Infection control in theatre

“*The germ is nothing, the terrain is everything.*” - Louis Pasteur 1895

**Introduction**

Our primary role as anaesthesiologists is to give effective and safe anaesthetics. The anaesthetic mortality rates have decreased from approximately seven per 100 anaesthetics administered in the early part of the last century, to two deaths per 10 000 in the 1980s, to about one death per 200 000-300 000 today. A single anaesthetist would have to give anaesthetics for a very long time to make a difference either way.

So the question is: how can we make an immediate real difference in our daily work? Safety is not only mortality, but includes morbidity and the exclusion of as many adverse advents as possible. Adverse advents during surgery occur in 3-23% of patients, depending on which studies you look at. The distinction between anaesthetic and surgical adverse events has become blurred and a great deal of what we do impacts on the outcome of the surgery. In a massive audit in Australia (Int J Qual Health Care, 2002), 22% of all surgical admissions had an adverse event, 48% which were preventable.

Remember that an adverse event is one that is caused by the health care management, rather than the disease process. Many of these adverse events included hospital-acquired infection and sepsis, many of which occurred in theatre. Depending on the type of surgery, between 1-10% of all surgical patients will develop a surgical site infection (SSI).

This talk will highlight the problem of infection in theatre and what we, as gatekeepers, can do to decrease this problem. This topic has become very topical and many editorials of late have covered it. This needs to be addressed by us now.

If not now, then when? If not you, then who?

**The decisive period concept**

All wounds will become contaminated. No operation site is 100% sterile. Infection establishes itself within two hours of contamination. This two-hour period is the decisive period. We need to support conditions that modify and prevent this transformation from contamination to infection.

**Surgical site infection**

An SSI is defined as an infection occurring within 30 days of surgery, or within one year of an implant. Think about this. We are grossly outnumbered. Each of us consists of 10 trillion human cells accompanied by our own microbiome of 100 trillion microorganisms that lives symbiotically inside our body.

Despite this 10:1 inequity we survive. How? This is because of an intact immune system and the integrity of our skin and mucous membranes. These microorganisms are organised as biofilms, impressively structured within three-dimensional matrices.

Surgical operations disrupt this balance and can cause serious SSI. There are probably 100 000 different bacteria species in our body, only 0.1% of which are culturable. Bacteria can multiply every 20 minutes. The enormity of the problem is clear. Antibiotics will not solve the problem. A holistic approach is required.
History

A short history lesson:

• 1847 - Ignac Semmelweis experienced a 20% maternal mortality in his hospital in Vienna, caused by puerperal sepsis secondary to streptococcal infection. The maternal mortality at home was 1%. He concluded that doctors themselves were transmitting the diseases between patients and he mandated that they wash their hands with a nail brush and chlorine (HTH). Infection fell to 1%. However, elsewhere doctors’ practices didn’t change. It was inconceivable to imagine that doctors were killing patients. It was proposed that vapours were responsible. Instead of being acclaimed, Semmelweis was dismissed from his job and eventually died in a lunatic asylum. Have we progressed that much?

• 1856 - Florence Nightingale brought mortality down dramatically during the Crimean War just by instituting basic hygiene like ventilation, improved sewers and antisepsis.

• 1862 - Louis Pasteur proposed the first germ (bug) theory.

• 1867 - Joseph Lister proposed the routine use of the antiseptic carbolic acid (phenol) in The Lancet.

• 1928 - Alexander Fleming discovered penicillin.

• 2006 - Peter Pronovost, a Johns Hopkins doctor, proposed a five-point checklist protocol (NEJM, 2006) that greatly reduced infections (by 66%) when inserting a CVP. In recognition of this, he was elected as one of Time magazine’s top 100 people of the year in 2008.

• 2011 - What legacy will we leave?

Why should we care about SSIs? There are six reasons:

1. The statistics of the problem

There are two million hospital infections per year in the USA, as a result of which 90 000 patients will die.

Four per cent of central lines become infected and between 5–35% of these patients die. The incidence of ventilator-associated pneumonia is 6% after 10 days on the ventilator; up to 40% will die. With urinary catheters, 4% become infected after 10 days. The incidence of surgical wound infection for all operations is 1-3%, and 10% for colon and bariatric surgery. Hospital mortality is more than double for any patient who becomes infected and the length of stay is almost three times as long, at great expense to all.

