

# SESLHD GUIDELINE COVER SHEET

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<b>KEY TERMS</b>	Surgical site infections, cardiothoracic, care bundle
<b>SUMMARY</b>	The document outlines clinical processes that should be followed that have been proven to reduce surgical site infections in cardiothoracic patients. A care bundle methodology is used throughout the guideline.

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**Reducing Cardiothoracic Surgical Site Infections through use of a  
Cardiothoracic Surgical Site Infection Care Bundle Guideline**

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## Introduction

Surgical site infections (SSI) are one of the most common and costly healthcare associated infections among hospitalised patients. SSIs result in increased length of stay, additional costs and potentially increase morbidity and mortality<sup>1</sup> and are preventable.<sup>2 3</sup>

A Care Bundle is a group of evidence-based interventions which are grouped together to achieve a particular outcome. Patient outcomes are maximised when all bundle elements are consistently performed or adhered to. Consequently, the care bundle can be a powerful driver to improve the reliable delivery of evidence-based care.

The World Health Organisation and the Centres for Disease Control and Prevention have developed evidence-based guidelines to prevent surgical site infections. The core elements of the SESLHD Cardiothoracic SSI Care Bundle are based on high level recommendations from both documents.

The aim of the SESLHD Cardiothoracic SSI Prevention Care Bundle is to prevent surgical site infections by modifying patient risk factors and ensuring best practice is performed by clinicians.

The Care Bundle is divided into:

1. Modifying Patient Risk Factors Outpatient
2. Modifying Patient Risk Factors Inpatient
3. Reducing Risk Factors Intra-Operative
4. Reducing Risk Factors Post-Operative

## Principles

Compliance with relevant National standards, NSW Policy Directives and other overarching documents such as:

- [Australian College of Perioperative Nurses \(ACORN\) Standards](#)
- [NSW Health Policy Directive PD2023\\_025 - Infection Prevention and Control in Healthcare Settings](#)

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## Definitions and Abbreviations

**ACORN:** Australian College of Perioperative Nurses standards.

**Decolonisation:** Use of topical and/or systemic antibiotics and/or other measures to eradicate MRO's from colonised persons.

**Immunonutrition:** Oral or enteral formulae enriched with nutrients that have been determined to enhance immune function. Nutrients with an immune stimulatory function that have been studied are arginine, glutamine, glycine, omega-3 polyunsaturated fatty acids and nucleotides.

**Malnutrition Screening Tool (MST):** A validated tool used to screen malnutrition risk in adults. Nutrition screen parameters include weight loss and appetite. To be completed at pre-admission clinic, on admission and weekly throughout the patient's admission. It is part of the Adult Admission Assessment Form (completed on admission in the acute setting) and the Waterlow Assessment Tool.

**MRSA: Methicillin-resistant Staphylococcus aureus.** A strain of *S. aureus* that is resistant to beta-lactam antibiotics including penicillins and cephalosporins.

**Incisional Negative Pressure Wound Therapy:** Use of a negative pressure pump and specific dressings applied over closed surgical wounds to create a negative pressure environment at wound site, thereby preventing wound complications in patients at risk of surgical site infection.

**Pre-operative load reduction:** Use of topical or systemic antibiotics to reduce the burden of colonisation with *Staphylococcus aureus* prior to surgical procedures.

**SEALS:** South Eastern Area Laboratory Services

## Overview of Recommendations

### Modifying Patient Risk Factors Outpatient

#### Smoking Cessation

- Ask patients preoperatively about their smoking status
- Advise patients who smoke of the specific perioperative risks of smoking
- Refer patients to NSW Quitline or other smoking cessation support programs
- Offer nicotine replacement therapy such as nicotine lozenges, gum or medication.

#### Glycaemic Control

- HbA1c determination in those with known diabetes is an effective tool for identifying patients at risk of inpatient hyperglycaemia and who would benefit from detailed glycaemic review
- Test HbA1c level with the aim of identifying degree of glycaemic control prior to admission
- Patients with poor glycaemic control (HbA1c >9% or blood glucose levels >10 mmol/L) should be referred to patient's local diabetes care provider for stabilisation of diabetes while waiting for surgery. Referral to Endocrinologist recommended
- HbA1c can be measured in patients without known diabetes who have elevated BGLs to help diagnose diabetes or pre-diabetes.

#### Screening and Decolonisation

- Screen for staphylococcus aureus 7-14 days before admission to a SESLHD facility
- Ensure positive patients start decolonisation therapy five days prior to surgery.

#### Enhanced Nutritional Support

- Record height/weight and screen for malnutrition using the Malnutrition Screening Tool (MST) during preadmission clinic visit
- Refer to a Dietitian if the patient is aged under 65 and BMI <18.5kg/m<sup>2</sup> or over 65 and BMI <22kg/m<sup>2</sup>

### Modifying Patient Risk Factors Inpatient

#### Smoking Cessation

- Similar to smoking cessations for outpatients, smokers are identified and encouraged to quit
- Smokers are offered nicotine replacement therapy such as nicotine lozenges, gum or medication, see [SESLHDPR/760 - Nicotine Replacement Therapy for smoking cessation](#)

#### Glycaemic Control

- Clinical staff refer to facility clinical Business Rule for Optimal Management of Diabetic Surgical Inpatients

#### Screening and Decolonisation of Emergency Admissions

- Screening and decolonisation of elective patients should ideally occur in the community or preadmission clinic within the optimal time range to optimise efficacy of treatment. If

MRSA or MSSA status is unknown at the time of admission (i.e. for emergency theatre) an assessment for risk should be undertaken

- If a patient is assessed high risk, load reduction therapy should commence until a negative result is confirmed or treatment has concluded (whichever occurs first).

### **Delirium Risk Screening**

- Delirium is a disturbance of consciousness and cognition that presents over a short period of time with a fluctuating course. Patients undergoing cardiac surgery are considered to be high risk of development delirium
- Delirium is a serious condition associated with increased mortality. Prevention is the most effective strategy
- Prevent post-operative delirium in cardiothoracic patients through screening, implementation of strategies to prevent and treat underlying causes.

### **Enhanced Nutritional Support**

- Patients are screened for nutritional status using the Malnutrition Screening Tool.
- Patients identified i.e. BMI < 18.5kg/m<sup>2</sup> and aged under 65 or BMI < 22kg/m<sup>2</sup> and aged over 65 should be referred to a Dietitian.

### **Sternal Support Vest**

- Patients are preoperatively assessed for risk of developing sternal wound complications
- In consultation with the Cardiothoracic Surgeon, patients identified as high risk are provided with a sternal support device and education regarding rationale for wearing the garment
- Risk of sternal wound complications are reduced if the support vest is worn for the optimal period (i.e. six weeks postoperatively).

### **Preoperative Showering**

- Patients are provided with an antiseptic agent to shower with at least the night before surgery.

### **Surgical Hair Removal**

- Hair clippers with a disposable head are used for any surgical hair removal
- Hair removal is timed as close as possible to the operating procedure
- Hair removal does not occur in the operating room.

## **Intraoperative: Best Practices to Reduce Surgical Site Infections**

### **Surgical Hand Scrub**

- Members of the surgical team follow an established hand hygiene practice to maintain healthy skin and fingernail condition
- All jewellery is removed from hands and arms prior to the surgical scrub
- The surgical team follow a standardised procedure for the pre-surgical scrub using skin antiseptic.

## Prophylaxis Antibiotics

- Please refer 3.2 for further detail, additional information and references.

## Skin Preparation

- Ensure surgical site is free of soil, debris, cosmetics and jewellery
- Alcohol is highly bactericidal and effective for preoperative skin antisepsis but does not have persistent activity when used alone. Use a skin prep combining Chlorhexidine gluconate with alcohol or an iodophor eg povidone iodine with alcohol to achieve rapid, persistent and cumulative antisepsis
- Preparation commences from the cleanest area (operative or incision site) and proceeds to the least clean area
  - If a highly contaminated area is part of the preparation, the area with a lower bacterial count is prepared first, followed by the area of higher contamination
- Only appropriately skilled personnel should perform surgical skin preparation
- Ensure the skin prep has completely evaporated before placing the drape. Once the agent has dried it is no longer flammable.

## Perioperative Oxygenation

- Aim to optimise tissue oxygenation and perfusion peri-operatively. Recommended strategies include appropriate oxygen therapy and ventilation; maintaining normovolemia and cardiac output.

## Normothermia

- Maintain normothermia intraoperatively for off-pump cardiac surgery cases
- The temperature setting on the device should be set at maximum and then adjusted to maintain a patient temperature of at least 36.6°C
- All irrigation fluids used intraoperatively, except for a period of induced hypothermia should be warmed in a thermostatically controlled cabinet to a temperature of 38-40°C
- Fluid warmers are indicated when large amounts of blood, intravenous fluid and or blood products are administered.

## Maintaining Normothermia following Transfer to Cardiothoracic Intensive Care (CT ICU)

- Apply Bair Hugger rewarming blankets as soon as the patient is admitted to CTICU
- Re-warm the patient to 36.5 degrees
- Use continuous blood temperature monitoring to ensure normothermia state
- Once the continuous core temperature monitoring is removed, monitor temperature four hourly via tympanic thermometer
  - If core temperature drops below 36 degrees, reapply the rewarming blanket.

