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Ideal surgical suite design – Part 1

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ABSTRACT: The aim of good theatre practice is to offer a sterile and safe environment in which to undertake veterinary surgery with consideration to reducing the risks to the patient. Theatre designs found in veterinary practice often use techniques and technology derived from human hospital designs.

Preventing hospital-acquired infection is an important consideration when designing a veterinary surgical suite. There is a risk of nocosomal infection, so it's important that aspects such as staff protocols, discipline, training and effective teamwork and communication are considered.[1,2]

History of theatre practice

In the 16th century, the Company of Barber-Surgeons was established. Barber-surgeons undertook surgical procedures, despite having little formal training. Infection rates were high as lack of infection control resulted in disease transmission from patient to patient and between patients and surgeons. This was compounded by overcrowding and lack of ventilation and sanitation.[3,4]

The development of antisepsis in 1867 by Lister led to a move towards developing operating rooms with the principal aim of eliminating infection.[5] From this, better theatre design techniques, such as having rooms and contents made from materials that could be washed easily with water, rounded angles and window frames flush with the inner surface of the walls.[3]

Surgeon attire evolved towards wearing theatre gowns instead of frock coats. The use of gloves, as well as washing hands before operating, was a big advance in technique and started in 1878.[5]

Steam sterilisation for instruments and drapes was introduced in 1886 by von Bergmann in Berlin.

The use of carbolic spray resulted in a reduction of mortality rates from 63 per cent to 18 per cent. Lister believed that more could be done to reduce this with the use of aseptic techniques. Suitable ventilation was later believed to have an effect on lowering mortality rates too.

In the 1940s, positive (plenum) pressure ventilation of operating suites was introduced. This resulted in the reduction of bacteria in the air and hence the reduction of postoperative sepsis rate.[6]

Ideal theatre design

The operating room design should consist of basic zones. It should be divided into aseptic, clean, protective and disposal areas.[7] A similar design is adopted in the National Health Service, consisting of zones – Aseptic, Ultra-clean, Super-clean, Clean and General.[4]

The main theatre would be considered as the aseptic zone; the clean zone would include areas such as the preparatory and scrub-up area. The protective zone would include the nurses' room, gowning area or changing facility. The disposal zone would be the sinks and items for used postoperative equipment and instruments.

When incorporating design features, the following should be considered:

- colour coding of each area, with staff allocated to a specific area wearing uniform in the corresponding colour.[2]
- operating rooms should be a dead end so they are completely isolated from any potential walk-through or personnel traffic from staff and patients.
- minimal furniture within the theatre

– this is ideally restricted to a large operating table.

- an anaesthetic machine connected to an active scavenging system (in preference to a passive scavenging system) to ensure reliable waste gas extraction control.
- items such as instruments and suture materials should be pre-organised and available prior to the surgery commencing.
- sterile, single-use theatre packs which are now manufactured and used regularly. This enables a smooth transition from clean areas to disposal.[5]
- restriction of furniture in theatre is paramount as excess equipment can harbour dust particles; as well as excessive horizontal surfaces which can pose a problem with infection control.
- furniture that may be needed should ideally be made of stainless steel, which is durable and easy to clean.
- intravenous drip stands and suitable waste 'kick buckets' should be available for use during surgery.
- ideally walls should be sealed with plastic material and white in appearance, which enables ease of cleaning.
- in the main theatre, all gases – such as oxygen and nitrous oxide – should be piped into the theatre with outlets on walls for easy access.
- electrical power points at 240 volts should be located at various points and recessed, as well as being at waist height in theatre.[8]
- large stainless scrub sinks are suitable for use. Such sinks are available with elbow or infra-red sensor operation.[9] In some hospitals, sterile water has been used for the purpose of scrubbing up. It has been suggested that this extra step for preventing bacterial contamination is not proven to be as beneficial as the use of alcohol-based solutions, skin preparation techniques and double-gloving, so sterile water is not a necessity.[10]
- floors should be made from a rubber-moulded compound which is non-slip, impervious and waterproof. They should also withstand stains and prevent the harbouring of bacterial infections with good drainage systems.

  The most common flooring used in theatres today is polyvinyl chloride, which is seamless and continuous with the wall for five or six inches.[8] Some manufacturers offer a floor type with an antibacterial quality which has been proven to reduce the viable cell count of hygiene-critical micro-organisms.
- a 'one-way' entry system into the theatre – which allows entry after scrubbing or entering via the preparatory area, but does not allow the staff to return – is ideal. This personnel activity requires discipline and good preparatory techniques, so that a revolving cycle from clean areas into aseptic area zones, then into postoperative area is maintained. Use of returning doors and self-sealing doors also promotes reduction of traffic which decreases bacterial air counts.

  Doors should also be kept closed for this reason. In some practices, electronic two-way doors are used. This allows a door to open and enter into a subspace leading to another door which automatically opens once the previous one closes, allowing entry without exposure to external air contamination.[6]
- an absence of corridors reduces any potential infection transmission – whether it's through patient transportation via trolleys or by personnel movement.[6] The overall design should ideally follow the principle of a revolving one-way system which offers a good flow within the building.

  A centralised nursing station – which allows nursing staff to monitor and observe all areas without having to leave the allocated area – is beneficial. This also has the benefit of ensuring that staff are on hand to deal with emergencies and to enable the monitoring of patients and personnel passing through to each area.
- windows have been previously considered unnecessary and in some cases are seen as a risk to infection control owing to condensation.[6] Latterly, there has been a shift towards the use of double glazing or single PVC-glazed glass. The technologies incorporated in these are supplemented by the introduction of blinds in between the sheets of glass in double-glazed windows.

  With this in mind, a large viewing window – which can be overseen by staff in the nurse's room – allows for both communication and observation of personnel flow, without compromising infection control.[5]

Emerging technologies, techniques and materials continue to have an impact on the design of new theatres. All are based on the sound principles which have been implemented and built upon over the years. VNJ

References

1. Fox, N. J. (1997) 'Space, Sterility and Surgery: Circuits of Hygiene in the Operating Theatre', *Society Science Medicine*, **45**(5): 649-657.
2. Rutland, G. (2011) 'Optimising the theatre environment' *Veterinary Nursing Journal*, **26**: 121-125.
3. Kay, R. S. (1967) 'Small Animal Hospital Theatre Design' *Journal of Small Animal Practice*, **8**(10): 593-598.
4. Johnston, I. D. A. & Hunter, A. R. (1984) *The Design and Utilisation of Operating Theatres*, Edward Arnold: London.
5. Essex-Lopresti, M. (1999) 'Operating theatre design', *The Lancet*, **353**: 1007-1010.
6. Humphreys, H. (1993) 'Infection control and the design of a new operating theatre suite', *Journal of Hospital Infection*, **23**: 61-70.
7. Holton, J. & Ridgeway, G. L. (1993) ' Commissioning operating theatres' *Journal of Hospital Infection*, **23**: 153-160.
8. Philips, N. (2007) Berry & Kohn's *Operating Room Techniques*, 11th Ed, Missouri: Mosby Elsevier.
9. Harsoor, S. S. & Bhaskar, B. S. (2007) ' Designing an Ideal Operating Room Complex' *Indian Journal of Anaesthesia*, **51**(3): 193-199.
10. Dharan, S. Pittet, D. (2002) 'Environmental controls in operating theatres' *Journal of Hospital Infection*, **51**: 79-84.