2. Financial implications

Incentives are being put forward in surgical procedures if targets are met. The Pay For Performance (P4P) is now in operation in several countries. As a motivation, if the antibiotic is given timeously, and a warm patient is bought back to PACU or is normoglycaemic at the end of the operation, then financial rewards are paid out.

Disincentives are also now in operation. Medical aids in South Africa are refusing to reimburse for iatrogenic hospital-acquired infections. Websites overseas now publish hospital infection rates and compliance rates for public viewing.

3. Health care workers. You’re being watched!

Patients and relatives are now educated to look out for transgressions. The following four paragraphs target patients and relatives, and are freely available on internet sites:

• “Make sure that all doctors and nurses wash their hands with soap and water, followed by an alcohol-based rub before and after caring for you.” (CDC and Joint Commission Site).

• “Speak up if someone tries to shave you before surgery. Ask why you need to be shaved? Why not clipped?” (5 million lives campaign site).

• Even family members can ask questions. “Family members should ask about raising the head of the bed in ICU to prevent VAP.” (CDC and Joint Commission site).

• “Ask if you will get an antibiotic. Most patients are on one only for a short time.” (5 million lives).

4. Solutions are readily available with good outcomes that cost almost nothing

Over 60% of SSIs are preventable. This information will be presented.

5. Evidence-based medicine is available for numerous interventions that prevent SSI

This will be deliberated.

6. Preantibiotic era

We are moving steadily towards a pre-antibiotic era as each year, more and more microbes become resistant to our dwindling source of antibiotics. No new antibiotics are being developed. Antibiotic stewardship is the last option. The only feasible
solution is implementation of basic infection prevention methods. These will be debated.

We can do the following to decrease SSI:

1. **Blood transfusions**

Blood transfusion, and especially transfusion after prolonged storage, provokes a non-specific inflammatory response, which may divert the immune system from a more appropriate focus - the real threat posed by bacterial contamination. A limited supply of “good killer cells” has to deal with old dead white cells rather than mop up bacterial. Transfusion-associated immunosuppression persists for weeks after discharge, making the patient susceptible to infection. This is mediated via the T and B cell functions. You will remember that kidney recipients who received pre-transplantation transfusions had better graft survival due to immunosuppression from the blood.

**Suggestions**

- Minimise erythrocyte transfusion.
- Transfuse blood less than two weeks old.
- Use leucocyte-depleted blood or filters.

2. **Glucose control**

Good perioperative glucose control is an independent risk factor that decreases SSI. Tight control improves the immunity of the body and decreases the inflammatory response. C-reactive protein concentration decreases with intensive insulin therapy. In the ICU, tight glucose control was shown to decrease mortality by 40% and the length of stay by 55%.

**Suggestions**

- Good glucose control perioperatively in all patients.
- Aim for a level between 7-10 mmol/l.
- Have a glucometer readily available and measure often in lengthy cases and for diabetics.
- Use a balanced salt solution. It is not necessary to give every patient a glucose infusion.

3. **Temperature**

Mild hypothermia (2 °C) triples the risk for wound infection and prolongs hospitalisation by 20%. Hypothermia triggers thermoregulatory vasoconstriction causing decreased oxygen tissue tension with a detrimental effect on the neutrophils, which are then unable to perform their function. Leucocyte superoxide production is impaired. Hypothermia also directly impairs the immune system. Hypothermia increases bleeding and transfusion requirements which in themselves support SSI.

**Suggestions**

- Maintain normothermia. Keep the core temperature amongst surgical patients between 36-38 °C.
- Think about using warm forced air in any procedure lasting more than one hour. Cover the patient with a passive insulator, such as a space blanket, plastic bag or even a sheet, as soon and for as long as possible, while covering as much surface area as possible. Adding a second layer reduces heat loss from 30% to 50%.
- Have a working thermometer in your theatre and measure the temperature of all your patients arriving in the PACU who have had lengthy surgery. Buy a portable electronic oral thermometer for easy accurate use.
- Keep the theatre temperature between 18-22 °C. Don't allow the theatre to become excessively cold overnight.
- Use preoperative warming to decrease the gradient fall following induction. One can have a hot shower or bath 10 minutes preoperatively, use warm forced air in the waiting room for major cases and warm all fluids used, such as intravenous and intraperitoneal.
- Neonates and infants obviously require special precautions.

4. **Smoking**

Smoking decreases tissue oxygenation from 65 mmHg to 44 mmHg in a “pack a day” smoker who is therefore relatively hypoxic most of the time. At this level, the incidence of SSI increases threefold. However, in more recent studies, the association is not as marked because smoking is now more difficult in the decisive period with the new smoking regulations. We all know that sometimes we cannot find the patient for a premed visit, as they are “outside smoking”.