## Lavage of Surgical Cavity

- There is no evidence to support irrigation of the cavity in cardiac surgery or in irrigation of the wound. This practice is not recommended.

## Sternal Wound Dressings

- Use an approved tool to determine patient's risk of sternal wound infection
- In low risk patients apply a hydrocolloid (comfeel) dressing to the sternal wound. Leave insitu until post-op day seven, or until day of hospital discharge

## Overview of Recommendations

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- In moderate to high risk patients apply an incisional negative pressure dressing in the operating theatre. Dressing should be left insitu until post-operative day seven or the day of hospital discharge.

### **Post- operative: Best Practices to Reduce Surgical Site Infections**

#### **Nutrition**

- Commence postoperative nutrition as soon as medically stable
- For the management of nasogastric feeding in the intensive care setting refer to local clinical business rules.



## Section 1 Modifying Patient Risk Factors Outpatient

- 1.1 Smoking Cessation**
- 1.2 Glycaemia Control**
- 1.3 MRSA and MSSA Screening and Decolonisation**
- 1.4 Enhanced Nutritional Support**

### Responsibilities:

Cardiothoracic consultants or delegate/s are responsible for ensuring patients who are referred for cardiothoracic surgery are assessed for surgical site infection risk. When risk factors are identified the consultant or delegate is responsible for implementing strategies to mitigate risk. To maximise efficacy, mitigating strategies, should be implemented prior to hospital admission. The World Health Organisation and the Centres for Disease Control Prevention have identified the following modifiable patient risk factors:

#### Modifiable risk factors include:

- Current smokers
- HbA1c > 6.5% or BGL >10mmol/L
- MRSA or MSSA positive
- Underweight or malnourished

#### Strategies to modify risk factors include:

- Smoking cessation
- Glycaemia control
- MRSA and MSSA screening and decolonisation
- Enhanced nutritional support

### 1.1 Smoking Cessation

**Overview:** The American College of Surgeons & Surgical Infection Society Guidelines<sup>4</sup> recommend smoking cessation four to six weeks before surgery for all current smokers, especially those undergoing procedures with implanted materials. The Centres for Disease Control Review recommends smoking cessation is initiated at least 30 days before surgery.<sup>5 6</sup> The American College of Surgeons support the use of nicotine lozenges, gum and medication to aid in smoking cessation. The Australian and New Zealand College of Anaesthetists in their guidelines on smoking, as related to the perioperative period, emphasise the importance of asking patients preoperatively about their smoking status, advising patients of the specific perioperative risks of smoking and referring patients to locally available smoking cessation support programs.

### Key Recommendations:

Clinicians referring patients for cardiothoracic surgery or clinicians in preadmission clinic will:

- Ask patients preoperatively about their smoking status
- Advise patients who smoke of the specific perioperative risks of smoking
- Refer patients to the NSW Quitline or other smoking cessation support programs
- Offer nicotine replacement therapy such as nicotine lozenges, gum or medication

NSW Quitline provides a free call-back service, including Aboriginal and multilingual advisors (13Quit or 137 848). (Cancer Institute 2018)

## 1.2 Glycaemic Control

### Key Recommendations:

Clinicians referring patients for cardiothoracic surgery or clinicians in the preadmission clinic will:

- **Test HbA1c** level with the aim of identifying degree of glycaemic control prior to admission
- Where practicable patients with poor glycaemic control (HbA1c >9% or blood glucose levels >10 mmol/l) should be referred to the patient's local diabetes care provider for stabilisation of diabetes while waiting for surgery. Referral to an Endocrinologist recommended.

### Target Levels:

Good Glycaemic Control	<b>HbA1c</b> ≤ 7%,
Suboptimal Control	7% to 9%
Poor Control	>9%

### NB: Sodium-glucose co-transporter 2 Inhibitors (SGLT2)

Due to the high risk of euglycemic diabetic ketoacidosis, SGLT2 inhibitors must be ceased two days before theatre. Alternative diabetes medication cover may be required to ensure the patient does not become hyperglycaemic.

## 1.3 Screening and Decolonisation Process

**Overview:** Staphylococcus aureus carriage increases risk of postoperative infection. Decolonise Staphylococcus aureus in positive patients with intranasal mupirocin 2% will reduce risk of postoperative infection. To maximise efficacy of treatment, intra nasal Mupirocin 2% needs to start five days before surgery.<sup>3</sup>

### Key Recommendations:

Clinicians referring patients for cardiothoracic surgery or clinicians in preadmission clinic will:

- Screen for staphylococcus aureus 7-14 days before admission to a SESLHD facility
- Ensure positive patients start decolonisation therapy five days prior to surgery.

### MSSA MRSA Screening Process

#### Ordering Pathology

- Clinicians to order "Nose swab for Staphylococcal culture" screening on EMR
- Note "screening pre cardiothoracic surgery" on request form

#### Checking and Actioning Results

- Treating teams are responsible for checking results prior to surgery and actioning positive results

- POWH: Pre-admission staff member/s will ensure that results are communicated to the consultant. Cardiothoracic Registrar should check results and prescribe decolonisation regimen
- SGH: Infection Prevention and Control Clinical Nurse Consultant will email results directly to Cardiothoracic CNE if screening undertaken in pre-admission clinic
- If the isolate is resistant to the decolonisation regimen, contact Infectious Diseases for input and advice.

### Decolonisation Process

#### Prescribing Mupirocin 2%:

- Decolonisation should only be applied to patients with known colonisation, in line with general principles of antimicrobial stewardship
- If patient is receiving a therapeutic course of anti-staphylococcal treatment, load reduction can still proceed although in general is more successful after active infection is treated
- Consider possible drug interactions and current medications prior to prescribing
- Provide the patient with a script for Mupirocin 2%
- Instruct patient to initiate treatment five days prior to surgery. The patient must be cooperative and able to follow the MSSA/ MRSA decolonisation regimen
- *The surgeon must be aware of the progress of results and status of load reduction program if applicable prior to commencement of surgery*

#### Staphylococcus aureus (MSSA and MRSA) Load Reduction

For details refer to [SESLHDPR/681 - Staphylococcus aureus \(MSSA and MRSA\) decolonization.](#)

## 1.4 Enhanced Nutritional Support

**Overview:** Surgery induces complex changes in the hemodynamic, metabolic and immune responses of the body, which can cause inflammation, affect wound healing and increase mortality.<sup>7</sup> Patients who undergo major surgery have an increased risk of malnutrition due to fasting periods, the stress of surgery, and the subsequent increase in metabolic rate. Pre-existing nutritional status has a profound impact on the immune system.

### Key Recommendations:

Clinicians referring patients for cardiothoracic surgery or clinicians in the preadmission clinic will:

- Record the patient's height / weight and screen for malnutrition. Use the Malnutrition Screening Tool (MST)
- Refer to a dietitian if the patient is aged under 65 and BMI <18.5kg/m<sup>2</sup> or over 65 and BMI <22kg/m<sup>2</sup>

## Section 2 Modifying Patient Risk Factors Inpatient

### 2.1 Modifying Patient Risk Factors Pre-Operative

2.1.1 Smoking Cessation

2.1.2 Glycaemic Control

2.1.3 Decolonisation – Emergency Patients or Patients without a swab result

### 2.2 Delirium Risk Screening

### 2.3 Enhanced Nutritional Support

### 2.4 Sternal Support Vest

### 2.5 Pre-Operative Shower

### 2.6 Hair Removal

#### 2.1.1 Smoking Cessation

##### Overview:

Patients undergoing surgery are more receptive to advice and information provide by health care professionals<sup>8</sup>. Effective smoking cessation interventions are comprised of brief assessment and advice, nicotine replacement therapy (NRT) and referral to a smoking cessation service such as the NSW Quitline<sup>9</sup>.

##### Key Recommendations:

- Smokers are identified and encouraged to quit
- Smokers are offered nicotine replacement therapy such as nicotine lozenges, gum or medication, see [SESLHDPR/760 - Nicotine Replacement Therapy for smoking cessation](#)

NSW Quitline provides a free call-back service, including Aboriginal and multilingual advisors (13Quit or 137 848)

#### 2.1.2 Glycaemic Control

**Overview:** Blood glucose levels rise during and after surgery due to surgical stress. Surgery causes a stress response that results in a release of catabolic hormones and the inhibition of insulin. Surgical stress influences pancreatic beta-cell function, which results in lower plasma insulin levels. Consequently surgical patients are at high risk of hyperglycaemia.<sup>3</sup> Hyperglycaemia is associated with an increased risk of surgical site infections.

##### Key Recommendations:

For optimal management of diabetic surgical inpatients refer to facility clinical business rule:

**POWH:** [POWH/SSEH CLIN023 - Surgery and Medical Procedures for Patients with Diabetes Mellitus](#)

**SGH:** [SGH-TSH BR 226 - Intravenous Insulin Administration - Adults and Maternity](#)

#### **NB: Sodium-glucose co-transporter 2 Inhibitors (SGLT2)**

Due to the high risk of euglycemic diabetic ketoacidosis, SGLT2 inhibitors must be ceased two days before theatre. Alternative diabetes medication cover may be required to ensure the patient does not become hyperglycaemic. Refer to facility clinical business rule for detailed management.

