



Practical measures to ensure health and safety in theatres

AUTHOR Sue Saunders, BSc, RN, is staff nurse, the Royal Bournemouth Hospital.

ABSTRACT Saunders, S. (2004) Practical measures to ensure health and safety in theatres. *Nursing Times*; 100: 11, 32-35.

It is essential for nurses to be aware of their legal and professional obligations regarding health and safety issues in the operating theatre. There should be strict policies and procedures in place to ensure a safe environment and to maintain the sterile field for the benefit of patients, staff and visitors.

A simple definition of health and safety is the state of being well in body and mind, and the condition of being free from danger and risks (Allen, 1991). Since the Health and Safety at Work Act 1974 the phrase has become synonymous with workplace legislation and the Management of Health and Safety at Work Regulations 1999 introduced more specific requirements to manage health and safety. Employers are obliged to carry out risk assessments and implement changes as necessary (Health and Safety Executive, 2003). Equally, employees have a legal obligation to take reasonable care of their own health and safety and to follow procedures provided for their protection.

In 1998 the Department of Health's *A First Class Service* set out quality assurance and improvement systems such as clinical governance, which made NHS organisations accountable for improving the quality of services and ensuring high standards of care (DoH, 1998a). All health professionals should have a clear understanding of clinical quality systems and processes for identifying and managing risk (DoH, 2002). In addition, the NMC (2002) states that nurses have a duty to identify risks to patients and to work with team members to promote environments that are conducive to safe practice.

Health and safety issues in theatres

Employers should introduce new members of staff to basic health and safety laws and principles. Nurse training incorporates awareness of specific legislation such as Manual Handling Operations Regulations 1992, Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995, and Control of Substances Hazardous to Health 2002.

There are additional health and safety issues specific to theatres. During the perioperative period several members of a multidisciplinary team may be present, together with occasional visitors, who may possess varying degrees of knowledge, training and experience. All present have a joint responsibility, within a relatively small and restricted area and surrounded by specialist

equipment and potential hazards, to work towards the successful completion of the patient's anaesthesia and surgery (Taylor and Campbell, 1999a).

Government initiatives such as the *Essence of Care* (DoH, 2001) have increased public expectations of health care. The detrimental effects of wound infection, both economically and with regard to patient morbidity, is well known. The role of decontamination as part of essential control measures is also well documented (Waller, 2002). In the theatre environment, the principles of decontamination and asepsis underpin many health and safety policies and protocols, with the aim of avoiding the introduction and spread of infection.

Staff, patients and procedures

During an operation health and safety procedures affect all those present including:

- The patient;
- The surgeon and the surgeon's assistants;
- The anaesthetist;
- Nursing staff and theatre practitioners;
- Health care assistants;
- Any visitors to the theatre such as students and medical representatives.

Special consideration must be given to patients under general anaesthetic, as they are unable to take care of their own safety needs or voice any concerns. Pressure area protection is a fundamental aspect of nursing care and particular attention should be paid to this in theatres as patients are incapable of moving at a time when additional risk factors are present (Hartley, 2003). Staff must ensure that visitors to theatres receive instruction in health and safety procedures.

During the total perioperative period health and safety procedures apply to all those who are in the theatre complex, including:

- All health care staff;
- Nurses and porters who collect and return patients to the ward;
- Administration staff;
- Sterile service unit staff;
- Domestic/housekeeping staff.

Theatre preparation

To ensure efficient and safe running of the theatre list, it should be managed by a designated person, usually the most senior. There should be sufficient staff on duty, and they should all have a clear understanding of their role in the team, based on their skills and abilities (Taylor and Campbell, 1999b).

All equipment should be tested before it is needed,

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BOX 1. STEPS TO DECONTAMINATION

- **Cleansing:** the removal of all material (soil, body tissue and body fluids) from the instrument or device. The cleansing process must precede all disinfecting and sterilisation procedures.
- **Disinfecting:** a process that eliminates many or all micro-organisms with the exception of highly resistant bacterial endospores. This process is usually accomplished using liquid chemicals or wet pasteurisation.
- **Sterilisation:** the complete elimination or destruction of all forms of microbial life. In the health care setting this is accomplished by steam under pressure, dry heat, ethylene oxide gas, gas plasma and liquid chemicals.

