Preventing **Surgical Site Infections**

Key Recommendations for Practice - Appendices

Developed by the Joint Royal College of Surgeons in Ireland/Royal College of Physicians of Ireland Working Group on Prevention of Surgical Site Infection (2012)

Appendix 1:

Terms of Reference and Membership of RCSI and RCPI working group on Surgical Site Infection

**Terms of Reference**

1. To produce evidence based recommendations to prevent surgical site infection and to advise on their implementation and audit

2. To propose indicators (process and outcome) to prevent surgical site infection including consideration of surgical antibiotic prophylaxis indicators

**Membership**

Joint chair:

- Dr Fidelma Fitzpatrick, Consultant Microbiologist, Beaumont Hospital and Health Protection Surveillance Centre, Dublin & RCPI and HSE Clinical lead - Prevention of Healthcare-associated Infection (RCPI)

- Mr. Paul McCormick, Colorectal & General Surgeon, St. James Hospital, Dublin (RCSI)

Members:

- Dr. Mary Browne, Consultant in Public Health Medicine, Quality and Patient Safety Directorate, HSE

- Dr. Robert Cunney, Consultant Microbiologist, Childrens Hospital Temple Street and Health Protection Surveillance Centre & Chair RCPI Hospital Antimicrobial Stewardship Subcommittee

- Mr. Sean Egan, Antimicrobial Pharmacist, Tallaght Hospital, Dublin

- Prof. Hilary Humphreys, Professor of Clinical Microbiology, RCSI and Consultant Microbiologist, Beaumont Hospital

- Mr. Seamas Mc Hugh, Surgical SpR

- Ms. Alison Mc Guinness, Infection Prevention and Control Nurse Specialist, St. Vincent’s University Hospital, Dublin

- Ms. Fiona Murphy, Assistant Director of Nursing, ORIAN directorate, St. James Hospital, Dublin
Appendix 2:
Sample audit form for single dose surgical antibiotic prophylaxis

### Pre-operative – at induction but before incision

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>The patient received the correct antibiotic(s)</td>
<td></td>
</tr>
<tr>
<td>Was the prescribed antibiotic (s) recommended for this operation (i.e., in local surgical antibiotic prophylaxis guidelines)?</td>
<td></td>
</tr>
<tr>
<td>Has a history of antibiotic allergy been recorded?</td>
<td></td>
</tr>
<tr>
<td>Has the patient’s recent microbiological history been considered/recorded when choosing the antibiotic (s) (e.g., history of MRSA or other multidrug resistant organism colonisation)?</td>
<td></td>
</tr>
<tr>
<td>The patient received the correct dose(s)</td>
<td></td>
</tr>
<tr>
<td>Has the patient received the correct dose for their weight, hepatic and renal function?</td>
<td></td>
</tr>
<tr>
<td>The antibiotic is given in the 60 minute window pre-incision (but 15 minutes before tourniquet application where one is applied)</td>
<td></td>
</tr>
<tr>
<td>Has the antibiotic been given within 60 min of skin incision? If the procedure needs a tourniquet to be applied, check that it has not been inflated before beginning administration of the antibiotics</td>
<td></td>
</tr>
</tbody>
</table>

### Intra-operative – post-incision, but pre-closure

<table>
<thead>
<tr>
<th>Question</th>
<th>No/Additional dose given</th>
</tr>
</thead>
<tbody>
<tr>
<td>The patient should not receive an additional dose of antibiotic(s) unless indicated</td>
<td>No additional dose given / additional dose given but indicated / additional dose given</td>
</tr>
<tr>
<td>Has the patient been re-dosed with antibiotics intra-operatively if they fall into one of the following pre-defined categories</td>
<td></td>
</tr>
<tr>
<td>a. In longer surgery - the re-dosing time will vary depending upon the half-life of the drug in question, and the patients underlying renal and hepatic function.</td>
<td></td>
</tr>
<tr>
<td>b. If blood loss of greater than 1.5 litres occurs intra-operatively</td>
<td></td>
</tr>
</tbody>
</table>

