Guidelines for the Prevention of Prosthetic Joint Infection

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Foreword

Prosthetic joint surgeries have become very commonplace and will continue to increase as the aging population expands. Each year approximately 250 are performed at the University Malaya Medical Centre and 17000 nationwide. A successful arthroplasty can significantly alter an individual's quality of life. Conversely complications can result in repeated surgeries, revision and increased mortality. One of the most feared complications is that of infection. Identifying factors and addressing those that increase the risk for infection pre-, peri- and post-operatively is therefore essential.

This handbook sets out to provide a practical guide to medical officers and orthopaedic trainees in the peri- and post-operative management of arthroplasty. The guidelines contained within this book is to assist medical officers and orthopaedic trainees become proficient in identifying conditions that may put a patient at risk of prosthetic joint infections. It also includes recommendations based on the best available evidence and international guidelines to prevent and manage these conditions. The authors must be commended for their efforts in putting together a practical, concise and easy to read book which we are confident will become a very important and useful resource for all.

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Preface

*This is a well-done complete guide for you on infection. You should know it by heart!*

My personal guides for infection are as follows:

**PREVENTION:**

The Surgeon is foremost. He/she must understand whether the patient is an A, B, or C.

A C patient has a poor immune system and you need to help them with antibiotic cement, Rifampin antibiotic in irrigation, and IV antibiotics for 48 hours – the nadir of the immune system after surgery is 48 hours. Give them oral antibiotics for three weeks. Second, the surgery itself must be efficient in both performance and time. Certainly, surgery beyond 2 hours increases risk; if necrotic tissue is left in the wound the risk is increased; and closure must be meticulous because prolonged drainage is the number one cause of infection. Obesity has a higher rate of infection because of drainage – these patients need two levels of closure of the fat layer. Obese patients need a compression wrap with 8-inch bias over thick dressing that is wrapped around thigh and waist (to keep wrap from migrating distally).

For every patient put half strength povidone-iodine into the wound before tying the last fascial suture to confirm tight fascial closure and leave povidone-iodine in the wound (fascial defects are the most common cause of prolonged drainage). For bloody cases, and all revisions, leave a drain in place until the hemovac collection is < 50 cc. If a wound drains (not spotting) for five days it must be reopened and hematoma drained and necrotic tissue debrided, and tight closure done. After reoperation, the IV antibiotics should continue until culture results available, and if a positive culture is present, we use IV antibiotics for 3 weeks.
TREATMENT:

Again, the surgeon is foremost! Surgery must be aggressive and remove ALL indurated and oedematous tissue. For a hip I only keep the gluteus medius, and for a knee I only keep the extensor mechanism. If there is an abundance of infected tissue and return for a second debridement in two days. The wound is always closed with through and through wires – I do not leave sutures in the wound. I favour single stage revisions except in Type C patients who need 2 stages. I use oral antibiotics for 3 months after completion of IV antibiotics. The use of povidone-iodine with closure, and approach to maintenance of a hemovac as well as to drainage is the same as above. If the patient goes home, the status of the wound and drainage can be done by pictures taken by cell phone and sent.

In closure, understand that you will get infections, and it is critical for the patient you do not put your head in the sand but be a decisive and aggressive surgeon. When you cure an infection that patient will be loyal to you for life because they know they are in trouble, and they know who saved them.

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Figure 1. Balancing systems and individual accountability in a safety culture. Re-printed with permission from Professor Gerald B. Hickson, Vanderbilt University Medical Center (1).
1.0 Introduction

The primary goal of joint replacement is to improve an individual's quality of life. A successful surgery translates to a happy, mobile and grateful patient. In contrast, its nemesis, infection, is the bane of both surgeon and patient. A periprosthetic joint infection (PJI) subjects the patient to anguish, high financial costs, prolonged hospitalization, repeated surgeries and, even if successfully salvaged, poorer outcome. This taxes our resources for operating time, puts our patients at risk and reminds us that we need to keep vigilant with our practice. It is obvious that the often-quoted adage, prevention is better than cure applies in all of medicine but in arthroplasty this is particularly poignant. It is everyone’s responsibility to prevent a PJI and it begins by doing simple things well, being attentive and systematic and most importantly having the correct attitude.

This booklet was initially written as a practical guide for medical officers beginning their masters posting in arthroplasty and focusses on the processes before and during surgery. With the rising number of referrals for infection, we hope this guide on preventing PJI may serve others as well. We have strived to present the evidence for these guidelines but where lacking, consensus forms the basis of our practice. We recommend the reader to look up these references. The section ‘unit’s practice’, which is often encountered in this booklet, refers to the practices of the Division of Joint Replacement (DJR), University Malaya Medical Centre. At other institutions, this can be followed at one’s discretion.

For our residents, this is our guidelines for patient selection and risk identification with room for discussion in individual less clear-cut cases in the clinic. Remember to be observant and disciplined with ward preparation and procedural steps in the operating theatre and stick to the time-tested practice.

Do your part in preventing surgeon and patient despair!

Professor Dr Azhar Mahmood Merican
2.0 Preoperative

2.1 Clinic

*Identify risk factors*

1. **Active joint or skin infection**
   - Surgery should be postponed in patients with active infection until they are adequately treated and the infection is eradicated.
   - An active systemic or local tissue infection may result in haematogenous or direct seeding of the implant following total joint arthroplasty (TJA) (2).
   - Patients with an effusion and a history of septic arthritis should undergo evaluation by serology (ESR, CRP, D-dimer) and joint aspiration for culture, white cell count and neutrophil differential.

*Unit’s practice:*
   - Elective TJA should be postponed in patients with active skin disease in proximity to the planned surgical site. Eczema even distally, if not controlled, has been a source for PJI requiring implant removal.
   - Identify skin rashes near or at the planned skin incision.
   - Scrutinise the foot, toes and web spaces for fungal infection (looking especially for desquamation or weeping areas).
   - Ensure no actively inflamed psoriatic lesions at the planned surgical incision (incision may need to be modified).
Figure 2
This skin lesion (neuropathic dermatitis) developed as a result of loss of sensation due to the surgical scar from the primary surgery.

It is reasonable to proceed for revision surgery provided the skin is not inflamed, weeping or cracked.

Figure 3
Check the feet and in between the toes for signs of fungal infection or eczema.

Also, examine the peripheral circulation (pulses and capillary refill) to exclude chronic limb ischaemia, which could lead to poor wound healing.

Figure 4
Left: Non-diabetic patient with fungal infection of the toes.

