- Auscultation of breath sounds
- Monitoring of EtCO2 ,
- Proper position of the endotracheal tube or laryngeal mask
- The mechanical ventilator should have audiovisual disconnect alarm
- Clinical signs are evaluated by continual observation during regional/sedation analgesic

Monitoring during anesthesia

-Multipara monitor

- sPO2
- ECG
- HR
- RR
- Temp
- EtCO2

-DC defibrillator

- Adult
- Paediatric

-AGM

-Anaesth.level monitors

Patient monitoring during anesthesia

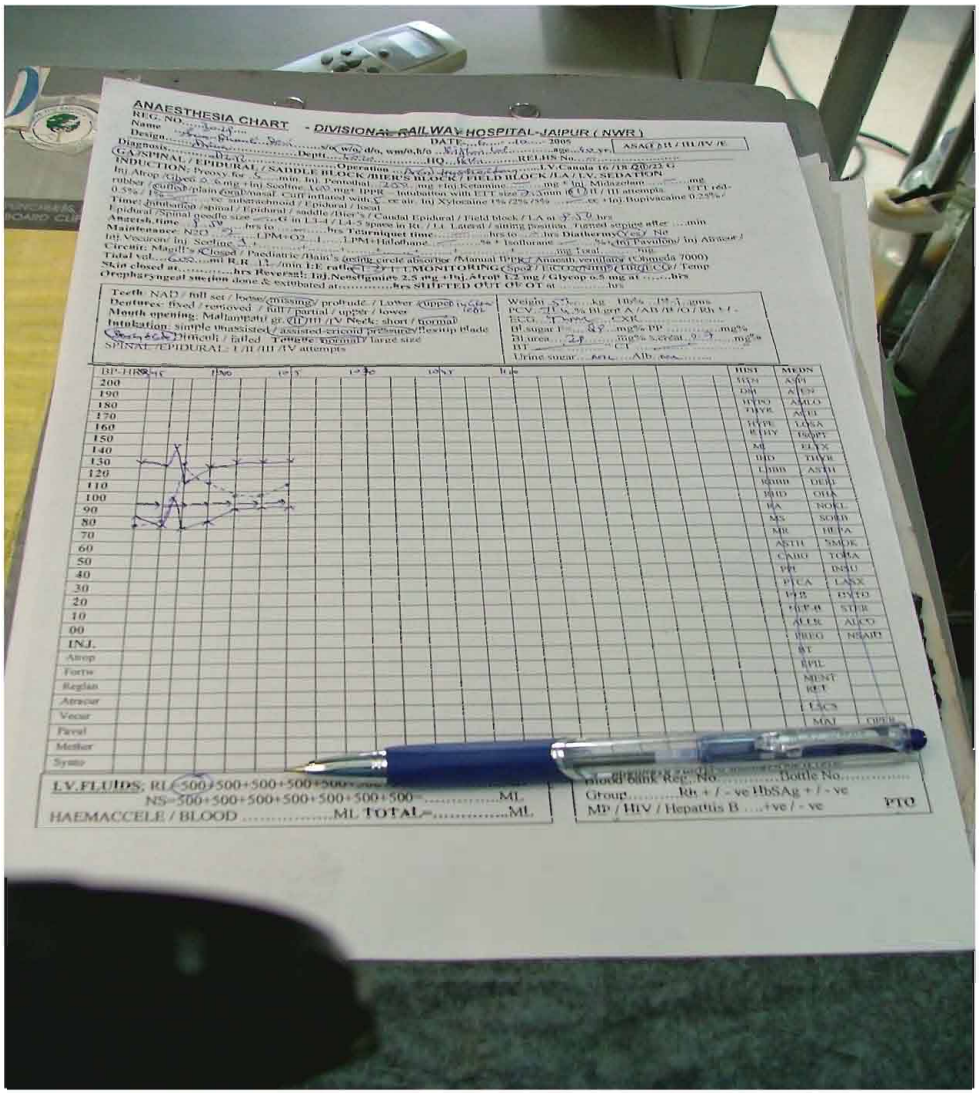
Circulation

- Continuous EKG during procedure
- NIBP every 5 minutes (minimum)
- Heart rate every 5 minutes (minimum)
- Pulse oximetry continuous
- Heart auscultation by oesophageal stethoscope
- IBP

Temperature

- should be monitored when clinically significant changes in body temperature are intended, suspected or anticipated

Anesthesia chart



POST-ANESTHETIC CARE

- **Applies to all locations and all patients that have received GA, regional anesthesia, or sedation/analgesia.**
- PACU or area equivalent is available to recover all patients after anesthesia administration
- If a patient is not sent to PACU there is a specific order documented on the record
- Patients transferred to the PACU are accompanied by a member of the anesthesia care team who is knowledgeable about the patient
- Patient transferred to the PACU will be continually evaluated & treated as needed during the transport with appropriate monitoring

PACU

EVALUATION IN PACU

Documentation of time of arrival

- Assessment and evaluation of the patient by the anesthesia recovery staff
- Transmission of a verbal report to PACU team from a member of the anesthetic team who accompanies the patient
- Transference of any pertinent information concerning the pre-op condition or surgery/anesthesia course
- A member of the anesthesia care team remains in the post anesthesia care area until the post anesthesia care nurse accepts responsibility for the case being transferred

CONTINUED EVALUATION IN THE PACU

Observation and monitoring by methods appropriate to the patient's condition (O2 saturation, ventilation, circulation, temperature)

- Pulse oximetry
- A written, accurate post anesthetic care report is available
- Medical supervision and coordination of patient care is by an Anaesthesiologist

DISCHARGE FROM PACU

- Anesthesiologist is responsible for discharge from the PACU and should be immediately available
- Approved discharge criteria are used
- PACU nurse may determine that the patient meets discharge criteria

Injections trolley

Anesthesia machine

OT Nurse laying the instruments

FLOW CHART

Prev. Pt. Leaves Room
Dirty Equipment Out
Clean Room
Reconfigure Equipment
New Instruments In
Open & Set Up Equip
Bring Patient In
Transfer
Monitors On
Induce Anesthesia
Presurgical Steps
Prep & Operate

OT in working-Do not enter

THANKS FOR YOUR PATIENCE