

# ISSUE 6 Liwewire

INFECTION CONTROL

April, 2016

**NEWS LETTER**

## FROM THE DESK OF EDITORIAL BOARD

### EDITORIAL BOARD



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Dear Friends,

We hope that you must have gone through the articles in the previous issues of Liwire infection control newsletter and thoughts from the stalwarts in the field must have triggered some thinking at your end. We are eager to know your feedback.

This issue is a continuation of the previous issue on OT layout. Using these as a guideline, look at your OT and compare it with the suggested layout. What is missing and how you can improve upon the same is the expected endpoint of the exercise. To the extent possible, the focus should be on solutions that are inexpensive. If you think it over, even very minor changes with less difficulty and little-to-moderate cost can make a lot of difference. So do think it over! We will be more than happy to answer any of your queries about how to overcome some problems that you may find difficulty in doing so yourself. Please feel free to send us your queries – we will genuinely try to give cost-effective YET time-tested and proven solutions to the extent possible, keeping in mind the most important causative factors of endophthalmitis.

In this issue too, we have articles from knowledgeable people in the field. We are sure that once you read and ponder on the issues raised here, you will be looking forward to the next issue. On our part, we aim to get more articles from experts in the field so as to give you an in-depth view on the topic of endophthalmitis. Unfortunately, we have not had an opportunity to learn all this during residency, which is a major lacuna in our training programmes. Hope this series will fill the gap and help you help your patients in the end.



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Dr. R. D. Ravindran is currently the Chairman of Aravind Eye Care System, Madurai. He had earlier served in Aravind Eye Care System as Chief Medical Officer at its eye hospitals located in Theni, Tirunelveli, Coimbatore & Puducherry. He is also the Chairperson of the International Agency for Prevention of Blindness (IAPB), India, and a board member of **Vision 2020 RIGHT TO SIGHT INDIA**, New Delhi. His areas of interests include community ophthalmology, quality assurance in eye care delivery, basic research in cataracts, & hospital administration. He has over 20 publications to his credit and has made over a hundred presentations at various national and international conferences.

## OPERATION THEATRE LAYOUT IN A HIGH-VOLUME TERTIARY EYE CARE CENTRE

The operation theatre (OT) is the core work area in any hospital. It is here that the actual product of eye care is delivered. Over 15% of our outpatients pass through the portals of the OT. Hence, to that effect, the layout of an OT can greatly influence the efficiency of the work, its quality and the general working atmosphere. This article recommends a layout that is suitable for high-volume cataract centres. It also briefly discusses the positioning and layout of OTs for other ophthalmic speciality services. The article limits this discussion to the physical layout of the OTs, how they connect to the ancillary units of the OT, and the work processes that can efficiently utilize such a layout.

The location and the flow of work inside the OT is very important for smooth functioning of all the activities inside the theatre and for achieving optimal productivity of the OT, and also in providing a sterile environment for conducting surgeries. The many components of the OT are the operating area, outside corridors, sterilization rooms, dress change room, toilets and waiting areas, storerooms, etc. The layout of any OT should take all this into account and keep movement unidirectional and as minimal as possible.

In a general medical hospital, it would be ideal if the OT is a dedicated one for ocular surgeries alone. Also, it is recommended that a permanent theatre team staffs the ophthalmic OT.

## HOW OT DESIGN CAN CONTRIBUTE TO BETTER STERILITY

Good layout design can enable the maintenance of sterility and to ensure a safe environment. The operating complex-which includes the operating rooms (OR), sterilization, patient preparation and recovery rooms, waste disposal area-should be situated in an area away from public movement and, ideally, should have the following features:

- Clear segregation of sterile and unsterile areas - preferably by an air lock or buffer zone.
- The sterile and unsterile zones inside the OR must be demarcated by coloured lines-only scrubbed staff remain in the sterile zone.
- The entrances for patients and staff should be separate.
- Separate areas for storing sterile and unsterile items.
- The OR should have seamless walls and a non-porous floor.
- There should not be any surface where dust might accumulate.
- Doors of the OR should always be kept closed to reduce the turbulence of the air flow.
- Restrict the number of personnel to the minimum during surgery.
- The door of the OR should be kept closed and movement must be restricted.
- If windows are present, they should be sealed.
- The OT should be maintained dry.