Right: A close-up view showing a break in the skin. This patient developed PJI requiring removal of implants.
2. **Revision surgery**
   - Revision surgery has been shown to be a predictor of infection following total knee arthroplasty (TKA) (3) and also total hip arthroplasty (THA) (4).

*Unit’s practice:*
   - The surgical history should be scrutinised, along with proper evaluation of the patient’s symptoms and signs, and appropriate workup for infection performed (ESR, CRP). Consider joint aspiration and analysis if infection is suspected pre-operatively.

3. **Diabetes mellitus**
   - Uncontrolled diabetes is significant predictor for surgical and systemic complications, mortality, increased length of stay and higher hospital costs (5).
   - A preoperative HbA1C of ≥ 8% is associated with a significantly higher risk of postoperative wound complications after TKA (6). Similarly, a high HbA1C has been described as a marker for surgical risk in TJA patients (7).

*Unit’s practice:*
   - Refer patients with uncontrolled diabetes to a physician or endocrinologist. Surgery is performed only when good control is achieved.
   - Aim for a pre-operative HbA1C of <8.0%.
4. **Malnutrition**
   - Patients with a preoperative serum albumin level of <39 g/L (or 3.9 g/dL) are at risk for prolonged recovery (poor wound healing, longer hospital stays, persistent wound drainage and increased susceptibility to infection) (8).

   - Indicators for malnutrition include serum albumin (<35 g/L), serum transferrin (<2.0 g/L) and absolute lymphocyte count (<1500 x 10^9/L). Verify units with standardized values at your specific centres and convert if necessary.

   **Unit’s practice:**
   - Malnourished patients are seen by a dietitian for calorie, protein, vitamin and mineral supplementation.

5. **Obesity**
   - With obesity (BMI ≥ 30 kg/m2), there is a high likelihood that other co-morbidities are present. Operative time is also prolonged and there is a greater need for blood transfusion. The odds of a morbidly obese patient (BMI > 40 kg/m2) having a knee PJI is 9 times more than a non-obese patient (10, 11).

   - Morbidly obese (BMI ≥ 40 kg/m2) patients have a higher risk of postoperative in-hospital infection, wound dehiscence and genitourinary complications (12).

   - Obese patients are also at risk of being administered under-dosed prophylactic antibiotics. Therefore, antibiotic dosage should be adjusted accordingly (13).
**Unit’s practice:**
- Advise weight loss prior to surgery if possible. A dietitian, physiotherapist or bariatric surgeon consult is advisable.
- Counsel overweight or obese patients regarding the increased risk of complications following TJA as part of informed consent.
- Defer surgery in the morbidly obese (BMI ≥ 40 kg/m²). (14)

6. **Smoking**
- Systemic postoperative complications are significantly higher in heavy tobacco users (>1 pack/day or 25 cigarettes) (15).
- Postoperative healing complications occur significantly more often in smokers compared with non-smokers and in former smokers compared to those who never smoked (16).
- The risk of deep infection is 3x more likely in smokers than in non-smokers (17).
- Longer periods of smoking cessation decrease the incidence of postoperative complications (18).
- Smoking intervention programs should be carried out at least 4 weeks prior to elective surgery (19).

**Unit’s practice:**
- Smoking cessation is strongly advised.
- Defer surgery in heavy smokers.

7. **Alcohol dependence**
- Patients who consume alcohol on a frequent basis (>40 units/week) have a significantly increased risk of postoperative complications (20).
- At least 4 weeks of abstinence is required to reverse physiologic abnormalities of excessive alcohol use (21).
Unit’s practice:
• Quantify a patient’s alcohol consumption and intervene if indicated prior to TJA.

8. Active renal or liver disease
• Arthroplasty procedures in patients with end-stage renal failure (ESRF) on haemodialysis are associated with a high rate of complications and death (22).
• A deep infection rate of 13% (23) and 19% (24) has been reported in ESRF patients who underwent THA.
• Patients with asymptomatic hepatitis C (HCV) have higher rates of surgical wound complications following arthroplasty (25). A thorough history taking is mandated to identify patients at risk of HCV but due to very low seroprevalence, routine screening is not recommended (26).
• Patients with advanced cirrhosis have a higher rate of complications and implant failure due to infection (27).

Unit’s practice:
• ESRF patients are admitted earlier and heparin-free dialysis arranged. Prior to surgery, blood transfusion can be carried out during dialysis if needed.
• The haemostatic balance and immunocompromised status of patients with liver disease needs to be optimized prior to surgery.
• Inform patients regarding the increased risk of complications, even after adequate optimization.
9. Steroid therapy

- A meta-analysis reported a significant increase in risk of PJI in patients on corticosteroid therapy (28).
- The American College of Rheumatology and American Association of Hip and Knee Surgeons recommend optimizing dosage of glucocorticoids prior to surgery, and peri-operatively administering the current daily dose of steroids rather than prescribing a supra-physiologic dose (“stress dose”) (29).

Unit’s practice:

- Identify patients on steroid treatment including traditional medications. Morning serum cortisol levels can be used as a screening method for suppression or overactivity of the hypothalamic-pituitary-adrenal axis (30). Levels outside of the normal range (145-619 nmol/L) may require further assessment and investigation or a referral to the endocrinologist, to reduce the risk of PJI.
- Avoid performing surgery in patients who have been taking prednisolone >7.5mg daily (or equivalent doses of cortisol) for more than 14 days (31, 32), as there is an increased risk of wound complications, such as poor healing. If this cannot be avoided, appropriate measures should be undertaken, and informed consent obtained.
10. **Immunosuppressive therapy**
   - Immunosuppression is a significant risk factor for surgical site infection (SSI) and PJI (33).
   - Consult the treating physician with regards to cessation of immunosuppressive drugs and disease modifying anti-rheumatic drugs (DMARDs).