**Suggestions**

- Encourage and educate all smokers about the decisive period and the risks to which they expose themselves.
- Consider giving the patient supplemental oxygen for a few hours, especially if the patient has undergone bowel surgery, as studies have identified these patients as high risk.
5. **Hair removal**

The use of a razor for hair removal when compared with a clipper results in a threefold increase in SSI. Razors cause dermal pits and hair follicles are exposed, resulting in folliculitis within one hour. Clippers have shown the best results, as depilatory creams can cause skin reactions.

**Suggestions**
- Use clippers and never razors. Remove razors from the hospital.
- Educate the patient not to self-shave.
- Ideally, no hair removal is optimal. If necessary, use clippers within two hours of surgery, followed by an antiseptic shower. Clipping should ideally not be done in theatre, as it contaminates the area. Clip only 5 cm around the incision.
- Clippers: Use disposable heads, in service for staff. Posters and stock should be maintained by a responsible staff member, otherwise they get misplaced.
- Educate surgical colleagues. This is most difficult. So rather clip the patient yourself.

6. **Antibiotic prophylaxis**

Given correctly in the decisive period preoperatively, antibiotics decrease SSI by 25%. Up to 40% of antibiotics are unfortunately given incorrectly in theatre, and many incentives and disincentives are used to try and improve compliance. *Staphylococcus aureus* is responsible in 55% of all SSI, and of these, half are MRSA.

**Suggestions**
- When appropriate, give the antibiotic one hour before incision time. Use a checklist to remind yourself. This improves compliance by up to 91%. Suggest a single dose, otherwise discontinue after 24 hours in cardiac, thoracic, orthopaedic and vascular surgical cases. Have a hospital protocol (antibiotic stewardship) to ensure best practice. This is becoming more important.
- Adjust the dose for obese patients, lengthy surgery, or where large blood volume changes occur.
- Start vancomycin two hours preoperatively as it requires longer infusion time.
- Caesarean sections. The recommendation is that the antibiotic be given prior to the first incision, rather than after the cord clamping.
- Tourniquet use: It is recommended that antibiotic prophylaxis be completed 30-60 minutes before inflation.

7. **Supplemental oxygen**

Supplemental oxygen has the potential to enhance host defenses against bacteria by augmenting tissue oxygenation to supernormal partial pressures. The primary defense against surgical pathogens is oxidative killing by neutrophils (90% of all host defenses for bacteria). This process is oxygen dependent, where molecular oxygen is transformed into superoxide and other high energy radicals. Neutrophils first phagocytise and then kill bacteria. Killing is dependent on the amount of oxygen over the entire physiological range.

Increasing the fraction of inspired oxygen from 30% to 80% doubles the tissue oxygenation from 60-110 mmHg without causing atelectasis. Several studies have shown that the risk of wound infection was halved. Oxygen was as effective as giving antibiotics. In some centres this is still a controversial issue.

**Suggestions**
- Increase inspired oxygenation in the surgical patient, especially those at high risk of SSI. Give 80% oxygen intraoperatively.
- Give vital capacity breaths as needed plus PEEP intraoperatively if the saturation falls below 98%.
- Give 40-80% oxygen in the postoperative period with CPAP if necessary if the saturations fall below 98% in high-risk patients.

8. **Antiseptic choice**

The skin is a major source of pathogens causing SSI. Several studies have shown that a chlorhexidine-alcohol scrub is superior to cleaning with povidone iodine (Betadine®) for preventing SSI. It has been shown to be nearly twice as effective. Fire hazards, although very small, are a potential problem with an alcohol-based solution. Iodine takes several minutes to work and its action is inhibited by organic compounds such as blood and pus. Chlorhexidine-alcohol solutions work almost instantly by altering the cell wall permeability, resulting in apoptosis and cell death of the bacteria. It also has an extended duration of action and is not affected by organic compounds.

**Suggestions**
- Two per cent chlorhexidine and 70% isopropyl alcohol should be the antiseptic of choice in hand washing, hand sprays, surgical skin preparations and for central line antisepsis.
• Avoid pooling around the patient and allow the chlorhexidine solution to dry for two minutes to avoid fire hazards.
• Possibly avoid in real emergencies where time is precious.