(Source: Alvarado 1999, cited in Miller 2002, p34)

and care should be taken with electrical equipment so that cables do not present a trip hazard or run across areas where there is a risk of fluids pooling. The heating should be set at a level that is safe and comfortable for patients and staff (Parker, 1999).

Infection control

A meticulous theatre-cleaning regime is fundamental to preventing infection. Theatres should be clean and dust free, ventilation systems must be in working order and doors must be kept closed.

All items needed for the operation should be in place and an adequate supply of regularly used items should be on hand to minimise movement to and from theatre during the operation (Taylor and Campbell, 1999b). The theatre floor should be cleaned thoroughly every day, and floors and surfaces should be damp-dusted between operations, ensuring any spillage of blood or body fluids is removed (Gould, 2001). A cleaning agent of proven activity should be used, cloths should be disposable and mop heads should be sterilised daily (Line, 2003).

Cleaning, disinfection and sterilisation

Reusable instruments should be processed according to local policy, along with theatre drapes and reusable scrub gowns. Decontamination is defined by Waller (2002) as 'the combination of processes including cleaning, disinfection and sterilisation, used to make a reusable device safe for further use on patients and handling by staff'. Miller (2002) suggests that the terms cleansing, disinfecting and sterilisation are used synonymously when they have distinct functions (Box 1).

Sterile field

This consists of the instrument trolleys, the scrub team and the draped patient. There must be a wide margin of safety marked by an invisible wall at the trolley edges,

which marks the barrier over which non-sterile items should not cross.

An aseptic technique is essential and sterile items must be received from the circulating person in a manner that does not contaminate the field. Any breaks in sterility or the sterile field should be reported immediately to the scrub person so that the contaminated item can be isolated and removed if possible (Taylor and Campbell, 1999a).

Instruments should be inspected by the scrub nurse and rejected if any visible sign of contamination remains after the sterilisation process.

The spread of resistant bacteria such as methicillin-resistant *Staphylococcus aureus* (MRSA) and conditions such as variant Creutzfeldt-Jakob disease (CJD) are well publicised by the media and are of particular concern (Waller, 2002). Patients who pose a high risk of infection should be left until the end of the case list and universal precautions strictly observed.

Protective clothing

Protective clothing protects theatre staff from potential infection from pathogenic micro-organisms and prevents clothing becoming wet or soiled (Xavier, 1999). Any person who enters a theatre should wear theatre pyjamas. Line (2003) explains that poly-cotton material allows bacteria through its weave and is easily dampened. This presents a hazard to staff and patients as body fluids can be absorbed and transferred.

The scrub practitioner wears a sterile, long-sleeved gown that is laundered after each theatre case. With the introduction of new European Union rules regarding the testing of re-usable materials it has been suggested that it will be increasingly common to use single-use gowns and drapes that are designed to resist wetting, tearing and bacterial penetration and dispersal (Line, 2003).

Footwear and gloves

Outside shoes should never be worn in theatre. The hospital should supply non-slip, anti-static theatre clogs or boots, which should be washed after each use.

Surgeons and scrub nurses who come into contact with sterile body areas wear sterile gloves (often two pairs). They should be put on according to the local scrubbing-up policy, ensuring an aseptic technique and taking care that the barrier system of gown and gloves is not broken where the two meet (Line, 2003; Parker, 1999).

Although wearing gloves does not prevent accidental needlestick injuries, the DoH (1998b) suggests that they help reduce the volume of blood to which the wearer is exposed. Clean gloves should be put on by circulating staff before touching patients or any equipment, specimens, or drapes that could be contaminated.

Nurses must wash their hands after wearing gloves as bacterial growth increases in the moisture that accumulates under them (Xavier, 1999). Concern has been raised over sensitivity to latex, therefore gloves should be worn only when necessary and removed immediately after completion of the task (Perry and Barnett, 1998).

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This article has been double-blind peer-reviewed.

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Theatre hats and masks

Theatre hats are worn routinely, and prevent loose hair and skin from falling on wounds or equipment (Parker, 1999). They are only fully effective if they cover the scalp and also the forehead if the wearer has a fringe.

The surgical mask was introduced over a century ago. Its continued use is controversial as evidence is not conclusive that wearing a mask reduces postoperative infection. Wearing a mask, however, does protect the practitioner from contact with body fluids (Parker, 1999).