### 2.1.3 Screening and Decolonisation of Emergency Patients

#### Pre-operative Decolonisation for Emergency surgery

- Where colonisation status is unknown at the time of surgery and the patient is assessed as high risk for MSSA/MRSA colonisation (see risk factors below), the patient should be swabbed and load reduction therapy commenced
- Screening swab results must be checked by treating team and load reduction ceased if negative

#### MSSA / MRSA Risk Factors<sup>10</sup>

- Current or recent hospitalisation
- Residing in a long-term care facility
- Invasive procedures such as urinary catheters, arterial lines, or central venous lines
- Recent or long-term antibiotic use
- Family members or close contacts who are health care workers
- Chronic renal dialysis
- Having a weakened immune system, such as in persons with HIV/AIDS
- Living in crowded or unsanitary conditions, such as prisons

Zeller JL, Golub RM. MRSA Infections. *JAMA*. 2011;306(16):1818. doi:10.1001/jama.306.16.1818 [cited April 2018]  
<https://jamanetwork.com/journals/jama/fullarticle/1104555>

#### Ordering MSSA and MRSA screening swabs - SEALS Pathology

- Clinicians to order “Nose swab for Staphylococcal culture” screening on eMR
- Note “screening pre cardiothoracic surgery” on request form

#### Notification of Results

- It is the treating team responsibility to check results
- If results are positive provide patient with a MSSA/MRSA Decolonisation factsheet

#### Mupirocin Resistant strains

- If the isolate is resistant to the decolonisation regimen, consultation with facility Infectious Diseases is recommended

## 2.2 Delirium Risk Screening

**Overview:** Delirium is an acute change in mental status that is common among older hospitalised patients. It is a serious condition that is associated with increased mortality. Prevention is the most effective strategy, but outcomes for patients with delirium can also be improved by early intervention. Confusion and delirium in post-operative cardiothoracic patients can reduce compliance to follow optimal sternal wound management, which in turn can increase risk of sternal dehiscence and sternal wound infection.

Predisposing risk factors	Precipitating risk factors
Age > 65 or ≥ 45 in Aboriginal and Torres Strait Islander peoples	Use of physical restraint
Pre-existing dementia	Use of indwelling catheter
Severe medical illness	Adding three or more medications
History of previous delirium	Multiple bed moves
Visual and hearing impairment	Pain
Depression	Surgery
Abnormal sodium, potassium and glucose	Anaesthesia and hypoxia
Polypharmacy	Malnutrition and dehydration
Alcohol / Benzodiazepine use	

### Key Recommendations:

- Prevent post-operative delirium in cardiothoracic patients through screening, implementation of strategies to prevent and treat underlying causes.
- Refer to [SESLHDPR/345 - Prevention, Assessment and Management of Delirium in Older People](#) for screening tool and interventions to prevent and manage delirium
- Contact Delirium Clinical Nurse Consultants for advice regarding education, support and implementation of processes in relation to delirium.

## 2.3 Enhanced Nutritional Support

**Overview:** A meta-analysis review indicates perioperative nutritional support improves clinical outcomes in malnourished patients. Improved outcomes include reduction in infections, post-operative complications and length of hospital stay.<sup>7</sup> Another study indicated maximising nutritional status pre-operatively reduced adverse clinical outcomes.<sup>11</sup>

### Key Recommendations:

- Record height / weight and screen for malnutrition using the Malnutrition Screening Tool (MST) during pre-admission clinic visit
- Refer to a dietitian if the patient is aged under 65 and BMI <18.5kg/m<sup>2</sup> or over 65 and BMI <22kg/m<sup>2</sup>

## 2.4 Sternal Support Vest

**Overview:** Evidence indicates wearing sternal support devices, in appropriately selected patients, reduces sternal wound complications and is associated with a shorter length of hospital stay<sup>12, 13</sup>

### Recommendations:

- Patients are preoperatively assessed for risk of developing sternal wound complications (see table below)
- In consultation with the Cardiothoracic Surgeon, patients identified as high risk are provided with a sternal support device and education regarding rationale for wearing the garment
- Risk of sternal wound complications are reduced if the support vest is worn for the optimal postoperative period of six weeks

Preoperative Patient Risk Factors <sup>12, 35</sup>	Intraoperative Risk Factors	Postoperative Patient Risk Factors (identified Post-op)
BMI >30% Diabetes Mellitus Ongoing steroid therapy Redo medial sternotomy Respiratory Disease (COPD) Severe osteoporosis Renal insufficiency Female (breast size) Advanced age Current smoker Previous mediastinal irradiation	Use of bilateral internal mammary arteries Prolonged bypass Use of an intra-aortic balloon pump Re-operation Sternal rewiring	Post-operative non-union Confusion /agitation Clicky sternum Severe Cough Postoperative bleeding

## 2.5 Pre- Operative Showering

**Recommendation:** Advise patients to shower or bathe (full body) with soap (antimicrobial or non-antimicrobial) or an antiseptic agent on at least the night before the operative day.

Source: Centres for Disease Control and Prevention Guideline for the prevention of SSI  
 Strength of Recommendation: Category IB—strong recommendation; accepted practice

### Key Recommendations:

- Patients shower or bathe with an antiseptic agent at least the night before surgery

## 2.6 Surgical Hair Removal Prior to Open Heart Surgery

**Recommendation:** For patients undergoing any surgical procedure, hair should not be removed or only if absolutely necessary. If hair is to be removed, a clipper only should be used. Shaving is strongly discouraged at all times, whether preoperatively or in the operating room.

Source: WHO Global Guidelines for the Prevention of Surgical Site Infection  
 Strength of Recommendation: Strong

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**Overview:** Body hair from the perioperative area is traditionally removed prior to open heart procedures. Body hair may obscure visualisation of the surgical site, interfere with suturing, utilisation of adhesive drapes and dressing materials. Surgical site infection risk is reduced if clippers rather than razors are used for hair removal.<sup>14</sup>

**Key Recommendations:**

- If hair removal is required use clippers with a disposable head
- Hair removal should not occur in the operating room
- Time hair removal to occur as close as possible to the operating procedure.



## Section 3 Peri-Operative: Best Practice Preventing Surgical Site Infections

- 3.1 Surgical Hand Scrub**
- 3.2 Prophylaxis Antibiotics**
- 3.3 Skin Preparation**
- 3.4 Peri-operative Oxygenation**
- 3.5 Normothermia**
- 3.6 Lavage Surgical Cavity**
- 3.7 Advanced dressings**

### 3.1 Surgical Hand Scrub

**Recommendation:** Surgical hand preparation is performed either by scrubbing with a suitable antimicrobial soap and water or alcohol based hand rub before donning sterile gloves.

Source: WHO Global Guidelines for the Prevention of Surgical Site Infection  
Strength of recommendation: Strong

**Overview:** The Centre for Diseases Control report that correct hand-washing reduces healthcare associated infections by 30%<sup>2</sup>. A standardised procedure for the surgical scrub allows members of the surgical team to consistently follow a protocol designed to achieve an effective surgical scrub.

#### Key Recommendations:

- All members of the surgical scrub team must follow established hand hygiene practices to maintain healthy skin and fingernail condition. All jewellery should be removed from the hands and arms prior to commencing a surgical scrub
- The surgical team should follow a standardised procedure for the pre-surgical scrub using skin antiseptic.

#### Summary of Literature Review:

Traditionally, surgical hand scrubbing is performed with antibacterial agents and cleaning with stiff brushes and flowing water. Alcohol-based dry-fast hand scrubs have been introduced to surgical hand washing by the end of 1990s.<sup>15</sup> Current evidence suggest that alcoholic hand rub is as effective as washing with povidone iodine.<sup>16</sup>

### 3.2 Prophylaxis Antibiotics

**Overview:** Randomised controlled trials have shown conclusively that appropriate surgical antibiotic prophylaxis reduces the rate of superficial and deep surgical site infections. Gram positive organisms, in particular *Staphylococcus aureus* and coagulase negative staphylococci, and Aerobic Gram-negative organisms are important causes of postoperative infection.

The appropriate use of surgical antibiotic prophylaxis reduces the rate of surgical site infections. Compliance with local guidelines that recommend the selection of appropriate

antibiotic(s), correct antibiotic dose, ideal timing of administration, and correct redosing regimen is endorsed.