### Post-operative

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post operative antibiotics are not prescribed unless otherwise indicated</td>
<td></td>
</tr>
<tr>
<td>Post-operative antibiotics should only be given if there is robust clinical evidence to support their use. For most patients pre-operative and intra-operative antibiotic prophylaxis will be sufficient.</td>
<td></td>
</tr>
<tr>
<td>Note</td>
<td></td>
</tr>
<tr>
<td>- This does not apply to surgery where contamination has occurred and where infection has been diagnosed at surgery.</td>
<td></td>
</tr>
<tr>
<td>- Check local guidelines to identify if post-operative antibiotics are required.</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 3:  
Suggested Measure to Improve the Appropriateness of Surgical Antibiotic Prophylaxis

Choosing the Right Agent

- Ensure processes and procedures are in place to alert prescribers in theatre to drug allergies. These procedures should be robust enough to identify allergy in patients who are unable to verbalise allergy in the operating room.
- Formulate local empiric antibiotic guidelines for surgical antibiotic prophylaxis which are evidence based, and take into consideration local microbiological epidemiology and patient factors.
- Ensure these guidelines provide recommendations for the treatment of patients with penicillin and cephalosporin allergy, and those with a history of MRSA colonisation or infection.
- Ensure that new staff members involved in the antibiotic selection process are fully educated on the agreed local policy and processes for antibiotic prophylaxis on entry to the institution.
- Ensure that these guidelines are readily accessible to view (online or hard copy) at the point of prescribing and administration in theatre.
- Ensure that there is clear designation of who is responsible in deciding which agent is to be given, who reconstitutes the drug, and who administers the drug. Consider how the agreed process fits in with other concurrent processes and procedures, and its amenability to timely antibiotic administration pre-incision (and pre-tourniquet application where this occurs).
- Ensure access is available to previous microbiological data on the patient undergoing surgery at the point of prescribing the antibiotic.
- Ensure access to the patient’s past medical history is available at the point of antibiotic prescribing in theatre.
- Ensure processes are agreed and in place to ensure the availability of timely expert advice if a patient falls outside agreed guidelines. This will be particularly important if a patient is known to be colonised with a less common potentially pathogenic organism.

Choosing the Right Dose

- Ensure access to information on the patient’s weight is available at the point of prescribing. This may require standardisation of the process of measuring and recording patient weight on the ward or in the outpatient’s department before transfer to theatre.
- Ensure access to U&E and LFT results at the point of prescribing.
- Agree a local policy on dosing antibiotics which is evidence based. This will be of particular significance when dosing aminoglycosides, glycopeptides, or in patients at extremes of weight.
- Consider the application of specific dose calculators for drugs where multiple calculations are required – e.g. aminoglycosides.
Antibiotic Administration: Get it Right.

- Examine the process in place for antibiotic administration. Examine at what stage in the pre-operative process antibiotics should be given. A balance needs to be struck between starting to administer antibiotics early enough to ensure adequate therapy, but not too late that incision time is delayed.
- Consider standardising the location of antibiotic administration e.g. induction room, on entry to the operating room etc. to ensure consistent practice.
- Consider the use of pre-agreed guidelines which allow for forward planning in drug and dose selection, and administration prior to the point of incision.
- Be aware of the time it takes to reconstitute and administer each required antibiotic and allow for this
- Ensure the procedure for tourniquet application includes a step to check if antibiotics have been administered before inflation of the tourniquet. Reliability may be improved by including a reminder to check about antibiotic administration on the tourniquet equipment.
- If a tourniquet is to be applied, set a countdown clock in theatre following the end of antibiotic administration to ensure a 15 minute time gap has elapsed before tourniquet inflation.
- Ensure the required antibiotics are readily available at the point of administration. Awareness of local guidelines and likely procedure throughput should guide stock levels.
- Ensure antibiotic vials and ancillary equipment are well ordered and clearly labelled in the theatre.
- Ensure guidance on antibiotic reconstitution and administration is readily available at the point of administration.
- Ensure that there is a standardised place to record antibiotic administration, drug, dose and time pre-incision and intra-operatively.
- Ensure that the initial incision cannot take place if antibiotics have not been administered at the pre-incision “time-out”.
Additional Doses of Antibiotics