When removed, care should be taken to handle masks by the strings so as not to contaminate the hands with any biological matter and they should be disposed of immediately (Perry and Barnett, 1998).

Sharps, swabs and instruments

It is recommended that counts of swabs, instruments (including scratchpads and diathermy tips), and sharps (needles and blades) should be undertaken at strategic points during an operation. This is to ensure no foreign body remains in a patient after closure of a wound (National Association of Theatre Nurses, 1998).

The scrub practitioner is responsible for counting all items used in an operation before incision, at first layer closure, and at skin closure. It is also standard practice to give a verbal report to the surgeon at the end of the procedure to the effect that all sharps, swabs, and instruments are correct (Pirie, 2004).

The count requires full concentration, should be audible, and should be carried out by two people, one of whom must be qualified. Both people should sign the theatre register.

The initial count should be recorded before the operation begins and any items that are added during the course of the operation should be recorded by the circulating nurse. All items counted during the course of the operation should be recorded clearly on a dry-wipe board. Items removed from the sterile field should be visibly deleted with a scoring line or cross (Pirie, 2004; Taylor and Campbell, 1999a).

Each swab counted must be checked to ensure its radiopaque strip is intact. This is because, in the event of a lost swab (or sharp, or instrument), the surgeon might request an X-ray to ensure that it has not been left in the patient. Any item deliberately left inside the patient should be clearly documented in the patient's notes.

Every sharp object in a theatre should be regarded as a potential source of injury. Accepted practices in the handling of sharps should be adhered to, for example avoiding manual re-sheathing of needles, and disposing of sharps in containers that comply with the British Standard 7320.

Needles, blades or instruments should never be passed directly hand to hand, but should be passed via a 'neutral zone', for example a receiver (Perry and Barnett, 1998). Needles and blades should be mounted for use using the correct instrument, never the fingers. Any sharps injury should be managed and reported to occupational health according to local policy.

BOX 2. CASE STUDY: HAZARDOUS WASTE

During the course of an operation, a porter in the back ('dirty') corridor attracted the attention of a circulating nurse to come to the waste disposal hatch.

He explained that he was new to the job, and though he was not squeamish he did not want to move a yellow sack as there was blood all over the floor beneath it and he was not sure what he should do.

On inspection the nurse realised that a suction bottle had inadvertently been packed before it had solidified, and despite being double-bagged it had leaked substantially.

She thanked the porter and told him he had done the right thing. It was not a matter of being squeamish. He should treat any blood as a potential source of infection to himself and to others.

Recognising her duty of care, and suitably protected with gloves and apron, the nurse re-bagged the waste for safe disposal and mopped the floor with a suitable cleaning fluid.

Specialist equipment

Electrosurgery (diathermy)

Electrosurgical (diathermy) devices use high frequency electrical current to generate heat, which can cut and coagulate body tissue (Brown, 2000). Diathermy may be used in either monopolar or bipolar mode. The patient's skin should be evaluated before and after diathermy use. Correct use of equipment will ensure that skin integrity remains intact. The patient should not be in contact with grounded metal objects as the provision of an alternative pathway for the electrical current could result in a burn. Any metal parts of the operating table that could come into contact with the patient should therefore be padded and jewellery and piercings should be removed before arrival in theatre.

Monopolar mode

In monopolar mode the electrical current flows from the generator in the electrosurgery apparatus to an active electrode, which is the surgeon's tool. The current continues through the patient to an adhesive dispersive plate (the return electrode) that is placed appropriately on the patient's body so that it is 'earthed' safely back to the electrosurgery unit, thereby preventing an electrical burn. The return electrode should be placed over a vascular, muscular area to promote electrical conductivity and to dissipate heat.

Shaving may be necessary as hair at the dispersive site prevents complete plate contact with skin. The plate should not be placed over bony prominences (this can impede return current), over implanted prostheses (there is a potential for overheating), over scar tissue or over areas distal to tourniquets where adequate tissue perfusion cannot be guaranteed.

Bipolar mode

In bipolar mode both active and return electrodes are combined within the same instrument. One prong of the bipolar forceps is active and the other is the return electrode. This system is safer because the patient does not form part of the electrical circuit and therefore a dispersive plate is not required. If the patient has a pacemaker, this is the system of choice to avoid a monopolar current passing through the heart. However, the low power, low voltage waveform used with this system means it is usually incapable of cutting (Wicker, 2000).