### Key Recommendations:

- For prophylaxis the use of **CEFAZOLIN 2 g (3 g if >120 kg) within 60 minutes before incision**, ideally 15-30 minutes before incision.
- Re-dose CEFAZOLIN at same dose if surgery  $\geq$  4 hours OR massive blood loss; timing based on **creatinine clearance, which may be approximated by eGFR**.
  - **CrCl > 50 mL/min** (eGFR >60 mL/min/1.73m<sup>2</sup>): re-dose at 4 hours;
  - **CrCl 20-50 mL/min**: re-dose at 8 hours;
  - **CrCl < 20 mL/min**: re-dose at 16 hours
- CEFAZOLIN dosing should be repeated **postoperatively** every eight hours for up to two further doses<sup>17</sup>
- Vancomycin should be added for patients who are known to be, or are at risk of being, **colonised or infected with MRSA**<sup>5, 17</sup> at a dose of 15 mg/kg started 30-120 minutes before incision (recommended infusion rate 10 mg/minute, this dose should be repeated postoperatively 12 hours after the initial dose).<sup>17</sup>
  - Vancomycin is not recommended as the sole prophylactic antibiotic as it has a narrower antimicrobial spectrum, inferior tissue and bone penetration, less desirable pharmacokinetics and slower bactericidal effects compared to cephalosporins.<sup>5</sup>
- For patients with a history of immediate hypersensitivity to penicillins, vancomycin and gentamicin (5 mg/kg) should be used as vancomycin lacks gram negative coverage<sup>5, 17</sup>
  - It's recognised that the combination of vancomycin and an aminoglycoside is associated with both nephrotoxicity and ototoxicity with delayed excretion after cardiopulmonary bypass. Therefore, a single preoperative dose of gentamicin is recommended.<sup>5 18</sup>.

[SGH-TSH BR 569 Antimicrobial Stewardship \(AMS\)- Surgical Antibiotic Prophylaxis Guideline](#)

### Summary of Literature Review:

- The Australian Therapeutic Guidelines recommend the use of a first generation cephalosporin, such as **cefazolin as the preferred drug for prophylaxis** in cardiac surgical patients, however it emphasises that antibiotic selection may need to be modified according to patient risk factors such as the presence of a pre-existing infection, recent antibiotic use, known colonisation with multi-resistant organisms e.g. MRSA, and environmental factors such as the organisms causing infection and the patterns of antibiotic susceptibility within the hospital, and the potential selection pressure of antibiotic use.

- The **optimal time** for preoperative intravenous antibiotic administration is within the 60 minutes before surgical incision <sup>4,17, 19, 20</sup> however ideally this should be within 15 to 30 minutes before surgical incision <sup>17, 21</sup>
- Due to the long infusion time required for the administration of Vancomycin, it is recommended that it be commenced 30 to 120 minutes before surgical incision <sup>17, 20</sup>
- A **repeat intraoperative dose** of CEFAZOLIN may be required if the procedure is prolonged. Re-dose CEFAZOLIN at same dose if surgery  $\geq$  4hour OR massive blood loss; timing based on **creatinine clearance, which may be approximated by eGFR.**
  - CrCl  $>$  50 mL/min (eGFR  $>$  60 mL/min/1.73m<sup>2</sup>): re-dose at 4 hours;
  - CrCl 20-50 mL/min: re-dose at 8 hours;
  - CrCl  $<$  20 mL/min: re-dose at 16 hours
- This dosing interval should be adjusted depending on the patient's renal function.<sup>18</sup> Repeat dosing may also be required in the event of massive blood loss during the procedure. The American College of Surgeons and Surgical Infection Society Guidelines recommend antibiotic re-dosing for every 1500 mL of estimated blood loss <sup>4</sup>
- **Postoperative doses** of intravenous antibiotics are recommended in cardiac surgery, but this should not extend beyond 24 hours
- Antibiotic pharmacokinetics are altered in **obese patients**. Therefore, dosage adjustment should be considered in this patient group. The American College of Surgeons and Surgical Infection Society Guidelines recommend antibiotic dosing for prophylaxis should be adjusted for weight. <sup>4</sup>

### 3.3 Skin Preparation

**Recommendation:** Use an alcohol based antiseptic solution preferably based on Chlorhexidine gluconate for surgical site skin preparation in patients undergoing surgical procedures. Solution must be allowed to dry by evaporation. Do not allow solution to pool under the patient. Staff should be trained/informed about potential harms and how to minimise risk.

Source: WHO Global Guidelines for the Prevention of Surgical Site Infection  
Strength of Recommendation: Strong

**Recommendation:** Perform intraoperative skin preparation with an alcohol-based antiseptic agent unless contraindicated.

Source: Centres for Disease Control and Prevention Guideline for the Prevention of SSI  
Strength of Recommendation: Category IA—strong recommendation; high-quality evidence

**Overview:** An effective antimicrobial agent should contain broad spectrum properties. Povidone–Iodine releases free Iodine during the drying process to kill bacteria. It is not required to be applied multiple times. Chlorhexidine-alcohol has been used as the gold standard to reduce surgical site infections worldwide for over a decade. Alcohol is highly

bactericidal and effective for preoperative skin antisepsis, however does not have persistent activity when used alone. When combined with chlorhexidine gluconate or an iodophor (e.g. povidone iodine) antisepsis is persistent and cumulative.<sup>21</sup>

Alcohol based skin preparations are rapid acting and are considered one of the most effective bactericides affecting gram positive and negative bacteria.<sup>22</sup> Alcohol solutions are flammable and can present a fire risk in the operating theatre due to the combination of alcohol in the skin preparation, oxygen rich environments and heat producing sources such as a diathermy.<sup>22</sup> Once the agent is dried (via evaporation) it is no longer flammable.<sup>21</sup> Despite the risk, fires in the operating theatre are rare and can be prevented by allowing the skin prep to thoroughly dry.<sup>23</sup>

### Key Recommendations:

- Use a dual agent skin preparation containing alcohol i.e. chlorhexidine gluconate or an iodophor
- Dual agent skin preparation is contraindicated if there is a known allergy to any of the components of the agent
  - Ensure the surgical site is free of soil, debris, cosmetics and jewellery
  - Preparation commences from the cleanest area (operative or incision site) and proceeds to the least clean area
  - If a highly contaminated area is part of the preparation, the area with a lower bacterial count is prepared first, followed by the area of higher contamination
  - The prepared area allows for extension of the incisions, potential drape shift and placement of drains and:
    - The preservation of skin integrity
    - The maintenance of aseptic technique
    - The prevention of pooling solution
    - The allowance of adequate contact time, drying time and vapour dissipation of the antimicrobial agent
      - Skin preparation of the patient is performed as per relevant ACORN Standards in conjunction with manufacturer's recommendations
      - Only appropriately skilled personnel should perform surgical skin preparation. The effectiveness of the skin prep is influenced by the knowledge of the:
        - Surgical site and procedure
        - Antimicrobial agent properties and application technique
        - The risk of the harm to the patient from interaction of the antimicrobial agent with other surgical equipment (such as ignition of the agent causing fire or chemical reaction)
- To eliminate the risk of fire ensure the prepped area is allowed to air dry completely before placing the drape on the patient and there is no pooling of solution under the patient
- The following criteria is documented:
  - Skin condition and integrity
  - Hair removal method, location and time
  - Type of antimicrobial agent used
  - Details of skin reaction, if any

- Postoperative skin assessment
  - The Instrument and Circulating Nurse must be aware of fire prevention strategies and how to manage a fire in the operating theatres, and ensure sufficient drying time is allowed for flammable skin prep solution and that the solution does not pool under the patient.

### 3.4 Perioperative Oxygenation

**Overview:** Tissue hypo perfusion and hypoxia is associate with an increased risk of surgical site infections. Tissue oxygenation is a strong predictor of SSI.<sup>24</sup> Bacteria in wounds are usually killed by intracellular oxidative mechanisms inside the leukocyte, and molecular oxygen is necessary for production of oxygen free radicals, especially bacterial superoxide. There is a direct correlation between the subcutaneous partial pressure of oxygen ( $pO_2$ ) and resulting postoperative wound infection, the critical level for this is a  $pO_2$  less than 30-40mmHg.<sup>25</sup> Improving tissue perfusion and oxygenation should therefore reduce the risk of wound infections.

### Key Recommendations:

- Aim to optimise tissue oxygenation and perfusion peri-operatively
- Recommended strategies include appropriate oxygen therapy and ventilation; maintaining normovolemia and cardiac output.

### Summary of Literature Review:

A major aim in cardiac anaesthesia is to ensure optimal oxygenation and perfusion of the heart and other end organs and tissues.<sup>26</sup> This can be challenging, as often the patients have severe cardiac disease and a host of other comorbidities including lung disease. When possible, the patient's medical condition is optimised preoperatively. Typically, intraoperatively an FIO<sub>2</sub> of 1.0 is used during cardiac surgery to maximise the arterial oxygen tension.<sup>26, 27</sup> A lower inspired oxygen concentration of 80% may prevent absorption atelectasis and reduce the risk of oxygen toxicity.<sup>26</sup> The use of PEEP, lung recruitment manoeuvres, aggressive pulmonary toilet and optimising ventilatory strategies are also used to improve oxygenation.<sup>28</sup> Any reversible contribution to hypoxia is addressed such as treatment of pulmonary oedema, bronchospasm, mucous plugging or pneumothorax.

Pulse oximetry and arterial blood gases are used to guide oxygenation and ventilation intraoperatively. Transfusion of blood products is frequently required to ensure optimal delivery of oxygen to the tissues. Cardiac output, atrial and ventricular filling pressures and transoesophageal ECHO as well as indicators of end organ and tissue perfusion such as mixed venous oxygen saturation, blood lactate, base excess, urinary output and near infrared spectroscopy are used to guide optimal volume resuscitation and the administration of vasopressors and inotropic agents.<sup>26, 27, 28</sup>

### 3.5 Normothermia

**Recommendation:** Maintain perioperative normothermia except for the period of cardiopulmonary bypass.

Source: Centres for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infections

Strength of Recommendation: Category IA—strong recommendation; high to moderate-quality evidence

**Overview:** Hypothermia, defined as a core body temperature less than 36.8<sup>0</sup> Celsius, commonly develops in patients during anaesthesia and surgery. Even mild hypothermia can be associated with adverse outcomes including myocardial ischemia, arrhythmias, coagulopathy and platelet dysfunction leading to increased blood loss, and an increased risk of SSI.