9. Checklists

The use of checklists in several studies has been associated with a substantial reduction in morbidity and mortality involving infection. Checklists provide a visual image of intended actions. They are best when short and uncluttered. The aviation industry has successfully used checklists for years, however doctors feel they are generally above the use of this aid. Fortunately, this is changing with impressive results and improved patient safety.

Here are three examples:

a) Peter Provonost, a Johns Hopkins intensivist, published an article in 2006 in the NEJM recommending five basic hygienic steps when inserting a central line. This is called a “bundle” and the power of the bundle brings together scientifically grounded concepts that, when all performed together, improve the clinical outcome. This resulted in a large and sustained reduction of up to a 66% in rates of catheter-related bloodstream infection. Up to 35% of these patients may have died.

b) A surgical theatre checklist based on the World Health Organization (WHO) was subjected to a study in the NEJM in 2008. Several perioperative steps were suggested, including sterility and the administration of antibiotics. The rate of death of these surgical patients was nearly halved and the inpatient complications decreased from 11% to 7%. This checklist has now been introduced into many theatres around the world. Sadly, this is not actively used in South Africa.

c) A poster entitled CATS (C = Clippers, A = Antibiotics, T = Temperature, S = Sugar) is used in theatre as a reminder of how to decrease SSIs.

Several other checklists are now used in the hospital for numerous activities. The average person makes seven to eight mistakes a day, some of which verge on being faults resulting in increased morbidity and mortality. The average ICU patient is subjected to 178 interventions a day. Checklists aid nursing care. Consider FASTHUG.

Checklists help cope with stress, fatigue, illness, interruptions, new situations and productive pressures. Checklists should be neither a “straight jacket” concern, nor “magic bullet” thinking. They are a necessary disruptive innovation that should improve safety if introduced in the right frame of mind.

Suggestions

• Be open to the use of simple checklists that have a proven track record.
• Empower the nurse to monitor these checklists. Have a culture of communication and tolerance. If hands are not washed, rather than say: “Wash your hands!”, say: “Is there any reason why you cannot wash your hands?”
• Use this talk as a checklist to decrease SSI.

10. Neuraxial anaesthesia

There is compelling epidemiological evidence that neuraxial anaesthesia reduces the risk of SSI. In a 2010 article published in Anaesthesiology, studies supported the use of this form of anaesthesia as a preventive approach to SSI. Certainly the 50% reduction in the report is of considerable importance.

There are three proposed potential mechanisms:

a) Decreased inflammatory response from surgery, allowing the immune response to focus better on the critical task of fighting bacteria.

b) Increased vasodilation and improved tissue oxygenation, resulting in better oxidative killing by neutrophils.

c) Improved postoperative analgesia, resulting in less of an autonomic response, which in turn would cause less vasoconstriction and improved peripheral perfusion and less SSI.

Suggestions

• Aim for a stress-free anaesthetic that will decrease SSI. This is best achieved by using a neuraxial anaesthetic solely, or combined with a general anaesthetic.
• The use of an epidural infusion for 48 hours will carry over into the post-operative period with a better chance of affecting SSI.

11. Modify the environment

Create a culture and an environment where health care workers strive for excellence in performance and safety.
Suggestions

- Air quality. The air conditioning should meet basic safety standards, for example 20 air changes per hour, the temperature should be between 18-22 °C and adherence is necessary to correct MERV standards. (minimum efficiency rating values). This needs to be followed up on a regular basis. A backup generator and uninterrupted power supply for power failures should be in place. Several reports exist where SSI occurred during power failures with a resultant law suit.
- Maintain positive-pressure ventilation in the theatre.
- Keep theatre traffic to a minimum - both numbers and theatre movement. Many theatre complexes “lock” the doors and only open for emergencies, while surgery is in progress.
- Strictly perform theatre surgical scrub and gowning as per protocol. Hand washing is the single most important thing we can do to reduce SSI. Checks and protocols are needed to ensure that this is always carried out properly. The Hawthorne effect applies here – the knowledge of being observed doubles the compliance with hand washing.
- Protect the wound with a sterile dressing for the first 24-48 hours.
- Remove invasive devices as soon as possible. For example, if the CVP or urinary catheter is no longer appropriate because the operation format changed, remove them in the PACU rather than casually leaving them in for a few days.
- Have boxes of gloves and hand antiseptic gel readily available in several places in theatre for easy access (large, medium and small gloves). It is estimated that less than 50% of healthcare workers wash their hands between cases for the average case. Only touch the patient with gloves on and always wash/gel hands between cases. Most importantly, the gel dispenser should be of the type that does not require to be held, otherwise cross infection occurs from the previous user.
- Practice universal precautions. Infection is a two-way street and healthcare workers must protect themselves.
- Staff with dermatitis or skin abrasions should take appropriate measures.
- Use appropriate filters on circuits (all patients), ventilators, fluids and bag-mask ventilation to prevent cross infection. Too often the same ambubag without a filter is used on different patients.
- Used bed linen should be handled with care.
- Schedule “dirty” cases last on the list to minimise risk. Where this is not possible, it is advised that a ventilated operating theatre should require a minimum of 15 minutes before proceeding to the next case.