**WHILE DECIDING UPON MATERIALS FOR THE INTERIOR OF THE OT, THERE ARE SOME BASIC CONCEPTS THAT MUST BE UNDERSTOOD AND FOLLOWED:**

- It is important point that the whole OT complex is kept dust-free; so ensure that any material is not likely to become flaky or to attract dust.
- Ensure that surfaces are made of materials that are easy to maintain and the layout should ensure that all surfaces are easy to reach.
- Because of the constant cleaning procedures, ensure that any surface material is long-lasting.

**IN ORDER TO INCORPORATE THE ABOVE FEATURES, THE OT COMPLEX SHOULD BE DESIGNED IN A WAY THAT IT INCORPORATES THESE FOUR MAJOR ZONES:**

- **Outer zone** acts as a reception area, and is accessible to all.
- **Clean zone** comprises the changing room and patient preparation room. This is a transfer zone and is accessible only to OT staff.
- **Aseptic zone** is a sterile area, and includes the space for scrubbing and gowning, the actual operating area as well as the area where instruments are cleaned and sterilized.
- **Disposal zone** stores used linen before sending it to the laundry. The used disposables are segregated and then disposed off.

**THE DIFFERENT AREAS AND ITEMS THAT NEED TO BE CHECKED FOR STERILITY AND QUALITY ARE THE AUTOCLAVES, AIR, WATER, AND CONSUMABLES THAT COME PRE-STERILIZED.**

1. Indicators to be used in the a steam autoclave are chemical indicators with every cycle, biological indicator at the first cycle, and process indicators that can be documented to show that the items have undergone sterilization.
2. **Water:** Filtered water can be used. Quality of water must be checked at least once a month.
3. **Air:** The air quality must be checked periodically for bacterial count. This must be done at least once a month. If any recent construction activity has been carried out, it can be done once a week for four times, using the settle plate method.

Central air conditioning of the OR is ideal and in a case where resources are not a constraint, a ventilation/heating ventilation air conditioning (HVAC) system may be installed. These systems have high efficiency particulate air (HEPA) filters and maintain indoor air temperature, humidity, control odours, clean the contaminated air and minimize the risk of transmission of air-borne microorganisms. Though ideal, it may not be possible in all secondary centres. In a secondary centre, the OT should be well ventilated and air conditioned with a split air conditioner. In addition, the air circulating inside should be filtered using a 0.3  $\mu$  filtering device such as a HEPA filter along with UV lights. These are commercially available and are not very expensive.

The additional expenses made in maintaining the ventilation as mentioned above will provide not only good ventilation but also ensure better sterility of the OR. This will reduce the post-operative infections, and hence is worth the expense. The use of fans in OR is not recommended as it adds to turbulence and lifts dust particles.

## **HOW OT DESIGN CAN CONTRIBUTE TO BETTER EFFICIENCY**

In a high-volume centre, it is vital to create systems that allow an optimum number of patients to be handled. To this effect, OT design can dictate how fast the surgeon can handle his/her patients as the OT layout can affect patient transfer and preparation duration. Intelligent space layout and ergonomic positioning of equipment will allow efficient flow of patients through the facility.

A combination of efficient work systems and equipment layout such as the 'two-table' system allows the surgeon's productivity to be maximized. The two-table system assigns two operating tables to a surgeon with one microscope. As the surgeon is performing surgery on one table, the patient is brought and readied on the next table. So when the surgery is over, the surgeon moves the microscope near the next patient, scrubs and starts the next surgery without a lapse. While such a system requires a lot of backend



work in terms of getting supplies and consumables ready for each surgery and coordinating the patient's preparation to be in tandem with the surgeon, the layout also plays a major role in making such workflows successful.

Within the OT, clearly demarcated locations for placement of trolleys and instruments on the trolleys, and bins for disposables and waste material can greatly ease the work in the OT, ensuring that everything is in its place.

In order to improve efficiency outside the actual OT, the layout should enable easy movement between the OT and the ancillary areas of the OT complex:

- **Reception/waiting area of the patients:** The area depends on the number of patients that are to be operated. It should be well lit and ventilated. A toilet for patient use should be part of this area
- **Block area:** We are mainly talking of regional/topical anaesthesia for cataract surgery patients. As the majority of surgeries are done under topical anaesthesia, it may be sufficient if comfortable chairs are provided. A few beds can be placed for those who need blocks.
- **Sub-sterilization room:** When high-volume surgeries are done, we have to have a place for cleaning and sterilization of instruments by high-speed autoclave in between surgeries. This can be a small room next to the OT with a separate door leading into the OT. Where there is more than one OT, this sub-sterilization room should be accessible to all the OTs.
- **Sterilization and instrument cleaning area:** The size of this area depends on the number of people and instrument sets that have to be cleaned and autoclaved. Autoclaves, ultrasonic cleaners wash basins must be provided.
- **Dress change rooms:** Changing rooms and washroom facilities for the staff should be placed so as to ensure that they can enter the OT directly after changing
- **OT stock room:** The size is again designed with the usage in mind. These should be easily accessible but should not affect sterility of the OT.