Laser surgery

'Laser' is an acronym for 'light amplification by the stimulated emission of radiation'. There are several hazards regarding the use of lasers in surgery. Transmitted directly or reflected into the eye, laser light can potentially burn the retina causing a permanent blind spot. If it hits the head of the optic nerve it may cause partial or total blindness. Since the beam is virtually non-divergent, increasing the distance from the laser confers little safety benefit.

Infrared laser light is perhaps more dangerous because it cannot be seen. The cornea, lens, and aqueous and vitreous humours should be considered risk areas.

If the skin is exposed to laser radiation it can cause a burning sensation. Skin of sedated or anaesthetised patients must be shielded. When lasers are in use theatre staff should wear eye protection, doors should be locked and windows covered to protect those outside the theatre (Kitching and Edge, 2003).

X-rays

Precautions should be taken to protect theatre personnel from the damaging effects of exposure to ionising radiation, which are well understood compared with other occupational risks. In accordance with the Ionising Radiation Regulations 1999, staff who work with ionising radiation should limit exposure to no more than is reasonably necessary, and should exercise reasonable care while carrying out such work.

Every employee who works with ionising radiation should make full and proper use of the protective equipment provided. The number of people present in theatre should be limited to those necessary for the procedure and those present must wear lead aprons. It is advisable for pregnant women to avoid X-rays because radiation may cause foetal abnormalities (Smith, 2000).

Hazards from volatile liquids or gases

Theatre ventilation systems help to extract toxic gases that could lead to fatigue, nausea, headaches and may play a part in a range of health problems including renal, hepatic, and neural diseases (Pressly, 2000). Therefore any system-failure warning lights should be reported, investigated and rectified promptly.

Parker (1999) states that the minimum requirement for air changes is 20 per hour in the actual operating room and the sterile supplies room. The smoke produced

when electrosurgical devices are used contains toxic substances that present biological and chemical hazards, so extraction systems should be used during procedures involving diathermy (Wicker, 2000).

It is advisable to avoid the use of flammable solutions with diathermy as there is the risk of ignition. Methyl methacrylate is a volatile flammable liquid used in orthopaedic surgery to make bone cement. The vapour given off on mixing may cause irritation of the eyes and the respiratory passages or a general feeling of ill health. Anyone affected should leave the theatre immediately. Soft contact lenses should be removed when methyl methacrylate is being mixed as they are permeable to irritant vapours.

Inhalation anaesthetics may be gases or volatile liquids and require suitable equipment for storage and administration. Gas cylinders used in theatre must be clearly labelled with the name or chemical symbol of the gas on the shoulder of the cylinder and the valve. They should be stored in a cool, well-ventilated room, free from flammable materials. No lubricant of any description should be used on the cylinder valves.

Nitrous oxide, used in anaesthesia, can be dangerous to both patient and staff if used for a prolonged period in an inadequately ventilated space. Side-effects can include megaloblastic anaemia and the depression of white cell formation (British Medical Association, 2000).

Waste disposal

Parker (1999) explains that theatre design should incorporate a sequence of clean zones from the entrance to the operating area, to allow easy movement of staff from one clean area to another.

Conversely, waste and contaminated items should be removed through 'dirty' areas without passing through clean areas. Body fluids collected in suction bottles should be treated with a gelling agent and allowed to solidify before being double-wrapped to prevent leakage (see case study, Box 2), as should waste tissue and bone fragments. All clinical waste (placed in yellow bags) should be labelled with the date, theatre number and case number to allow traceability.

From an environmental point of view, machines are now available that use microwaves to make used materials safe for disposal in landfill sites. Normal rubbish should be placed in black bags and disposed of in landfill sites to avoid incineration and minimise air pollution.

Conclusion

There are many potential health and safety hazards in theatres. Nurses have a professional and legal obligation to follow appropriate policies and procedures to protect themselves, colleagues and the local community. Each person, regardless of status, should take responsibility for health and safety precautions. New staff and visitors must be informed of special practices. At the centre of theatre practice is an anaesthetised person whose exposure to risks should be minimised to maximise his or her chance of a positive outcome following surgery. ■

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