A patient is re-dosed with antibiotics intra-operatively if they fall into one of the following pre-defined categories:

a. In longer surgery - the re-dosing time will vary depending upon the half-life of the drug in question, and the patient’s underlying renal and hepatic function.

b. If blood loss of greater than 1.5 litres in adults or 25ml/kg in children occurs intra-operatively

- Provide robust reminder systems which prompt antibiotic re-administration in longer surgery, e.g. in-built alarms with local IT or anaesthetic equipment or a trigger at 4 hours post incision to highlight the need for re-administration?
- Explore the option of providing alerts to prompt antibiotic re-dosing if blood loss has been above 1.5 litres in adults or 25ml/kg in children, e.g. a written reminder on stored blood, or on swab supplies.

Post-operative antibiotics should only be given if there is robust clinical evidence to support their use. For most patients pre-operative and intra-operative antibiotic prophylaxis will be sufficient. Note - this does not apply to surgery where contamination has occurred or infection is diagnosed at surgery.

- If antibiotics are required post-operatively, ensure processes are in place which enables clear communication to medical and nursing staff in the ward area with respect to indication/reason, name of drug (generic name), dose and duration.
- Post-operative antibiotics with a stop date should be prescribed on the patient’s drug Kardex before the patient leaves theatre.
Appendix 4:

Sources of Evidence and relevant links

- Health Protection Scotland, targeted literature review. April 2012: What are the key infection prevention and control recommendations to inform a surgical site infection (SSI) prevention quality improvement tool? http://www.hps.scot.nhs.uk/haic/ic/publicationsdetail.aspx?id=50987
- Van Kasteren MEE, Mannien J, Ott A, Kullberg B, de Boer AS. Antibiotic prophylaxis and the risk of surgical site infections following total hip arthroplasty: Timely administration is the most important factor. Clin Infect Dis 2007;44:921-927
- Tomita M, Motokawa S. Effects of air tourniquet on the antibiotics concentration in bone marrow, injected just before the start of operation. Mod Rheumatol 2007;17(5):409-12.
• Retzial K. Fighting fire with preparation. AORN Connections. October 2009
• Aseptic Non Touch Technique. http://www.antt.org.uk/ANTT_Site/Home.html
• Surgical site Infection – Protocol, Factsheets etc: http://www.hpsc.ie/hpsc/A-Z/MicrobiologyAntimicrobialResistance/InfectionControlandHAI/Surveillance/SurgicalSiteInfectionSurveillance/
• Hand Hygiene e-learning tool on HSE Land: http://hseland.aurionlearning.com/handhygiene/clinical/story.html
• E-learning for surgeons: http://www.surginfection.com/
Appendix 5:
Sample Business Case - Justification documentation for changing from Current Skin Antisepsis practice to 2% Chlorhexidine and 70% Isopropyl Alcohol Skin Antisepsis for use.

Summary: 2% chlorhexidine and 70% isopropyl alcohol has been shown in randomised, double blind controlled trials to significantly reduce surgical site infections (SSI's). By reducing these preventable Hospital Acquired Infections (HAIs), by up to 41% (quoted results), 2% chlorhexidine and 70% isopropyl alcohol will generate significant savings in both bed days and hence costs as well as improving morbidity and patient outcomes.

Background: Evidence to support 2% Chlorhexidine and 70% Isopropyl Alcohol

Overall, there are 38 studies on 2% chlorhexidine and 70% isopropyl alcohol covering a broad range of applications across prevention of catheter related blood stream infections, surgical site infections and preventing false positive blood cultures. All show a significant improvement over every other type of skin preparation.