The benefits of induced hypothermia during cardiopulmonary bypass is well described; normothermia should be maintained at other times intraoperatively. Pre-warming using forced air warming devices, the use of forced air warming devices intraoperatively, the warming of irrigation fluid and the use of intravenous fluid warmers are recommended.

Forced air warming devices are the most effective method to maintain temperature during surgery.<sup>29</sup>

**Key Recommendations:**

- It is recommended that normothermia is maintained intraoperatively for off- pump cardiac surgery cases. The temperature setting on the forced air warming device should be set at maximum and then adjusted to maintain a patient temperature of at least forced 36.6°C.<sup>30</sup>
- Core temperature is the best single indicator of body temperature. During open heart and thoracic surgery core temperature is best measured from the nasopharynx or tympanic membrane, as the ambient temperature may affect the open thoracic cavity (i.e. the temperature measured from the oesophagus will be less accurate)
- Heat loss from the administration of cold intravenous fluids also contributes to hypothermia. The administration of 1 litre of fluid at room temperature will reduce the mean body temperature by 0.25°C<sup>29</sup>. Fluid warmers are indicated when large amounts of blood, intravenous fluid and or blood products are administered
- All irrigation fluids used intraoperatively, except for a period of induced hypothermia should be warmed in a thermostatically controlled cabinet to a temperature of 38-40°C in order to prevent heat loss.<sup>29</sup>

**Normothermia following Transfer to CT ICU**

- Apply Bair Hugger rewarming blankets as soon as the patient is admitted to CTICU.
- Re-warm patients to 36.5 degrees
- Use continuous blood temperature monitoring to ensure normothermia state
- Once the continuous core temperature monitoring is removed, monitor temperature four hourly via tympanic thermometer
- If core temperature drops below 36 degrees, reapply the rewarming blanket.

**Summary of Literature Review:**

Normally following the induction of anaesthesia, the fall in body temperature occurs in three phases. The greatest drop occurs in the first half hour or phase one, this is due to vasodilatation combined with an altered cold threshold in the hypothalamus which allows a redistribution of body heat from the core tissues to the skin where heat is lost through radiation, phase two commences after about an hour as core temperature falls more slowly and proceeds in a linear manner as heat lost is greater than heat production. The final phase commences at three to five hours as equilibrium is reached where heat lost is matched by heat production and thermoregulatory vasoconstriction.

Traditionally induced intraoperative hypothermia has been extensively used in cardiac surgery involving cardio-pulmonary bypass or circulatory arrest. Relatively small degrees of hypothermia can offer significant cerebral protection, as the structural and functional cerebral metabolic rate decreases by six to seven% per degree centigrade reduction in temperature.

In off pump cardiac surgery (OPCAB) a patient's temperature is influenced by the same environmental sources of heat loss as that of patients having non cardiac surgery.

Additionally, because the thorax is open and the extremities are exposed for vein harvest, maintaining normothermia is difficult. Hannan et al demonstrated that OPCAB patients who developed even mild hypothermia had significantly higher rates of sternal wound infection, sepsis, respiratory failure and bleeding<sup>31</sup>. Normally for patients that require cardiopulmonary bypass a fall in core temperature occurs after bypass has been terminated, in part because of redistribution of heat within the body and further because of heat loss. This decline in temperature will be greater if difficulties are encountered and the chest remains open for an extended period and if transfusion of large volumes of blood products are needed for excessive bleeding. Often by the time the patient is admitted to the intensive care unit the core temperature may be 35°C, especially after off-pump cases.

The operating room temperature is the most critical factor influencing heat loss, because it determines the rate at which metabolic heat is lost by radiation and convection from the skin and by evaporation from within skin incisions. Consequently, increasing the room temperature is one way to minimise heat loss. The National Institute for Healthcare and Care Excellence (NICE) guidelines recommend that the room temperature should be above 21°C when the patient is exposed and that the patient should be covered during the procedure. The **forced air warming device** is the most effective method to maintain temperature during surgery.<sup>29</sup> It is best placed over the patient as it provides insulation and cutaneous warming.

### 3.6 Lavage Surgical Cavity

**Overview:** The evidence to support intracavity lavage and wound irrigation with either an antiseptic or antibacterial is the subject of a recent Cochrane Review<sup>32</sup>

The summary from the Cochrane review goes on to state:

“Twenty studies involving 7192 participants compared washing out with no washing. The results showed no clear difference in SSI rates (low-certainty evidence). Antibacterial washing solutions may reduce infection rates compared with non-antibacterial solutions (low certainty evidence from 36 trials involving 6163 participants.)

Two studies involving 484 participants compared standard washing methods (pouring using a jug or a syringe) with pumping or pulsing the washing solution. There may be fewer SSIs when the solution is pumped into the wound (low-certainty evidence).

There may be fewer SSIs when a solution of povidone iodine is used compared with an alternative antiseptic (superoxidised water, Dermacyn) (low-certainty evidence from one trial with 190 participants). The results for all other comparisons showed no clear differences or were very uncertain. Wound reopening (dehiscence), infections, which are hard to treat with antibiotics, and deaths were not widely reported. Washing out wounds may not affect the length of time people stay in hospital (low- or moderate-certainty evidence)”



**Key Recommendations:**

- There is no evidence to support irrigation of the cavity in cardiac surgery or in irrigation of the wound. This practice is not recommended.

**Summary of Literature Review:**

A total of 20 studies were reviewed involving 7192 participants. This included one study, which examined wound irrigation in 190 patients having cardiac surgery (Mohd 2010 Dermacryn in reducing infection of a median sternotomy wound). Patients having cardiac bypass surgery had the closed wound soaked in either povidone iodine or Dermacryn (superoxidised water) for 15 minutes. There appeared to be a reduction in infections in the Dermacryn group, but the quality of the evidence was deemed low. An earlier study (1990), compared intracavity lavage with povidone iodine versus no lavage for patients undergoing early repeat sternotomy (22 had lavage and 21 did not). The results suggested a reduction in post-operative wound infection. No further publications were identified.

**3.7 Sternal Wound Dressings / Advanced dressings**

**Overview:** There is a substantial body of evidence to support the use of negative pressure wound therapy on closed surgical wounds to prevent post-operative SSI.<sup>33</sup>

The majority of studies, in relation to closed incisional negative pressure therapy, reported negative pressure therapy was associated with decreases in wound complications, wound dehiscence, SSIs, haematoma/ seroma formation and incisional drainage.<sup>34</sup>

**Key Recommendations:**

- Use of an approved tool (eg. Fowler score) to determine patient's risk of sternal wound infection (see appendix)
- In low risk patients apply a hydrocolloid (comfeel) dressing to the sternal wound. Leave insitu until post-op day seven or until day of hospital discharge.
- In moderate to high risk patients apply an incisional negative pressure dressing in the operating theatre. Dressing should be left insitu until post-operative day seven or the day of hospital discharge.

**3.8 Nutritional Support**

Oral diet should be commenced as soon as suitable to avoid unnecessary fasting<sup>35</sup> For patients in the critical care setting who are not suitable for oral diet, enteral nutrition should be commenced within 24-48 hours. If enteral nutrition is not tolerated after the usual troubleshooting (e.g. prokinetics, post-pyloric feeding), parenteral nutrition should be commenced.

**Key Recommendations:**

- Commence postoperative nutrition as soon as medically stable
- For the management of nasogastric feeding in the intensive care setting refer to local clinical business rules.

## References

- <sup>1</sup> Mazzeffi M., G. J.-L. (2017). Healthcare-associated infections in cardiac surgery patients with prolonged intensive care unit stay. *Ann Thorac Surg*, 1163-70.
- <sup>2</sup> Centres for Disease Control and Prevention. (2017). Guideline for the Prevention of surgical site infection. *JAMA Surgical*.
- <sup>3</sup> World Health Organisation. (2016). Global Guidelines for the prevention of surgical site infection. Geneva: World Health Organisation
- <sup>4</sup> American Cof Surgeons and Surgical Infection Society. (2016 ). Surgical Site Infection Guidelines 2016 Update.
- <sup>5</sup> Lazar HL, Vander S, Engelman R, Orgill D, Gordon S. (2016). Prevention and management of sternal wound infections. *J Thorac Cardiovasc Surg*, 962-72.
- <sup>6</sup> Mangram AJ, Horan TC, Pearson ML, Silver J, Jarvis W. (2008). Guideline for prevention of surgical site infection. *Infect Control Hops Epidemiol*, S51-61.
- <sup>7</sup> Culebras. (2013). Malnutrition in the twenty-first century: an epidemic affecting surgical outcome. *surg Infect*, 14 (3), 237-43.
- <sup>8</sup> Fong. (2018). Perioperative Smoking Cessation Interventions. The Joanna Briggs Institute
- <sup>9</sup> Cancer Institute. (2018). Smoking Cessation Framework for HSW Health Services. Sydney: Cancer Institue NSW.
- <sup>10</sup> Zeller JL, Golub RM. MRSA Infections. *JAMA*. 2011;306(16): 1818.doi:10.1001/jama.306.16.1818 [cited April 2018]  
<https://jamanetwork.com/journals/jama/fullarticle/1104555>
- <sup>11</sup> Zhong J, K. k. (2015). effect of nutritional support on clinical outcomes in peroperative malnourished patients: a meta-analysis. *Asia Pac J Clin Nutr*, 24 (3), 367-378.
- <sup>12</sup> Gorlitzer M., W. F. (2010). A prospective randomised multicentre trial shows improvement of sternum related complications in cardiac surgery with the Posthorx support vest. *Interactive Cardiovascular & Thoracic surgery*, 714-718.