**Unit’s practice:**
- Request patients to list down or bring their regular medications during the pre-operative assessment. Identify patients on DMARDs or biologics.
- Inform the treating rheumatologist on the plan for arthroplasty and formulate a joint management plan on how to best optimise the patient’s medication and prevent PJI.
**DMARDs: CONTINUE through surgery**

<table>
<thead>
<tr>
<th>Medications</th>
<th>Dosing Interval</th>
<th>Continue/ Withhold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methotrexate</td>
<td>Weekly</td>
<td>Continue</td>
</tr>
<tr>
<td>Sulfasalazine</td>
<td>Once or twice daily</td>
<td>Continue</td>
</tr>
<tr>
<td>Hydroxychloroquine</td>
<td>Once or twice daily</td>
<td>Continue</td>
</tr>
<tr>
<td>Leflunomide (Arava)</td>
<td>Daily</td>
<td>Continue</td>
</tr>
<tr>
<td>Doxycycline</td>
<td>Daily</td>
<td>Continue</td>
</tr>
</tbody>
</table>

**BIOLOGICS: STOP preoperatively & schedule surgery at the end of the dosing cycle. RESUME medications minimum 14 days postoperatively in absence of wound healing problems, SSI or systemic infection.**

<table>
<thead>
<tr>
<th>Medications</th>
<th>Dosing Interval</th>
<th>Schedule Surgery (relative to last dose administered)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adalimumab (Humira) 40 mg</td>
<td>Every 2 weeks</td>
<td>Week 3</td>
</tr>
<tr>
<td>Etanercept (Enbrel) 50 mg or 25 mg</td>
<td>Weekly or twice weekly</td>
<td>Week 2</td>
</tr>
<tr>
<td>Golimumab (Simponi) 50 mg</td>
<td>Every 4 weeks (SC) or Every 8 weeks (IV)</td>
<td>Week 5, 9</td>
</tr>
<tr>
<td>Infliximab (Remicade) 3 mg/kg</td>
<td>Every 4, 6 or 8 weeks</td>
<td>Week 5, 7, 9</td>
</tr>
<tr>
<td>Abatacept (Orencia) weight-based</td>
<td>Monthly (IV) or weekly (SC)</td>
<td>Week 5, 2</td>
</tr>
<tr>
<td>500 mg; IV 1000 mg; SC 125mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tocilizumab (Actemra) SC 162 mg;</td>
<td>Every week (SC) or Every 4 weeks (IV)</td>
<td>Week 3, 5</td>
</tr>
<tr>
<td>IV 4 mg/kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rituximab (Rituxan) 1000 mg</td>
<td>2 doses 2 weeks apart every 4-6 months</td>
<td>Month 7</td>
</tr>
<tr>
<td>Anakinra (Kineret) SC 100 mg</td>
<td>Daily</td>
<td>Day 2</td>
</tr>
<tr>
<td>Secukinumab (Cosentyx) 150 mg</td>
<td>Every 4 weeks</td>
<td>Week 5</td>
</tr>
<tr>
<td>Ustekinumab (Stelara) 45 mg</td>
<td>Every 12 weeks</td>
<td>Week 13</td>
</tr>
<tr>
<td>Belimumab (Benlysta) 10 mg/kg</td>
<td>Every 4 weeks</td>
<td>Week 5</td>
</tr>
<tr>
<td>Tofacitinib (Xeljanz) 5 mg: STOP 7 days preoperatively</td>
<td></td>
<td>7 days after last dose</td>
</tr>
</tbody>
</table>

**SEVERE SLE-SPECIFIC MEDICATIONS: CONTINUE in the perioperative period.**

<table>
<thead>
<tr>
<th>Medications</th>
<th>Dosing Interval</th>
<th>Continue/ Withhold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mycophenolate</td>
<td>Twice daily</td>
<td>Continue</td>
</tr>
<tr>
<td>Azathioprine</td>
<td>Daily or twice daily</td>
<td>Continue</td>
</tr>
<tr>
<td>Cyclosporine</td>
<td>Twice daily</td>
<td>Continue</td>
</tr>
<tr>
<td>Tacrolimus</td>
<td>Twice daily (IV &amp; PO)</td>
<td>Continue</td>
</tr>
</tbody>
</table>

**NOT-SEVERE SLE: DISCONTINUE in the perioperative period.**

<table>
<thead>
<tr>
<th>Medications</th>
<th>Dosing Interval</th>
<th>Continue/ Withhold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mycophenolate</td>
<td>Twice daily</td>
<td>Withhold</td>
</tr>
<tr>
<td>Azathioprine</td>
<td>Daily or twice daily</td>
<td>Withhold</td>
</tr>
<tr>
<td>Cyclosporine</td>
<td>Twice daily</td>
<td>Withhold</td>
</tr>
<tr>
<td>Tacrolimus</td>
<td>Twice daily (IV &amp; PO)</td>
<td>Continue</td>
</tr>
</tbody>
</table>

*Table 1* 2017 American College of Rheumatology/American Association of Hip and Knee Surgeons Guideline for the Perioperative Management of Antirheumatic Medication in Patients with Rheumatic Diseases Undergoing Elective Total Hip or Total Knee Arthroplasty (29).
11. Intravenous drug users (IVDU)
   - A high incidence of infection after arthroplasty has been reported among patients who are IVDU (34).
   - A patient who is still an active IVDU should not undergo TJA.

Unit’s practice:
   - Elicit high-risk behaviour from thorough history taking and examination. Refer to the psychiatrist if necessary.

12. Human Immunodeficiency Virus (HIV) infection
   - Rates of deep joint sepsis after primary TJA in HIV-positive patients with haemophilia are 18.7%, significantly higher than in the normal population (35). However, HIV-positive patients without haemophilia have lower risks of complications (36).
   - Recent studies from western countries (where HIV is well controlled) have shown better PJI rates than in the past but the risk for PJI is still higher when compared to the non-HIV population (RR: 2.28) (37). Conversely, Kildow et al. reported that HIV patients are not at higher risk of infection but there is a higher risk (3.2x) of revision (mechanical complication) at 90 days (38).
   - Tan et al. reported that should PJI occur in HIV patients, there is a higher risk of acquiring antibiotic-resistant organisms (4).
Unit’s practice:
• Consult infectious disease specialists regarding CD4 counts and viral loads.
• Optimise patient’s other co-morbidities prior to considering TJA. Screen for other co-existing viral infection.
• The surgeon must be satisfied that the patient no longer has high risk behaviour, has continued access and is compliant to anti-retroviral therapy.
• Shared decision making with informed consent on the risk and benefit of TJA should be done, outlining the other available alternatives for treatment.
• A multidisciplinary approach to the management of these patients is best.

13. Dental infection
• All patients undergoing elective arthroplasty should be screened for evidence of active dental infection and treated.
• Dental infections can harbour virulent bacteria that can be the source for PJI (39).

Unit’s practice:
• If a patient has not seen a dentist in the last year, advise or arrange for a visit.