12. Personal protective equipment (PPE)

What is worn is fairly controversial and compliance with the code of each theatre complex is essential. Here are some guidelines:

Suggestions

Theatre caps

Theatre staff usually wear disposable headgear, although there is little evidence for this practice, except scrub staff in close proximity to the operating field. The suggestion is that their general use should still be adhered to.

Theatre suits and gowns

The skin of staff working in the operating theatre is a major source of bacteria. Clean suits should be worn by everyone. Sterile procedures require full sterile gear. If contamination is likely, wear a plastic apron. Contaminated clothing should be changed at the earliest opportunity. There is no evidence to show that wearing surgical attire outside of theatre and returning to the theatre without changing increases SSI. Usually, a coat or overgown is worn.

Shoes and overshoes

Special footwear should be worn in the theatre and cleaned if contaminated. Overshoes should be discouraged because hands become contaminated when the overshoes are put on or removed.

Face masks

The use of face masks to decrease SSI has been questioned. However, masks with a face shield should be worn when there is risk of body fluid splash into the face. Masks must be worn by anaesthetists during sterile procedures. Masks can be worn to protect the anaesthetist from inhaling infected droplets, which is more relevant during coughing at intubation and extubation. PACU nurses should always wear gloves and masks when necessary.

In summary, wear masks when near a sterile site, or when protection is need. Adhere to local theatre policy. Wear N-95 masks when tending high-risk tuberculosis patients and also on the premed round. Encourage patients to wear one.
Gloves

The use of sterile and unsterile gloves in appropriate situations is encouraged. It has been demonstrated that 98% of anaesthetists’ contact with patients’ blood could be prevented by routine use of gloves. It is estimated that less than half of anaesthetists wear gloves when working routinely with patients! This sends a poor message to the anaesthetic nursing assistants.

13. Contamination of drugs

This problem is easily overlooked. Avoid multidose ampoules or vials, as there are a number of reported articles highlighting this problem. These include heparin, ketamine, contrast solutions and insulin. Propofol sharing and storage overnight is also discouraged. Beware when sharing a mixed solution of phenylephrine, ephedrine or saline flush. Contamination cases have been reported in all of these.

Suggestion

- Never share!

14. Anaesthetic equipment and infection control

Items of anaesthetic equipment may become contaminated either by direct contact with the patient, or indirectly via splashing, by secretions, or from handling by staff. Decontamination or single-use disposable equipment should follow a strict and safe code of practice. Nominate a staff member in theatre to oversee this.

Suggestions

- Masks (if not disposable), McGill forceps and laryngoscope blades should all be washed with soap and water and then soaked for at least 10 minutes in an appropriate antiseptic solution, such as hydrogen peroxide (Biocide®).
- Do not forget to decontaminate the catheter mount and angle piece between cases if not disposable.
- Anaesthetic breathing systems should have a new filter for each case and should be changed/cleaned daily.
- Anaesthetic machines and work surfaces should be wiped down with antiseptic solutions.
- All other equipment like BP cuffs and pulse oximeters must be kept antiseptically clean.
- All filters that become moist will allow the passage of microorganisms to pass across them (so change early).

Take time between cases if necessary. Rushing and having a fantastic turnover of five minutes following a septic case serves no function if the subsequent patient develops an SSI and spends the next 10 weeks in hospital. Follow recommended published guidelines.

15. Patients and infection control

Some contributing factors are modifiable and other non-modifiable. They include the bacterial load, the virulence of the microbes and the host resistance.

Suggested patients at risk:

- ASA classification greater than 2.
- Obesity, diabetics, AIDS and chemotherapy patients.
- Steroid use.
- Alcohol abuse.
- Malnutrition and poor hydration. Optimise feeding and give intravenous fluids if necessary.
- Shower or bath patients in an antiseptic solution preoperatively and use intranasal mupirocin (Bactroban®).
- Possible screening of patients for Staphylococcus infection.
- Optimise the health of your patient to the best of your ability. Get the patient to the preanaesthetic clinic as early as possible so that time and effort can be spent on the patient.