- 
- <sup>13</sup> Tsang W, Modi A, Ahmed I Ohri S. Do external support devices reduce sternal wound complications after cardiac surgery? 2016. *Interactive CardioVascular and Thoracic Surgery*, 23, 6 957-961.
- <sup>14</sup> Gillespie B, Polit D, Hamlin L, Chaboyer W. (2012). Developing a model of competence in the operating theatre: psychometric validation of the perceived preoperative competence scale-revised. *International Journal of Nursing Studies*, 60-101.
- <sup>15</sup> Chen S, C. C. (2014). Antibacterial effects on dry-fast and traditional water-based surgical scrubbing methods: A two-time point experimental study. *Nursing and Health Sciences*, 179-185.
- <sup>16</sup> Liu L, Mehigan S. (2017). The effects of surgical hand scrubbing protocols on skin integrity and surgical site infection rates: a systematic review. *ACORN*, 21-30.
- <sup>17</sup> Australian Therapeutic Guidelines. (2022). Surgical antibiotic prophylaxis: *Therapeutic Guidelines summary tables*. [ABG16-Surgical-antibiotic-prophylaxis-Collated-table-v4.pdf](#)
- <sup>18</sup> Guidelines for surgical antibiotic prophylaxis for prevention of surgical site infection in cardiac surgical patients at Prince of Wales Hospital
- <sup>19</sup> Bratzler D, Dellinger E, Olsen K, Perl T, Auwaeter P et al. (2013). Clinical practice guidelines for antimicrobial prophylaxis in surgery. *Surg Infect*, 73-156.
- <sup>20</sup> Scottish Intercollegiate Guidelines Network. (2014). Antibiotic prophylaxis in surgery.
- <sup>21</sup> Anderson D, Podgorny K, Berrios-Torres S, Bratzler D, Dellinger E et al. (2014). Strategies to prevent surgical site infections in acute care hospitals. *Infect Control Hosp Epidemiol*, S66-88.
- <sup>22</sup> Department of Health Queensland Government. (2012). Centre for Health care related infection surveillance and prevention and tuberculosis control. Guideline surgical skin disinfectant . Brisbane: Department of Health Queensland Government.
- <sup>23</sup> NSW Government Ministry of Health. (n.d.). Safe use of alcohol based skin procedures for surgical and anaesthetic procedures. NSW Health Safety Information.
- <sup>24</sup> Kurz A, Fleishmann E, Sessler D, Buggy D, Apfel C, Akca O. (2015). Effects of supplemental oxygen and dexamethaxone on surgical site infection: A factorial randomised trial. *Br J Anaes*, 115 (3): 343-443.

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- <sup>25</sup> Finn Gottrup Oxygen in wound healing and infection World J Surg 2004.28, 312-315
- <sup>26</sup> Hensley FA, Martin DE, Gravlee GP. (n.d.). Cardiac Anaesthesia.
- <sup>27</sup> Miller RD. (n.d.). Temperature Monitoring. Anaesthesia.
- <sup>28</sup> Murray MJ, Coursin DB, Pearl RG, Prough DS. (n.d.). Critical Care.
- <sup>29</sup> Sessler DI, Moayeri A. (1970). Skin surface warming:heat flux and central temperature. Anaesthesiology, 73:218
- <sup>30</sup> National Institute for Healthcare and Care Excellence, 2008.
- <sup>31</sup> Hannan EL, Samadashvili Z, Wechsler A, Jordan D, Lahey SJ, et al. (2010). The relationship between perioperative temperature and adverse outcomes after off pump coronary artery bypass grafting . Journal of Thoracic and Cardiovascular Surgery.
- <sup>32</sup> Norman G, Atkinson R, Smith T, Rowlands C, Rithalia AD et al. (2017). Intracavity lavage and wound irrigation for prevention of surgical site infection (Review).
- <sup>33</sup> Dohmen P., M. T. (2014). Use of incisional negative pressure wound therapy on closed median sternal incisions after cardiothoracic surgery: Clinical evidence and consensus recommendations. Med Sci Monit, 1814-1825
- <sup>34</sup> Willy C, Engelhardt M, Stichling M, Grauhan O. The impact of surgical site occurrences and the role of closed incision negative pressure therapy. 2016 International Wound Journal ISSN 1742-4801
- <sup>35</sup> Weimann A, Braga M, Carli f, Higashiguchi T, Hubner M. et al. ESPEN Guideline: Clinical nutrition in surgery 2017. Clin Nutr June; 36(3): 623-650
- Hani N, Mufti M, Hirsch G. Perioperative prediction of agitated (hyperactive) delirium after cardiac surgery in adults – The development of a practical scorecard. 2017. Journal of Critical Care 42 192-199

## Appendix A: SESLHD Cardiothoracic Surgical Site Infection Care Bundle

SESLHD Cardiothoracic Surgical Site Infection Care Bundle				
<b>Modifying Patient Risk Factors</b> <b><u>Outpatient</u></b>	<b>Bundle Elements</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
<b>Smoking Cessation</b>	Smokers are identified and encouraged to quit at the time of referral.			
	Referral to NSW Quitline or other service (13Quit or 137 848)			
	Nicotine replacement therapy offered to those receptive to quit			
<b>Glycaemic Control</b>	HbA1c level tested pre admission			
	If HbA1c 7% - 9% or BGL > 10mmol/L referred to GP for diabetes management			
	If HbA1c ≥ 9% or BGL ≥ 12 mmol/L referred to local Diabetes Care provider for diabetes stabilisation prior to surgery			
<b>MRSA &amp; MSSA Screening</b>	Screened for MRSA and MSSA (nose and groin), 10-14 days prior to OT			
	Results checked within 48 hours			
<b>Decolonisation Treatment</b>	+ve patients start intranasal mupirocin 2% ointment five days before OT date			
	+ve patients start aqueous Chlorhexidine washes five days before OT date			
	Decolonisation patient information provided			

## Modifying Patient Risk Factors Outpatient

Most patients attending NSW Health Services who smoke do not receive smoking cessation interventions (Cancer Institute, 2018). Patients undergoing surgery have been found to be more receptive to advice and information provided by health care professionals (Fong, 2018).

Effective smoking cessation interventions comprise brief assessment and advice, nicotine replacement therapy (NRT) and referral to a smoking cessation service.

Benefits of smoking cessation are exponential over time. Within weeks of cessation immune function is improved in individuals who quit smoking. Two meta-analyses demonstrated reduced wound complications four weeks after smoking cessation (Truntzer, 2017). In another study a perioperative smoking intervention at 4 weeks prior to surgery demonstrated a significant reduction in the complication rate.

There is also convincing evidence that active smokers at the time of cardiac surgery have a higher incidence of infective complications and increased mortality (Sepebripor AH, 2012) (Jones R, 2011).

Quitting for 3 weeks has been shown to improve wound healing (Kuri M, 2005). Quitting for 6 weeks decreases sputum volumes to normal and improves pulmonary function and at 6 months immune function is significantly recovered (Kotani N, 2001).

Hyperglycaemia is associated with an increased risk of surgical site infections. (World Health Organisation, 2016).

Staphylococcus aureus is a common cause of infections. A large proportion of infections due to Staphylococcus aureus originate from the patient's own flora (World Health Organisation, 2016). MRSA and MSSA can be effectively treated with nasal Mupirocin 2% (Schweizer, 2015). To maximise efficacy of treatment, Mupirocin 2% needs to start 5 days before OT.