14. Urinary tract infection (UTI)
• UTI has the potential to cause bacteraemia and post-surgical wound infections (40).
• Patients with symptomatic UTI should have a urinalysis and urine culture done. The infection must be adequately treated with antibiotics prior to elective surgery.
• Asymptomatic bacteriuria is common in females and is not a contra-indication for arthroplasty. Routine testing of asymptomatic patients prior to surgery is not recommended (41, 42).
**Unit's practice:**
- Detailed history i.e. fever, dysuria, haematuria, and urgency is taken from all patients. A urine FEME and urine culture is performed in symptomatic patients. A positive nitrite and leukocyte esterase (FEME) indicate that UTI is present. Treat according to cultures and ensure pathogen is clear prior to surgery.

15. **Previous intra-articular injection (IAI)**
- An IAI risks contaminating the joint with bacteria.
- Some studies have shown that the risk of PJI is higher in patients who have received an IAI with steroids prior to TJA (43, 44).
- Evidence regarding viscosupplementation is lacking.

**Unit's practice:**
- The interval between IAI and TJA should be at least 3 months (45) if given corticosteroids, or 6 months if multiple IAIs were performed.

16. **Staphylococcus aureus screening**
- *S. aureus* colonisation in patient’s nasal or skin flora is known to increase the risk of SSIs and PJIs in arthroplasty patients (46).
- There is a paucity of evidence on the cost-effectiveness of routine *S. aureus* screening in pre-TJA patients (47).
- Universal decolonisation of *S. aureus* has been described, and intra-nasal mupirocin has been found to be effective in eradicating nasal *S. aureus* (48) but there is a theoretical risk of increased resistance to mupirocin.
- Walsh et al. described renal insufficiency, diabetes and immunosuppression as independent risk factors for colonisation with *S. aureus* (49).
**Unit's practice:**

- Screening should be performed in patients who are at high risk of PJI and of colonisation of S. aureus.
- If S. aureus is present, decolonisation is performed. Patients should receive intranasal application of 2% mupirocin ointment with a combination of chlorhexidine gluconate (CHG) body wash 5 days prior to surgery (50).

### 2.2 Ward

1. **Preoperative showering or cleansing**
   - Whole-body skin cleansing with chlorhexidine gluconate (CHG) the night before and morning of surgery lowers the incidence of SSI (51). Antiseptic soap is appropriate if patient is sensitive to CHG.
   - Skin cleansing with CHG is effective in reducing the risk of MRSA skin colonization (52).

**Unit’s practice:**

- Advise patient to shower or bathe (full body) with soap (antimicrobial or non-antimicrobial) or an antiseptic agent (CHG) on the night before and morning of the operative day.
2. Preoperative hair removal

- The Centre for Disease Control and Prevention (CDC), WHO and the Asia Pacific Society of Infection Control (APSIC) recommend not removing hair routinely unless the hair will interfere with surgery at the incision site (50).
- Clipping is the preferred method for hair removal. Shaving may cause abrasions that can become sites of bacterial growth.
- Timing of hair removal: a moderate quality of evidence shows that hair removal the day before surgery does not affect the SSI rate compared to hair removal on the day of surgery (OR: 1.22; 95% CI: 0.44-3.42) (53).

**Unit’s practice:**

- Removal of hair at the operative site, when required, should be performed close to the time of surgery to reduce the risk for microbial growth from breaks in the skin. It may be done the night before surgery in the ward or in the preoperative holding area. Hair removal in the operating theatre is discouraged. Should it be done on table, loose hair should be properly cleared and disposed to prevent contamination of the surgical wound.
3.0 Intraoperative

3.1 Perioperative drugs

3.1.1 Preoperative antibiotics

1. Choice of antibiotic
   • A 1st generation cephalosporin (cefazolin) is administered for routine perioperative surgical prophylaxis. They have good cover for gram-positive organisms and have excellent distribution profiles in bone, synovium, and muscle (54).
   • The efficacy of cefazolin as antimicrobial prophylaxis in reducing PJI in THA patients is demonstrated by Hill et al. The incidence of deep infection reduced from 3.3% to 0.9% (55).
   • In patients who are allergic to penicillin, clindamycin or vancomycin are reasonable alternatives.
   • For patients known to be colonised with methicillin-resistant Staphylococcus aureus, it is reasonable to add a single preoperative dose of vancomycin 15mg/kg to the recommended agent(s) 120 minutes before incision.

2. Timing of antibiotic
   • Preoperative dose of antibiotics should be administered within 30-60 minutes of surgical incision (56). This allows for adequate tissue (fat) concentrations at the time of skin incision.
   • Due to extended infusion time, vancomycin and fluoroquinolones should be started within 2 hours before incision.
   • When a tourniquet is used, the antibiotic must be completely infused before inflation.
   • Consider additional antibiotic administration if the surgery time is twice the half-life of the antibiotic, or when blood loss exceeds 2000 mL or if fluid resuscitation is over 2000 mL (57).
Unit’s current practice:
- Administer IV cefazolin (2g; 3g if > 120 kg) within 30-60 mins prior to incision.
- Vancomycin (15 mg/kg), if used, is infused over an hour and started when the patient is called to OT.

3.1.2 Tranexamic acid (TA)

- Administration of TA reduces the amount of blood loss and allogenic blood transfusion in THA and TKA patients (57, 58).
- Its use is not associated with an increased risk of venous thromboembolism or other adverse events (58). It is unclear whether TA is contraindicated in a patient with history of cerebrovascular accident, vascular stent, myocardial infection or transient ischaemic attack (59).

Unit’s practice:
- 1g TA is administered intravenously after induction. If the patient is underweight (≤50kg), give 10mg/kg bodyweight.
3.2 Operative environment

The probability of SSI is determined by 3 major variables: (1) number and virulence of bacteria, (2) host defence and (3) environment.

1. Laminar air flow (LAF)
   • TJA may be performed in an OT without laminar flow. Studies have not shown lower SSI rates in laminar flow rooms.

2. Operating room attire and face mask
   • All personnel should wear clean theatre attire including disposable head covering and face mask, when entering the OT.
   • Surgical masks provide a mechanical obstacle for personnel secretions as well as protecting them from patients’ blood and bodily fluids.

Unit’s practice:
   • All personnel are to wear a face mask in OT especially once instrument trays are opened.

3. Operating room traffic
   • Airborne particulate bacteria and shedding by personnel are major sources of contamination. The number of airborne bacteria correlates with the incidence of PJI (60).

   • Operating room traffic should be kept to a minimum.
   • Movement of objects (personnel and/or operating room equipment including opening and closing doors) can generate air currents that cause deposition of bacteria in the surgical site (61).
   • A rising trend in SSIs is observed as the number of people in the OT increases (62).
4. **Patient positioning**  
   - Good positioning practices allow for better exposure, referencing and reduced operative time.