## LAYOUT SPECIFICATIONS UNIQUE TO TERTIARY EYE CARE CENTRES

While the OT layout will have to be designed for the speciality equipment and consumables, the same principles of efficient layout and ergonomic placement of equipment allowing for smooth flow of staff and patients applies here as well.

For those specialities that require general anaesthesia to be administered, the layout should consider the placement of support systems and the OT complex should have space for a separate GA room for preparation and recovery.

Most tertiary care centres are also training institutes and the OT layout should be planned to accommodate trainees, with space for observation, and careful consideration of the equipment, which will come with special fittings for observation and wall-mounted televisions that may be used to display live surgeries via the microscope.

## QUALITY ASSURANCE

For a high-volume surgical practice to be sustainable, an effective quality assurance (QA) system should be instituted. QA systems should address all aspects of the care provided. While designing the layout of the OT, one should take into consideration the space requirements as well as the workflow defined by these QA procedures, keeping in mind that a robust QA system is as vital to the OR as any other equipment.



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## OPERATION THEATER LAYOUT

- Away from public movement.
- Dedicated eye OT only to be used. (Make shift OTs to be used only under extenuating circumstances with the prior permission from Government officers.)
- Separate septic OT away from main OT.
- Space – minimum 180 sq ft. for one OT table.
- Maximum 5 personnel per 180 sq ft. (separate OT with single OT table for each surgeon is the highest ideal). The microbial level in the OT is directly proportional to the number of people moving about in the theatre.
- One OT table per theatre. No second table to prepare the next case!
- Separate entry for both scrubbed staff and unscrubbed staff/patients. Scrubbed staff enters towards the head end of the patients. More space towards head end.
- Segregation of sterile and unsterile area. Floor lines, etc., should be used to delineate them.
- Strict restriction of circulating staff/observers in the sterile area.
- Spring-type door hinges.
- All doors should be airtight – rubber can be used for the purpose.
- Air lock to be created by providing an enclosed space before the main operating room.
- Air should move from clean to less clean areas.
- Air changes should be at least 15–20 per hour – minimum requirement is split AC. Window AC is not considered good as it circulates outside air into the OT.

- Ultraviolet lights can help clean the environment by killing the organisms

due to their bactericidal property.

- Humidity should be controlled and maintained between 45 and 60%.
- Temperature should be maintained between 23 and 25°C.
- No fans, coolers or exhaust fans should be permitted inside the OT.
- No loose wires, holes and cracks should be present.
- Flooring should not contain marble as it is a porous material. Kota stone, granite or large-sized vitrified tiles are useful. Epoxy/stainless steel can also be used.
- There should be full wall tiling of large-sized tiles.
- False ceiling of gypsum is alright.
- All the corners should be rounded between floor and walls so as to avoid dust accumulation; coving.
- No rough surfaces; should be washable, scratch-proof and scrub-resistant.
- Avoid light colours – shows dirt.
- Dedicated furniture and material for OT. Not to be shared or exchanged. Avoid wood, fabric, paints and porous material. Stainless steel, plastic, powder-coated steel (rust-free material) should be used.
- No boards, calendars, notices and photos are permitted.
- No or minimal storage spaces or cupboards allowed. Should have castor wheels to enable easy movement.
- No platform should be there above the height of the table, which is called the sterile level.
- No surfaces where dust can accumulate.
- Material like gas cylinders, trolleys, torches, etc., brought in from outside should be cleaned and disinfected before shifting them inside the OT, even if urgent.
- Outside clothes, footwear, pens, briefcases, bags and files do not go into the OT.