<b>Modifying Patient Risk Factors <u>Inpatient</u></b>	<b>Bundle Elements</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
<b>Smoking Cessation</b>	Smokers are identified and encouraged to quit using the 5 “A” approach			
	Smokers are referred to QUIT line or other service (13Quit or 137 848)			
	Nicotine replacement therapy offered to those receptive to quit			
<b>Glycaemic Control</b>	Local CBRs are followed for the management of diabetic surgical patients POWH <a href="#">POWH/SSEH CLIN023 - Surgery and Medical Procedures for Patients with Diabetes Mellitus</a> SGH <a href="#">SGH - TSH BR 226 - Intravenous Insulin Administration - Adults and Maternity</a>			
<b>MRSA and MSSA Screening Decolonisation</b>	If MRSA and MSSA results not available within 5 days of OT, patient is risk assessed for MRSA and MSSA carriage (see MRSA /MSSA risk assessment tool)			
	If identified as high risk intranasal Mupirocin 2% ointment commenced			
	Decolonisation treatment ceased if swabs return -ve			
<b>Delirium Prevention</b>	Prevent post-operative delirium in cardiothoracic patients through screening, implementation of strategies to prevent and treat underlying causes. Screening and strategies are followed as per <a href="#">SESLHDPR/345 - Prevention, Assessment and Management of Delirium in Older People</a>			

<b>Enhanced Nutritional Support</b>	Patient screened for underweight / at risk of malnutrition using the Malnutrition Screening tool			
	Patients with a Malnutrition Screening score $\geq 2$ are referred to a Dietitian <ul style="list-style-type: none"> <li>• Patients aged 65 years or over with a BMI <math>&lt; 22 \text{ kg/m}^2</math> are referred to a Dietitian</li> <li>• Patients aged under 65 years with a BMI <math>&lt; 18.5 \text{ kg/m}^2</math> are referred to a Dietitian</li> </ul>			
<b>Wound Management Sternal Support Vest</b>	Patients are risk assessed for potential to develop sternal wound complications			
	Patients identified high risk, are considered for a sternal support vest			
<b>Pre-operative shower</b>	Patient has showered or bathed with an antiseptic agent at least the night before theatre			



## Modifying Patient Risk Factors Inpatient

Patients who undergo major surgery have an increased risk of malnutrition due to fasting periods, the stress of surgery, and the subsequent increase in metabolic rate. Nutritional status can have a profound impact on the immune system. (Zhong, 2015)

Surgery induces complex changes in the hemodynamic, metabolic and immune responses of the body, which can cause inflammation, affect wound healing and increase mortality (Culebras, 2013). Patients who undergo major surgery have an increased risk of malnutrition due to fasting periods, the stress of surgery, and the subsequent increase in metabolic rate. Nutritional status can have a profound impact on the immune system. Malnutrition associated with a weakened immune system and impaired stress resistance results in an inability to effectively respond when it encounters stress such as major surgery, trauma and infection with an estimated 55% of patients undergoing major cardiovascular surgery acquiring an infection (Zhong J, 2015) , (Culebras, 2013) (Tepaske R, 2001)

There is evidence that early use of external non-elastic sternal support devices reduces sternal wound complications and may be associated with a shorter length of hospital stay (Tsang, et al. 2016)

Randomized controlled trial evidence suggested uncertain trade-offs between the benefits and harms regarding the optimal timing of the preoperative shower or bath, the total number of soap or antiseptic agent applications, or the use of Chlorhexidine gluconate washcloths for the prevention of SSI. (Berrios-Torres S, Umscheid C, Bratzler D, Leas B, Stone E et al, 2017)

Reducing SSIs Intra-Operative	Bundle Elements	Yes	No	N/A
Surgical Hair Removal	Hair removal is restricted to what is surgically necessary			
	Hair removal is via electric clippers with a single-use head			
	Hair removal is timed to occur as close as possible to the operating procedure			
	Hair removal is performed in non OT area			
Prophylactic Antibiotics	First dose of prophylactic cefazolin 2g given within 60 minutes (ideally 15-30 minutes) before incision			
	An alternative prophylactic antibiotic is given to patients with a history of immediate hypersensitivity to penicillins			
Skin Preparation	Skin prepped with 2% Chlorhexidine gluconate in 70% isopropyl alcohol solution or iodine/alcohol solution (unless contraindicated) and allowed to dry by evaporation			
	Skin prep timed to occur immediately before incision			
	Pooling of preparation avoided			
	Skin prep applied with the appropriate technique			
Normothermia	Aim for normothermia pre and post bypass			
	Forced air warming devices set at maximum and then adjusted to maintain a patient temperature of at least 36.6°C			
	All irrigation fluids used intraoperatively, except for a period of induced hypothermia should be warmed in a thermostatically controlled cabinet to a temperature of 38-40°C to prevent heat loss (National Institute for Healthcare and Care Excellence, 2008)			
	Fluid warmers are indicated when large amounts of blood, intravenous fluid and or blood products are administered			
Glycaemic Control	BGL within target range 5mmol/L to 10mmol/L			
	If on an insulin infusion, BGL checked hourly			

<b>Optimal Tissue Oxygenation and Tissue Perfusion</b>	Maintain appropriate FiO2 / Ventilation / cardiac output			
<b>Wound Management Negative Pressure Dressing</b>	Patients with risk factors for sternal wound complications are identified Patients identified as high risk (modified Fowler score > 10) are considered for negative pressure wound management			
	In appropriately selected patients PICO negative pressure dressing applied in the operating theatre and left insitu for six to seven days			
	Low risk patients have a hydrocolloid (comfeel) dressing applied in the operating theatre and left insitu until post-op day seven or until day of hospital discharge			

## Reducing SSIs Intra-Operative

For patients undergoing any surgical procedure hair either should not be removed or only on the basis of necessity, removed only with a clipper. Shaving is strongly discouraged at all times, whether preoperatively or in the OR. (World Health Organisation, 2016)

Prophylactic antibiotics are timed to optimise bactericidal concentration in the serum and tissues when the incision is made. (Therapeutic Guidelines: Antibiotic, version 16. 2019). Aim for appropriate antibiotic selection, dose, and timing of first and repeat dose.

The Australian Therapeutic Guidelines (Therapeutic Guidelines: Antibiotic, version 16. 2019) recommend the use of a first generation cephalosporin, such as cefazolin as the preferred drug for prophylaxis in cardiac surgical patients, however it emphasises that antibiotic selection may need to be modified according to patient risk factors such as the presence of a pre-existing infection, recent antibiotic use, known colonisation with multi-resistant organisms e.g. MRSA, and environmental factors such as the organisms causing infection and the patterns of antibiotic susceptibility within the hospital, and the potential selection pressure of antibiotic use

Alcohol based antiseptic solutions for surgical site skin preparation are more effective to aqueous solutions in reducing SSI (World Health Organisation, 2016)

The benefits of induced hypothermia during cardiopulmonary bypass is well described; normothermia should be maintained at other times during the intraoperative period.

Core temperature is the best single indicator of body temperature. During open heart and thoracic surgery core temperature is best measured from the nasopharynx or tympanic membrane, as the ambient temperature may affect the open thoracic cavity (i.e. the temperature measured from the oesophagus will be less accurate)

There is a substantial body of evidence to support the use of negative pressure wound therapy on closed surgical wounds to prevent post-operative SSI (Dohmen et al, 2014).

A majority of studies of closed incisional negative pressure therapy reported that use was associated with decreases in wound complications, wound dehiscence, SSIs, haematoma/ seroma formation and incisional drainage (Willy et al 2016).

<b>Reducing SSIs Post –Operative</b>	<b>Bundle Elements</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
<b>Normothermia</b>	Warming device (i.e. Bair Hugger rewarming blankets) applied to patient directly on admission to CTICU			
	Re-warmed to 36.5 degrees			
	If the patient's core temperature drops below 36 degrees, the rewarming blanket is re applied			
<b>Prophylactic Antibiotics</b>	For prophylaxis the use of cefazolin 2g repeated postoperatively every eight hours for up to two further doses. (Therapeutic Guidelines: Antibiotic, version 16. 2019)			
<b>Glycaemic Control</b>	BGL within target range 5mmol/L to 10mmol/L			
<b>Timely Extubation</b>	Protocol driven extubation			
<b>Nutrition</b>	Oral diet should be commenced as soon as suitable to avoid unnecessary fasting			
	For patients in the critical care setting who are not suitable for oral diet, enteral nutrition should be commenced within 24-48 hours.			
	If enteral nutrition is not tolerated after the usual troubleshooting (e.g. Prokinetics, post-pyloric feeding), parenteral nutrition should be commenced			
<b>Wound Management Sternal Support Vest</b>	Patients are risk assessed for sternal wound complications (see Preoperative, Intra operative and postoperative risk factors)			
	Patients at high risk are provided with a sternal support device			

## Appendix B: Pre-operative decolonisation factsheet

### Cleaning your home during your treatment

- Change your bedsheets, pillowcases and towels each day.
- Wear clean clothing after showering.
- Clean frequently touched surfaces each day using a clean cloth and detergent. Discard the cloth after use.
- Ensure all members of the household have their own towels.

To help you remember your treatment, please tick these boxes:

Date started: .....

Day 1 Wash  Ointment 1  Ointment 2

Day 2 Wash  Ointment 1  Ointment 2

Day 3 Wash  Ointment 1  Ointment 2

Day 4 Wash  Ointment 1  Ointment 2

Day 5 Wash  Ointment 1  Ointment 2

Please bring this brochure with you when you come to hospital regardless of whether you have completed the 5 days of treatment.

Where can I find more information?

If you have any questions, please contact your surgeon.

**Disclaimer:** This factsheet provides basic general information only and is to be used as a quick guide, not as a complete resource on the subject.

### References

Adapted from Clinical Excellence Commission. 2020. Infection Prevention and Control Practice Handbook.



Publication review date October 2023



## Preparing your skin for surgery

Reducing Staphylococcus aureus and MRSA on your skin



Produced by St George Hospital and Prince of Wales Hospital Infection Control Departments



### Why do I need to prepare my skin for surgery?

Your recent test showed that you have a bacteria (germ) called *Staphylococcus aureus* on your skin. It is important to reduce this bacteria on your skin, to prevent infection after your surgery. Decolonisation is a treatment which reduces this bacteria.