*Unit’s practice*:  
- When positioning a patient for TKA, the foot should be hanging off the edge of the bed. Side thigh support and foot support are placed to stabilise the flexed knee (Figure 5).  
- When positioning for THA, ensure adequate exposure of the buttock and no impingement from the supports.  
- Ensure all supports are tightened well to prevent them from becoming loose once the limb is draped.

5. **Operating light handles**  
   - The use of sterile light handles is discouraged - it can be a source of contamination (63).

*Unit’s practice*:  
- After marking the skin incision (prior to skin prep and draping), adjust the OT lights to give good visualization of the surgical site.
Figure 5
The patient is positioned supine on the table and brought down until the feet are off the table so that the flexed knee is a comfortable distance from the surgeon during surgery. In this case, the hips are slightly abducted to allow easier simultaneous surgery with two teams.

Note: The tourniquet is placed high up proximally and secured. The skin incision should be marked.

Figure 6
Surgical helmet and proper pre-gowning position.
6. **Body exhaust suits**
   - Currently, there is no conclusive evidence to support the routine use of these suits in performing TJA (64).

*Unit’s practice:*
   - Wear a surgical helmet for healthcare worker protection and to prevent non-sterile shedding from scalp and cap into surgical field (Figure 6).

7. **Hand Washing**
   - Hand hygiene should be performed prior to manipulation and positioning of the patient, in accordance with the World Health Organization’s (WHO) 5 Moments for Hand Hygiene and Surgical Hand-rubbing Technique (Appendix 1).
   - The recommended duration of surgical hand washing with antiseptic agent is a minimum of 2 minutes for the first case (57). A shorter period may be appropriate for subsequent cases.
   - Potentially pathogenic bacteria have been cultured from water droplets from surgeons’ arms after surgical hand scrubbing (65). This can be a source of infection.

*Unit’s practice:*
   - Use a brush to clean the nails for the first case on the list.
   - Do not drip water onto the gowning table (Figure 7).

**Figure 7**
After surgical hand washing, be careful not to drip water onto the gowning table.
Figure 8
Surgical skin preparation. Prep the foot thoroughly. A sterile personnel holds up the leg, ensuring his/her gown is clear of the non-sterile table. A green sterile towel is placed to protect sterility. Ensure the urinary catheter is out of the surgical field. A sterile personnel carefully disinfects the limb, starting from the incision site, moving peripherally.
8. **Gowning**

*Unit’s practice:*

- No handling of any other sterile items on the gowning table except the hand towel and gown.
- Stand away from the gowning table to prevent your sterile gown from touching or brushing against the gowning table.
- Once gowned and gloved, all personnel moving in the sterile field should do so in a manner to maintain sterility.
  - Do not turn your back to sterile field or sit while wearing sterile personal protective equipment (PPE).
  - Sterile personnel should pass each other front to front or back to back.
  - Maintain hands above the waist.
  - Be aware of sterility especially during idle periods (waiting for intraoperative imaging).
- Be careful of contamination from non-sterile body parts of sterile personnel. You can easily contaminate yourself or the sterile foot of the patient (when manipulating the extremity in the case of THA) with the nurses’ head or shoulder.
### 3.3 Surgical skin preparation

- In a multicentre clinical trial, chlorhexidine gluconate (CHG) in alcohol was shown to be more effective than aqueous povidone-iodine (PVP-I) alone (66). However, no difference was reported in a study comparing CHG and PVP-I, when both preparations contained isopropyl alcohol (67).
- If the CHG-alcohol or PVP-I-alcohol combination is not commercially prepared, it is not advisable to mix them before application as the concentration may not be optimal. Instead use the preparations sequentially, with alcohol used following CHG or PVP-I.
- Povidone contact time: There is a time-dependent decrease in number of skin colonies following application of a 5% povidone spray (without scrubbing) (68). In this study, 3 minutes was deemed effective. In a study of peripheral intravascular catheter insertion, using 10% PVP-I, no differences in contamination (CFUs > 15) were noted between a drying time of 30 seconds and 2 minutes (69). A prospective randomised study of skin prep in spine surgery recommends PVP-I to dry for several minutes. (70)
- Blood or proteinaceous material can inactivate disinfectants. These can be removed by cleaning the skin with cetrimide 2% prior to draping.
Unit's practice:

- Following hand washing and gowning, prep limb(s) from toes right up to a tourniquet placed high in the proximal thigh (for TKA) and from the ankle up to the abdomen (for THA). Povidone-iodine 10% is first applied followed by isopropyl alcohol 70% (Figure 8). Alternatively, chlorhexidine 2% in 70% alcohol can be used (applied with friction).
- A contact time for povidone-iodine 10% of 2 minutes prior to application of a second prep of an alcohol-based solution (left to air dry) is recommended.
- Make sure alcohol solution is completely dried before draping to prevent fire hazard.

3.4 Surgery and surgical instruments

1. Duration of surgery
   - There is a 9% increase in the risk of deep SSI per 15 minute-increment increase in operative time (71).
   - Shorter duration of surgery can reduce the incidence of SSI following THA and TKA (72).
   - A coordinated effort should be made to minimize the duration of surgery without technical compromise of the procedure.

2. Draping

Unit’s practice:

- Ensure draping is performed with care and due attention to sterility is given.
- If disposable drapes are used, placing a green towel underneath the limb prevents the diathermy tip from burning a hole through the drapes if it is not placed in the diathermy quiver.
3. **Incise drapes**
   - An incise drape impregnated with slow-release iodophor inhibits skin recolonization and prevents lateral migration of bacteria from exposed areas of the skin (73, 74).

*Unit’s practice:*
   - Iodophor-impregnated incise drape is used and placed without any folds or wrinkles.

4. **Instrument trays**
   - Opening of instrument trays should occur as close to the start of the surgical procedure as possible.
   - There is a direct correlation between duration of open exposure of instrument trays and risk of bacterial contamination. Contamination rate is 4% at 30 minutes, 15% at 1 hour, 22% at 2 hours, 26% at 3 hours, and 30% at 4 hours. “1/6 at 1, 1/5 at 2, 1/4 at 3, 1/3 at 4” (75).
   - Trays should be covered with sterile drapes when not in use for extended periods, as this reduces bacterial contamination rates by 4-fold (76).