- Outside boxes and cartons are not allowed. Syringes, disposables, and IOLs should be transferred to food-grade plastic boxes and trays.
- No openable windows.
- Autoclave room should be away from main OT.
- Zoning inside the OT:
  - ✦ Outer Zone – reception, footwear removal area. Dress protocols should be displayed here, e.g. street clothes may be allowed here.
  - ✦ Clean Zone – changing room/transfer zone, cleaning area, temporary waste holding area.
  - ✦ Aseptic Zone – scrubbing/gowning/gloving/operation room/autoclave room
  - ✦ Disposal Zone – where equipment and supplies are processed
- Barrier between zones – physical and mental.
- No direct entry from outer to central sterile zones.
- No direct ventilation between outer and sterile zones. Doors between two zones should not be opened simultaneously.
- Ventilation
  - ✦ Well ventilated
  - ✦ Filter (0.3 micron) the circulating air
  - ✦ HEPA (high efficiency particulate air) filter
  - ✦ Positive pressure ventilation
  - ✦ Vertical unidirectional flow on operating table
  - ✦ Minimum 15 air exchanges per hour
  - ✦ Class 100 air – highest ideal; however for eye OT, class 10,000 is enough



**Air Cleaner**



**Air Curtain**



**Dehumidifier**



**Ultraviolet Light**

## SCHEMATIC DRAWING OF OPERATION THEATRE

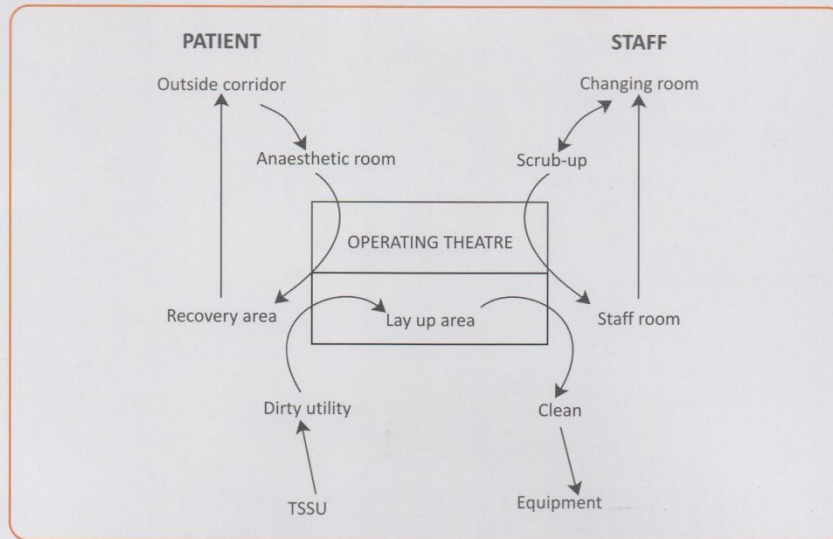


Fig. Movement of theatre staff, patients, and equipment into the operation theatre

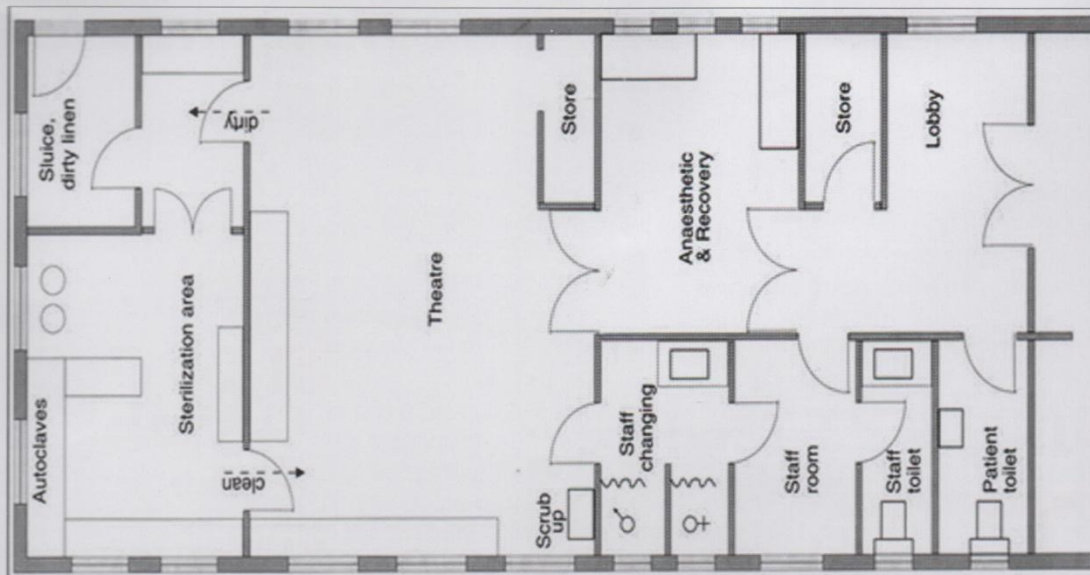


Fig. Theatre plan (not to scale)