### What is *Staphylococcus aureus*?

*Staphylococcus aureus* (also called Golden Staph) may be part of your normal skin bacteria. Most of the time, it lives in your nose or on your skin without causing any problems. This is called **colonisation**.

In some cases, the bacteria may be hard to treat with common antibiotics and are called Methicillin Resistant *Staphylococcus aureus* (MRSA).

These bacteria are usually harmless but if you have open wounds (like after surgery), they can cause serious infection.

### Reducing *Staphylococcus aureus* on your skin

This treatment will take five days. Your surgeon will tell you when to start.

#### What you need

- Nasal ointment mupirocin 2% (Bactroban)
- Body-wash (2% aqueous chlorhexidine solution OR, 1% triclosan)
- Cotton buds
- Small alcohol wipes
- Alcohol gel/rub (optional)

#### Before starting your treatment

- Remove nose, ear and other body piercing items and keep them out during treatment.
- Clean removed items with alcohol wipes and place into a container for storage.
- Replace old toothbrushes, razors, opened roll on deodorant, skin adhesive tapes, skin creams and solutions, pumice stones, sponges, make up brushes, creams, and anything else you use on your skin.
- Wash hair brushes and combs, nail files, plastic toys, and clippers in the dishwasher or discard.
- During treatment, remove dentures every evening and clean carefully using a denture brush and mild soap and water, or denture paste.
- Disinfect other personal items daily with alcohol wipes.

### Instructions for your five days of treatment

Each day, for five days, you will need to wash yourself with the body wash and use the nasal ointment morning and night.

#### Using the body wash


1. Apply body wash all over your body, from head to toes. Be sure to apply to your hair, under your arms, into the groin and into any folds of skin.
2. Allow the wash to remain on your skin and hair for three minutes.
3. Get into the shower or bath and rinse well. Close your eyes and mouth when washing face or shampooing. If you get body wash in your eyes or mouth—rinse with water.

**Do not use other soap at the same time, as this may inactivate the antiseptic wash.**

#### Using the Nasal Ointment

1. Wash hands well with soap and water or disinfect hands with alcohol gel/rub.
2. Open the nasal ointment. Place a small amount (size of match head) of ointment onto a clean cotton bud and massage gently around the inside of your nostril (no more than 2-3 cm inside). Use a new cotton bud for the other nostril.
3. After applying the ointment, press a finger against the nose next to the nostril opening and use a circular motion to spread the ointment within the nose.
4. Wash hands well with soap and water or disinfect hands with alcohol gel/rub.

## Appendix C: SGH and POW Cardiothoracic Surgery Admission Checklist




SES090006

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 <b>Health</b> South Eastern Sydney Local Health District		FAMILY NAME GIVEN NAME	MRN <input type="checkbox"/> MALE <input type="checkbox"/> FEMALE
<b>Facility:</b>		D.O.B. ____/____/____ M.O.	
		ADDRESS	
		LOCATION / WARD	
COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE			
Pre-operative Cardiothoracic Surgery Checklist	Date completed	Print & sign name & designation when completed	
Height + weight, BMI, vital signs, BGL			
Physiotherapy consult: education & spirometry			
Education - booklet & DVD			
Dental check + orthopantomogram (OPG) (valve surgery only)			
Delirium screen (use facility preferred screening tool)			
Anaesthetic & other medical review			
Anaesthetic consult			
Consent			
Premedication ordered			
Other medical review (as per surgeon's request) e.g. Endocrine review			
Medications			
Check if patient is taking any of the following: <b>Anti-platelet &amp; anti-coagulant therapy</b> e.g. aspirin, clopidogrel, enoxaparin, ticagrelor, warfarin, NSAIDs, NOACs (i.e. apixaban, dabigatran, rivaroxaban), IV heparin infusion Tick if <input type="checkbox"/> Yes <b>Date ceased:</b> ____/____/____			
<b>Supplements with an anti-coagulant effect</b> e.g. Fish oil, garlic, ginkgo, ginseng, glucosamine Tick if <input type="checkbox"/> Yes <b>Date ceased:</b> ____/____/____			
<b>Sodium glucose co-transporter inhibitors (SGLT2i)</b> e.g. Forxiga (dapagliflozin), Invokana (canagliflozin), Jardiance (empagliflozin), Steglatro (ertugliflozin) Tick if <input type="checkbox"/> Yes			
<b>Withhold at least 72 hours before surgery</b>			
<b>Tests &amp; imaging</b>			
Transthoracic echocardiogram (within last 3 months)			
CXR PA + lateral			
ECG within 24 hours of surgery			
Other as per surgeon's request e.g. Carotid doppler, vein mapping, CT Chest, ABG			
<b>Bloods</b> UEC, CMP, LFT, FBC, Coags, HbA1c, Iron studies Hep B/C, HIV, Troponin			
Does patient need an iron infusion? <input type="checkbox"/> Yes <input type="checkbox"/> No			
Group & hold Valid until: _____			
<b>Urinalysis</b>			
<b>MRSA &amp; MSSA swabs</b> Nose & groin Request "Staphylococcus aureus screening" on pathology request form			
Results if available: _____			

CARTIOTHORACIC SURGICAL PRE-OPERATIVE CHECKLIST

SES090,006

NO WRITING Page 1 of 2



 <b>Health</b> South Eastern Sydney Local Health District	FAMILY NAME	MRN
	GIVEN NAME	<input type="checkbox"/> MALE <input type="checkbox"/> FEMALE
<b>Facility:</b>	D.O.B. ____/____/____	M.O.
	ADDRESS	
<b>CARDIOTHORACIC SURGICAL PRE-OPERATIVE CHECKLIST</b>		
COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE		
<b>Infection risk considerations</b>		
<b>Angiogram site:</b> Check for signs of infection Swab if required		
<b>If MRSA or MSSA positive:</b> Has patient completed 5 days of decolonisation treatment? <input type="checkbox"/> Yes <input type="checkbox"/> No Date treatment started _____ • Document number of days of treatment: _____ • Continue decolonisation and notify ICU if <5 days • If result not available, assess patient's risk of MRSA/MSSA carriage. Start decolonisation if patient has high MRSA/MSSA risk		
<b>Shower in hospital-specified antiseptic wash</b> – night before and morning of surgery		<b>PM:</b> <b>AM:</b> <b>Size:</b>
<b>Meets sternal support vest criteria</b> (refer below) <input type="checkbox"/> Yes <input type="checkbox"/> No If patient has one or more risk factors discuss with surgical team to determine if vest is required		
<b>VTE risk assessment</b>		
<b>VTE risk assessment completed</b>		
<b>VTE prophylaxis prescribed</b>		
<b>Nursing admission &amp; assessment</b>		
• Adult admission assessment and nursing care plan • Check patient's, GP & NOK details are correct on front sheet/labels • Attach 2 ID/allergy bands.		
<b>Inform CT Theatres &amp; ICU of any alerts</b> e.g. bariatric (>100kg), infectious, cytotoxic precautions		
<b>Hair clipping guide</b>		
<b>Coronary Artery Bypass</b>		<b>Valve Surgery</b>
 <b>Front</b>	 <b>Back</b>	 <b>Front</b>
 <b>Back</b>	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <p> Shaded Area = Body area to be clipped. Check with nurse following clipping</p> </div>	
<b>Sternal support vest criteria</b>		
If patient meets one or more risk factors consult with surgical team to determine if vest is required		
<b>Pre-operative risk factors</b>		<b>Intraoperative risk factors</b>
<input type="checkbox"/> BMI >30% <input type="checkbox"/> Diabetes mellitus <input type="checkbox"/> Ongoing steroid therapy <input type="checkbox"/> Redo median sternotomy <input type="checkbox"/> Respiratory disease (COPD)	<input type="checkbox"/> Severe osteoporosis <input type="checkbox"/> Renal insufficiency <input type="checkbox"/> Female (large breast size) <input type="checkbox"/> Advanced age <input type="checkbox"/> Current smoker <input type="checkbox"/> Previous mediastinal irradiation	<input type="checkbox"/> Bilateral internal mammary arteries used <input type="checkbox"/> Prolonged bypass time <input type="checkbox"/> Use of intra-aortic balloon pump <input type="checkbox"/> Re-operation <input type="checkbox"/> Sternal rewiring

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## Version and Approval History

Date	Version no:	Author and approval notes
September 2018	DRAFT	Suzanne Schacht
September 2018	DRAFT	Draft for comment period
November 2018	DRAFT	Processed by Executive Services prior to Clinical and Quality Council approval.
December 2018	1	Approved by the Clinical and Quality Council to publish.
January 2020	2	Addition of appendices B and C. Approved by Executive Sponsor. Published by Executive Services.
March 2021	3	Minor review. Load Reduction Process removed. Replaced with link to SESLHDPR681 added (page 11); Pre-operative decolonisation for emergency surgery section amended (page 15). Appendix B replaced with updated brochure.
April 2021	3	Approved by Executive Sponsor.
13 November 2024	3.1	Minor review. Links updated. Checklist updated. Approved at SESLHD Drug and Therapeutics Committee with amendments.