*Unit’s practice:*
   - Instruct nurses not to open sets until the anaesthetist has successfully induced the patient or in the case of a long procedure, to only open the relevant set for the correct stage of surgery.
   - In revision surgery, only the relevant instrument tray is opened. For e.g., in a case of revision THA, the tray for removal of implant is opened first, leaving the arthroplasty instruments unopened until needed.
   - It is important to alert the implant representative of this staged opening of trays and to ensure all trays are available in order to avoid the situation of missing instruments only realized intraoperatively.
5. **Knife blade**
   - Scalpel blades that have been used for skin incision have a contamination rate of 9.4% in one study (63) and as high as 15.3% in another (77).

*Unit’s practice:*
   - The knife blade should be changed after skin incision for handling or cutting of deeper tissues.

6. **Suction tips**
   - Usage of suction tips longer than 60 minutes results in higher rates of contamination (57).

   Suction tips can be introduced into the femoral canal to evacuate fluid but not left in the canal, where they can circulate large amounts of air and particles that may contaminate the surgery.

*Unit’s practice:*
   - Suction tips should be changed every 60 minutes to prevent contamination.
7. Gloves
   • Glove change is recommended at least every 90 minutes or more frequently (57). It is necessary to change perforated gloves, which occurs after 90 minutes on average (78).
   • Davis et al. (63) reported a glove contamination rate of 20% and advised changing gloves after draping and before application of a cutaneous adhesive.
   • Permeability of gloves will be compromised by the exposure to methacrylate cement and should be changed after cementation.
   • Perforations can also occur at the end of the bone preparation phase due to instruments, bone debris, surgical knots, scalpel blades or bone pins (79). Consider changing of gloves after bone preparation, prior to implantation.
   • High rates of glove contamination have also been demonstrated after the reduction stage of a THA (80).

Unit’s practice:
   • Sterile personnel should be aware of the condition of their gloves. Changing of gloves is recommended after draping, before handling of implants, and when macroscopic perforations are noted.
   • Gloves should also be changed once every 60-90 minutes.
8. **Irrigation of surgical wound**
   • Irrigation should be used to dilute contamination and non-viable tissue. A greater volume of irrigation would be expected to achieve greater dilution. 4L of pulse lavage is effective for removing the bone and cement particles during cemented TKA (81).
   • Use of high-pressure pulsatile lavage is time-saving and removes necrotic tissue and debris more effectively (82). It also improves the mechanical stability of cemented arthroplasty by allowing better cement penetration in cancellous bone tissue.

*Unit’s practice:*
   • Irrigation should be performed prior to cementing to obtain a clean bone bed and also after implants are in place to effectively remove necrotic debris and loose cement in the wound.

9. **Splash basins**
   • Blood-stained instruments are commonly washed in ‘splash’ basins. These basins are repeatedly used during a surgical procedure and should therefore be considered a potential source of contamination (83).
   • Anto et al. (84) demonstrated that 23.8% of specimens from splash basins tested positive for bacterial contamination, and they suggested that surgeons should stop using them.

*Unit’s practice:*
   • Instruments should be regularly wiped clean to avoid contamination. The use of a splash basin for soaking blood-stained instruments is discouraged.
10. Contaminated instruments
   • The use of Cidex (glutaraldehyde 2.4%) will disinfect instruments if soaked for 20 minutes (85). It does not sterilize and its use is prohibited for critical equipment.
   • Immediate use steam sterilization, previously known as flash sterilization can be used to sterilize dropped instruments intra-operatively (86). However, its use is restricted to emergency sterilization of singular instruments without lumens. It should not be used for the sake of convenience. All critical reprocessing steps for sterilization including cleaning, decontamination, rinsing and aseptic transfer from the sterilizer to the point of use should be observed, regardless of which sterilization cycle types (gravity or dynamic air removal) are used.

Unit’s practice:
   • Dropped i.e. contaminated instruments are discarded unless absolutely necessary.
   • Immediate use steam sterilization may be utilized for single contaminated instrument in emergency conditions. **Not to be used for implants**, whole instrument trays, instruments with channels etc.
   • Soaking in Cidex (glutaraldehyde 2.4%) is NOT an option.
4.0 Postoperative

4.1 Wound dressing after TJA

- Use of occlusive dressing with alginate hydrofiber is recommended (57).
- An occlusive dressing secured with hydrocolloid was found to have a lower blister rate, a lower rate of dressing change and lower rate of SSI (87).

Unit's practice:
- Only change dressing if soaked.

4.2 Postoperative antibiotics

- Postoperative antibiotics should not be administered for greater than 24 hours after surgery (57, 88).
- Prolonged prophylaxis is discouraged because of possibility of added antimicrobial toxicity, selection of resistant organisms and unnecessary expense (89).
- There is no evidence to support the continued use of postoperative antibiotics when urinary catheter or surgical drains are in place (57).
- In TJA, as in other clean and clean-contaminated procedures, do not administer additional antimicrobial prophylaxis doses (beyond 24 hours) after the surgical incision is closed in the operating room, even in the presence of a drain (CDC guideline) (56).

Unit's practice:
- Antibiotic prophylaxis is continued within 24 hours of surgery for three to four doses depending on the antibiotic used.

For preoperative antibiotics, please refer to section 3.1.1.
4.3 Urinary catheter

- A direct association between use of urinary catheter and PJI remains controversial.
- The risk of UTI has been shown to be directly related to the duration of urinary catheter remaining in situ, especially if in situ for more than 48 hours (90).

*Unit’s practice:*
- It is recommended to remove the urinary catheter as soon as possible, preferably within the first postoperative day.
- Exceptions are observed in male patients with benign prostatic hypertrophy or patients with other urinary tract issues that require longer catheterization.

4.4 Blood transfusion

- Patients receiving allogenic transfusions were 2.1 time more likely to develop post-operative infections compared to patients receiving no transfusion (91, 92).
- Perioperative measures such as screening and treating anaemia, careful haemostasis, minimizing surgical time and use of tranexamic acid can reduce the need for transfusions.