16. The surgeon

The surgeon plays a role in SSI. The following factors influence outcome:

- Duration of surgery.
- Pre-operation wound contamination: The wound needs to be methodically and thoroughly cleaned and scrubbed before the scrub sister approaches the patients. This dramatically decreases the bacterial load.
- The microenvironmental changes at the surgical site are often determined by what the surgeon does, or does not do. These changes can promote infection. Poor haemostasis produces haematoma and a haemoglobin-rich nutrient for microbial proliferation. Electrocautery, braided sutures and dead space (obesity and lack of drainage) lead to ineffective or no phagocytosis. Phagocytic cells must have a tissue surface upon which to migrate and phagocyte bacteria.
- Clearly surgical techniques play a massive role. Anything that anaesthesiologists can do to contribute to correct surgical technique...
will influence the incidence of SSI. Safe hypotension will decrease the length of surgery, and it's acceptable to move the light if it helps the surgeon to find that bleeder!

17. Others

Syringe sharing is a real hazard and several articles have been published describing this problem. Claude reports that 3.3% of syringes became contaminated when used at the injection site closest to the intravenous cannulae.

Laryngoscope handles are often neglected between cases. Wipe with an antiseptic solution.

Needleless connectors and stopcocks harbour infected material and should be wiped with an alcohol swap if the patient arrives with one in situ.

Computer keyboards, iPods, cellphones, personal bags and stethoscopes all transmit bacteria and need to be continually cleaned. A stethoscope on a sweaty chest in the waiting room will be a perfect way to infect your next hip replacement.

While working in New Zealand, the author was exposed to a novel way of decreasing infection from cellphones. Anaesthesiologists answering surgeons’ cellphones is not deemed acceptable. In Whangerei, no cellphones were allowed in theatre. They were dropped off in clear bags at reception, marked with the doctor’s name. If the phone rang, one of two receptionists would answer and a message would only be sent through if it was really urgent. Messages were available to the staff at the end of each case. Hands-free sets are encouraged.

Sterile water and saline plastic ampoules that are joined often have small breaks and leaks from previous “openings” that promote cross-infection. They then sit in the anaesthetic trolley for days and possibly incubate bacterial growth. One solution is to get the pharmacy to break them up in a controlled manner beforehand.

Check where the patient is going postoperatively, as the ward/ICU often have their own protocol and brand of infusion pumps, and the first thing that happens on returning to their unit is that the whole infusion set is changed. The anesthesiologist’s sterile dressing is broached, with a possible source for infection.

An editorial article in *Anaesthesia and Analgesia* (January 2011) points the spotlight directly at us! It is entitled “Surgical site infections and the anesthesia professionals’ microbiome: we’ve all been slimed. Now what are we going to do about it?” In essence, it suggests we are walking microbiomes who are organised as biofilms (slime) and a ready source of infection. The article questions our hand-washing behaviour, whether we should be routinely swabbed and if all phones, bags and coats should be banned from theatre.

Have we reached a plateau in our attempts to reduce SSI through antibiotics and sterilisation? If so, then one of the remaining targets is the anaesthetic provider. Yes, you and me! Have we become the “Typhoid Marys” of this century?

I hope my surgeon never sees this article, otherwise besides being told that my patient is awake and moving, I will be blamed for any micro-boil that develops!

Finally, these 17 interventions and checklists should be audited on a regular basis for compliance and patient outcome. Feedback with improved patient safety should follow.

**Summary**

In summary, the following simple inexpensive actions would go a long way to decreasing SSI and ensuring a safer anaesthetic:

1. Careful use of blood transfusions.
2. Good perioperative glucose control.
3. Aim for normothermia.
4. Smoking education.
5. Only clippers for hair removal.
6. Appropriate antibiotic prophylaxis.
7. Give supplemental oxygen.
9. Use checklists.
10. Use more neuraxial anaesthesia.
11. Modify your environment in theatre optimally, and wash hands often.
12. Use personal protective equipment correctly.
13. Avoid contamination of drugs.
14. Decontaminate anaesthetic equipment.
15. Optimise surgical working conditions.
16. Adequate patient and infection control.
17. Attend to the little things in theatre as they all make a big difference.

Just imagine if we could regularly carry out these 17 steps together to create a “South African Super-Infection Bundle.” We would have the best postoperative infection statistics in the world!

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Bibliography

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