2% chlorhexidine and 70% isopropyl alcohol is recommended by or complies with the infection control guidelines of many organisations, including:

- UK Health Protection Agency Rapid Review Panel – Recommendation 1 (A recommendation 1 means the NHS in England should include 2% chlorhexidine and 70% isopropyl alcohol in their pre operative skin preparation infection control protocols as appropriate)
- Department of Health Saving Lives Delivery Programme 2005 Updated in 2010 for SSI's
- Epic2 Guidelines 2007
- Infectious Disease Society of America 2008
- DOH(2011) High Impact interventions-prevention of surgical site infections
- National Blood Service UK 2006
- National Kidney Foundation UK 2006
- Scottish Intensive Care Society Audit Group 2005
- American Association of Critical Care Nurses 2005

A study published in the New England Journal of Medicine by Darouiche R et al in 2010 showed that 2% chlorhexidine and 70% isopropyl alcohol reduced surgical site infections in clean contaminated surgery by 41% compared with povidone iodine scrub and paint. When comparing specific types of infection, 2% chlorhexidine and 70% isopropyl alcohol was significantly more protective than povidone iodine against both superficial incisional infections (52% reduction) and deep incisional infections (67% reduction). The number needed to treat with 2% Chlorhexidine and 70% Isopropyl Alcohol instead of povidone iodine in order to prevent one case of SSI was approximately 17.
A study published in the Management of Infection Control showed that when 2% chlorhexidine and 70% isopropyl alcohol was introduced 25 months into a study investigating the effectiveness of HICPAC/CDC recommendations, the Central Venous Catheter related infection rate fell a further 62% from that obtained with earlier interventions.

**How 2% Chlorhexidine and 70% Isopropyl Alcohol Works**: 2% chlorhexidine and 70% isopropyl alcohol works by rapidly killing microorganisms by the action of the alcohol denaturing cell protein. The chlorhexidine gluconate maintains persistent antimicrobial activity by disrupting the cell membrane and precipitating cell contents. Also as a sterile, single-use applicator, 2% chlorhexidine and 70% isopropyl alcohol promotes aseptic technique, as recommended in the SARI guidelines. Applicators eliminate direct hand-to-patient contact, helping prevent cross-contamination. The sponge applicators’ gentle-friction scrub helps the solution to penetrate the first five cell layers of the epidermis where microorganisms that can cause bloodstream infections and SSIs reside. Applicators ensure a smooth flow of solution and prevent pooling on the patient’s skin or the surrounding area.

The 70% isopropyl alcohol rapidly kills microorganisms versus free iodine, which requires two minutes to begin antimicrobial activity. 2% chlorhexidine and 70% isopropyl alcohol maintains antimicrobial activity for at least 48 hours compared to two hours for free iodine. 2% Chlorhexidine and 70% Isopropyl Alcohol antimicrobial activity is effective against microorganisms including gram-positive and gram-negative bacteria, Methicillin-resistant *Staphylococcus aureus* (MRSA), Vancomycin-resistant Enterococci (VRE), *Clostridium difficile*, *Acinetobacter* spp., and most viruses and fungi. Remains active in the presence of blood, serum and other protein-rich biomaterials unlike traditional iodophors, which are neutralized. Chlorhexidine demonstrates low incidence of irritation.

**Financial Implications**: By reducing preventable surgical site infection, based on the recent infection surveillance data and the 42% infection reduction rate postulated, a large hospital of 800 beds would annually save 1,771 bed days and net financial savings of 789,420

**References**

1. SARI Guidelines Prevention of Intravascular Catheter-related Infection Sub-Committee Health Protection Surveillance Centre December 2009
4. Data on file. CareFusion Corporation
11. Rauk et al., American J. of Infection Control May 2010-12-03