*Unit’s practice:*
- A thorough assessment of patient’s symptoms and risk factors is mandated. Transfusion of packed cells is restricted to patients with symptomatic anaemia (regardless of the haemoglobin levels) or if the post-operative haemoglobin (after 48 hours) is less than 80g/dL.
- Transfusion may be indicated earlier in patients with a low cardiorespiratory reserve.
### 5.0 Checklists

#### 5.1 Checklist for Reducing PJI (Preoperative in Clinic)

<table>
<thead>
<tr>
<th>No.</th>
<th>Checklist (Preoperative in clinic)</th>
<th>Tick (✓)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rule out active joint or skin infection</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Preoperative HbA1c &lt; 8%</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>BMI &lt; 40</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Assess for malnutrition. Optimise accordingly.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Cessation of immunosuppressive drugs or steroids. Liaise with rheumatologist if necessary</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Dental clearance</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>No symptoms of UTI. Urinalysis if indicated</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Smoking cessation</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Alcohol abstinence</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Enquire about high-risk behaviour, viral screening if necessary</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>No intraarticular injection in the preceding 3 months</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Clarify regarding recent usage of traditional medication. Identify the type of medication, frequency and duration of usage</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Screen for S. aureus colonization in at-risk patients. If present, start decolonization therapy</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Educate patient on the indications for surgery, risks involved. Identify and address any unrealistic expectations.</td>
<td></td>
</tr>
</tbody>
</table>
# Unit Perioperative Checklist

<table>
<thead>
<tr>
<th>Name:</th>
<th>Surgeons:</th>
</tr>
</thead>
<tbody>
<tr>
<td>RN:</td>
<td>Date:</td>
</tr>
<tr>
<td>IC number:</td>
<td>Time started:</td>
</tr>
<tr>
<td>Procedure:</td>
<td>Total Hip Arthroplasty</td>
</tr>
</tbody>
</table>

**Pre-operative**

<table>
<thead>
<tr>
<th>Prior to induction</th>
<th>✓</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consent and site checked</td>
<td></td>
</tr>
<tr>
<td>Antibiotic given 30 minutes prior to incision</td>
<td></td>
</tr>
<tr>
<td>Antibiotic for cement available (1st and 2nd stage revision for infection)</td>
<td></td>
</tr>
<tr>
<td>Radiographs displayed</td>
<td></td>
</tr>
<tr>
<td>Implant sets present and sterilised</td>
<td></td>
</tr>
</tbody>
</table>

**Post-induction | ✓**

| CBD placed in aseptic manner, bag placed anterior and towards head end of table | |
| Patient brought to end of table and patient positioned in the lateral position, buttocks closer to the edge of table | |
| Pelvis is level | |
| Check supports: | |
| - Not in the way of hip flexion | |
| - Not obscuring skin prep area / planned incisions | |
| Diathermy pad placed | |
| Skin incision marked | |
| U-drape placed | |
| Lights adjusted (one focusing distally, one proximally) | |
| IV tranexamic acid (1g) given | |
| Surgical instrument sets only opened after successful spinal / regional or close to GA induction | |

**Gowning and Surgical Skin Preparation | ✓**

| Surgical hand washing (brush to clean nails for first surgery of the day) | |
| Hand drying with minimal handling of sterile items | |
| Do not drip water on prep table, gloves and gowns | |
| Application of sterile hood covers and gowning. Double gloves. | |
| Non-sterile personnel to hold foot | |
| Prep limb from ankle to abdomen. When crossing over from the patient’s anterior to posterior, do not contaminate self by brushing against non-sterile personnel holding the leg or other non-sterile objects. | |
| Do not double back to incision site | |
| Allow for 2 minutes of povidone contact time | |
Repeat skin preparation with alcohol based solution  
The foot is wrapped with a sterile towel by sterile personnel. Sterile stockinette applied  
Sterile draping is placed, ensuring adequate exposure of incision and possible extension  
Dry off limb and apply adhesive povidone-iodine skin drape  
Change gloves after draping  
Ensure minimal OR traffic

**Intra-operative**

| Skin incision and exposure | ✓ |
| Change knife blade for deeper tissues |
| **Prolonged surgery** | ✓ |
| Change of suction tips every 60 minutes |
| Change of gloves every 90 minutes |
| Re-administration of antibiotics:  
  After 3 hours  
  If blood loss exceeds 2000mLs  
  Fluid administered exceeds 2000mLs |

**Post-operative**

| Dressing | ✓ |
| Regular inspection of dressing to check if it is blood stained. Change only if soaked to the edge of the dressing.  
  If not soaked, leave in-situ until day 14 |
| **Urinary catheter** | ✓ |
| Early removal of indwelling catheters (preferably day 1) |
| **Drains** | ✓ |
| Surgical drains (if used) should also be removed early, preferably in the first 24-48 hours. |

**Infected cases**

| Pre-operative | ✓ |
| Check that the aerobic and anaerobic blood culture bottles (BACTEC™) are available |
| In 2<sup>nd</sup> stage revision cases, to arrange for alpha defensin test or if indicated, a frozen section study intra-operatively |
a. Radiographs loaded.
b. Body supports optimal position.
c. U-drape covering groin and perineal areas.
d. Lights focusing on acetabulum and femur canal.
e. Contralateral limb: hip in 0° flexion and knee 30° flexion.

a. Diathermy and suction machines placed at the head of bed. Ensure well covered when draped.
b. Urine bag away from surgery site, accessible to anaesthetist.
a. Limb covered from tips of toes to distal femur.
b. Ensure contralateral tibial tuberosity palpable.
c. Exposure from iliac crest to distal thigh.
d. Iodophor-impregnated incise drape applied ensuring no exposed skin or edges.
e. Quiver and diathermy placed as shown.
### Pre-operative

<table>
<thead>
<tr>
<th>Prior to induction</th>
<th>✓</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consent and site checked</td>
<td></td>
</tr>
<tr>
<td>Antibiotic given 30 minutes prior to incision (at least 15 minutes prior to tourniquet inflation)</td>
<td></td>
</tr>
<tr>
<td>Antibiotic for cement available (1st and 2nd stage revision for infection)</td>
<td></td>
</tr>
<tr>
<td>Radiographs displayed</td>
<td></td>
</tr>
<tr>
<td>Implant sets present and sterilised</td>
<td></td>
</tr>
<tr>
<td><strong>Post-induction</strong></td>
<td>✓</td>
</tr>
<tr>
<td>CBD placed in aseptic manner, bag placed anterior and towards head end of table</td>
<td></td>
</tr>
<tr>
<td>Patient brought to end of table</td>
<td></td>
</tr>
<tr>
<td>Thigh and foot supports placed, ensuring good hip flexion</td>
<td></td>
</tr>
</tbody>
</table>
| Check supports:  
  - Well placed and tightened  
  - Not obscuring skin prep area / planned incisions | |
| Tourniquet applied to the upper thigh with adequate padding. Secured well to prevent distal migration during surgical skin preparation | |
| Diathermy pad placed | |
| Skin incision marked | |
| Lights adjusted (one focusing distally, one proximally) | |
| IV tranexamic acid (1g) given | |
| Surgical instrument sets only opened after successful spinal / regional or close to GA induction | |
| **Gowning and Surgical Skin Preparation** | ✓ |
| Surgical hand washing (brush to clean nails for first surgery of the day) | |
| Hand drying with minimal handling of sterile items | |
| Do not drip water on prep table, gloves and gowns | |
| Application of sterile hood covers and gowning. Double gloves. | |
| Prep limb from toes to calf. In unilateral cases, ensure sterile drape placed on contralateral foot prior to surgical skin preparation | |
| Foot held with sterile towel by sterile personnel | |
| Skin prep continued right up to the tourniquet | |
| Do not double back to incision site | |
| Allow for 2 minutes of povidone contact time | |
### 5.0 CHECKLISTS

#### DjR Peri-operative Checklist

| Repeat skin preparation with alcohol based solution |  |
| Sterile stockinette applied |  |
| Sterile draping is placed, ensuring adequate exposure of incision and possible extension |  |
| Dry off limb and apply adhesive povidone-iodine skin drape |  |
| Change gloves after draping |  |
| Ensure minimal OR traffic |  |

#### Intra-operative

| Skin incision and exposure | ✓ |
| Change knife blade for deeper tissues |  |

#### Prolonged surgery

| Change of suction tips every 60 minutes | ✓ |
| Change of gloves every 90 minutes |  |
| Re-administration of antibiotics: After 3 hours |  |
| If blood loss exceeds 2000mLs |  |
| Fluid administered exceeds 2000mLs |  |

#### Post-operative

| Dressing | ✓ |
| Regular inspection of dressing to check if it is blood stained. Change only if soaked to the edge of the dressing. |  |
| If not soaked, leave in-situ until day 14 |  |

| Urinary catheter | ✓ |
| Early removal of indwelling catheters (preferably day 1) |  |

| Drains | ✓ |
| Surgical drains (if used) should also be removed early, preferably in the first 24-48 hours. |  |

#### Infected cases

| Pre-operative | ✓ |
| Check that aerobic and anaerobic blood culture bottles (BACTEC™) are available |  |
| In 2nd stage revision cases, to arrange for alpha-defensin or if indicated, frozen section study intra-operatively |  |
5.0 CHECKLISTS

a. Body supports optimal position.
b. Urine bag on contralateral limb and towards anaesthetist.
c. Diathermy and suction machine away from surgical field and well covered once draped

a. Put on stockinette before application of specific TKR drape, anterior aspect cut to expose incision site.
b. Iodophor-impregnated incise drape applied ensuring no exposed skin or edges.
a. Lights focusing on knee in flexion and in extension.
b. Surgical field adequately covered with drapes with no exposed areas.
c. Adequate length of drapes distally.
### 6.0 Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDC</td>
<td>Centre for Disease Control and Prevention</td>
</tr>
<tr>
<td>CFU</td>
<td>Colony Forming Units</td>
</tr>
<tr>
<td>CHG</td>
<td>Chlorhexidine gluconate</td>
</tr>
<tr>
<td>CRP</td>
<td>C-reactive protein</td>
</tr>
<tr>
<td>ESR</td>
<td>Erythrocyte sedimentation rate</td>
</tr>
<tr>
<td>FEME</td>
<td>Full examination and microscopic examination</td>
</tr>
<tr>
<td>HIV</td>
<td>Human immunodeficiency virus</td>
</tr>
<tr>
<td>IAI</td>
<td>Intra-articular injection</td>
</tr>
<tr>
<td>IVDU</td>
<td>Intravenous drug users</td>
</tr>
<tr>
<td>LAF</td>
<td>Laminar Air Flow</td>
</tr>
<tr>
<td>MRSA</td>
<td>Methicillin-resistant Staphylococcus aureus</td>
</tr>
<tr>
<td>OT</td>
<td>Operating theatre</td>
</tr>
<tr>
<td>PJI</td>
<td>Periprosthetic joint infection</td>
</tr>
<tr>
<td>PPE</td>
<td>Personal protective equipment</td>
</tr>
<tr>
<td>SSI</td>
<td>Surgical site infection</td>
</tr>
<tr>
<td>TA</td>
<td>Tranexamic acid</td>
</tr>
<tr>
<td>THA</td>
<td>Total hip arthroplasty</td>
</tr>
<tr>
<td>TJA</td>
<td>Total joint arthroplasty</td>
</tr>
<tr>
<td>TKA</td>
<td>Total knee arthroplasty</td>
</tr>
<tr>
<td>UTI</td>
<td>Urinary tract infection</td>
</tr>
</tbody>
</table>
7.0 References


8.0 Appendix

Appendix 1

Your 5 Moments for Hand Hygiene

1. Before touching a patient
   - When?: Clean your hands before touching a patient when approaching him/her.
   - Why?: To protect the patient against harmful germs carried on your hands.

2. Before clean/aseptic procedure
   - When?: Clean your hands immediately before performing a clean/aseptic procedure.
   - Why?: To protect the patient against harmful germs, including the patient’s own, from entering his/her body.

3. After body fluid exposure risk
   - When?: Clean your hands immediately after an exposure risk to body fluids (and after glove removal).
   - Why?: To protect you and the health-care environment from harmful patient germs.

4. After touching a patient
   - When?: Clean your hands after touching a patient and his/her immediate surroundings, when leaving – even if the patient has not been touched.
   - Why?: To protect you and the health-care environment from harmful patient germs.

5. After touching patient surroundings
   - When?: Clean your hands after touching any object or furniture in the patient’s immediate surroundings.
   - Why?: To protect you and the health-care environment from harmful patient germs.

World Health Organization
Patient Safety
SAVE LIVES
Clean Your Hands

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Appendix 2

Surgical Handrubbing Technique

- Handwash with soap and water on arrival to OR, after having donned theatre clothing (cap/hat/bonnet and mask).
- Use an alcohol-based handrub (ABHR) product for surgical hand preparation, by carefully following the technique illustrated in Images 1 to 17, before every surgical procedure.
- If any residual talc or biological fluids are present when gloves are removed following the operation, handwash with soap and water.

Images 1-7: Smear the handrub on the right forearm up to the elbow. Ensure that the whole skin area is covered by using circular movements around the forearm until the handrub has fully evaporated (10-15 seconds).

Images 8-10: Now repeat steps 1-7 for the left hand and forearm.

Images 11-17: When the hands are dry, sterile surgical clothing and gloves can be donned.