Warfarin: Management of Emergency Surgery

(includes other vitamin K antagonists eg phenindione and acencoumarol)

Discuss with Haematology team if:
- INR is > 5
- Major coagulopathy e.g. Platelets <50
- Urgent reversal needed (e.g. multiple trauma/head injury/life threatening bleeding*)

vit K + prothrombin complex concentrate (Octaplex) may be required

High Thrombotic Risk Patients include:
- Patients with mechanical mitral or tricuspid valves or previous history of valve thrombosis
- Patients within 30 days of venous/arterial thromboembolism .
- Patients with recurrent thrombosis on anticoagulation

Stop Oral Anticoagulant

Surgery possible within 24h; active bleeding* or a high risk of bleeding and INR>1.5

No → Check INR 12-24hrly aim INR≤1.5 for surgery (NB iv vitamin k takes 6-12hrs to reduce INR)

Yes

Reverse with **3mg IV vitamin K**

Check INR in **12h**

Is INR ≤1.5 → No

Yes

Is surgery delayed > 24h → No → Await Surgery

Yes

Repeat INR daily (to ensure INR not rising)

Whilst awaiting surgery: If INR is sub therapeutic start ***"bridging therapy"***

- High thrombotic risk patients → intravenous heparin (UHBT protocol) No loading required → Stop 4-6h pre-operatively
- Low thrombotic risk patients → SC Clexane 40mg *Rv dose according to VTE guidelines If Wt < 50Kg Or if eGFR < 30ml/min → Stop 10-12h pre-operatively

POSTOPERATIVE MANAGEMENT

Only restart anticoagulation on written instructions from the surgical team
Consider restarting warfarin on the evening of surgery. **DO NOT reload the patient:**
Restart at preop dose (unless interacting meds started in which case may need lower dose)
Delays in restarting the anticoagulant must be reviewed every 24 hours

+ Restart ***"bridging therapy"*** if INR is sub-therapeutic

- High thrombotic risk patients → **Therapeutic clexane**: delay starting until **at least 48hrs postop.** Regularly assess patients for risk of bleeding use **prophylactic** clexane in the interim. If thrombotic risk felt to be very high, or bleeding risk very low, therapeutic clexane may be commenced sooner but **not before 24hrs post op**. Most patients can be managed with Clexane 1mg/Kg bd
  Intravenous heparin: use only in patient with mechanical mitral/tricuspid Valves, prior valve thrombosis or high risk valves eg ball and cage valves. Delay starting until 12hrs post op **DO NOT use a loading dose**
- Low thrombotic risk patients → SC Clexane 40mg* 12-24h post surgery

[redacted]

Continue ***''bridging therapy''*** **until INR is within therapeutic range** then stop

Reviewed May 2015 Next review May 2017

Extended to May 2019

NICE National Institute for Health and Care Excellence

NICE guideline

Hip fracture: management

Clinical guideline

Published: 22 June 2011
nice.org.uk/guidance/cg124

Your responsibility

The recommendations in this guideline represent the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, professionals and practitioners are expected to take this guideline fully into account, alongside the individual needs, preferences and values of their patients or the people using their service. It is not mandatory to apply the recommendations, and the guideline does not override the responsibility to make decisions appropriate to the circumstances of the individual, in consultation with them and their families and carers or guardian.

Local commissioners and providers of healthcare have a responsibility to enable the guideline to be applied when individual professionals and people using services wish to use it. They should do so in the context of local and national priorities for funding and developing services, and in light of their duties to have due regard to the need to eliminate unlawful discrimination, to advance equality of opportunity and to reduce health inequalities. Nothing in this guideline should be interpreted in a way that would be inconsistent with complying with those duties.

Commissioners and providers have a responsibility to promote an environmentally sustainable health and care system and should assess and reduce the environmental impact of implementing NICE recommendations wherever possible.

Contents

This guideline is the basis of QS16.

Overview

This guideline covers managing hip fracture in adults. It aims to improve care from the time people aged 18 and over are admitted to hospital through to when they return to the community. Recommendations emphasise the importance of early surgery and coordinating care through a multidisciplinary hip fracture programme to help people recover faster and regain their mobility.

NICE has also produced a guideline on osteoporosis: assessing the risk of fragility fracture.

In April 2017, we reviewed the evidence for the management of intracapsular hip fracture and changed recommendations 1.6.2 and 1.6.3 to emphasise the role of total hip replacement.

Who is it for?

- Healthcare professionals
- Commissioners and providers
- Adults with hip fracture and their families and carers

Recommendations

People have the right to be involved in discussions and make informed decisions about their care, as described in your care.

Making decisions using NICE guidelines explains how we use words to show the strength (or certainty) of our recommendations, and has information about prescribing medicines (including off-label use), professional guidelines, standards and laws (including on consent and mental capacity), and safeguarding.

The following guidance is based on the best available evidence. The full guideline and addendum give details of the methods and the evidence used to develop the guidance.

Some aspects of hip fracture management are already covered by NICE guidance and are therefore outside the scope of this guideline. To ensure comprehensive management and continuity, the following NICE guidance should be referred to when developing a complete programme of care for each patient: technology appraisals guidance on osteoporotic fragility fracture prevention (denosumab for the prevention of osteoporotic fractures in postmenopausal women; and the following medicines for the primary and secondary prevention of osteoporotic fragility fractures in postmenopausal women: alendronate, etidronate, risedronate, raloxifene and strontium ranelate, and also teriparatide for secondary prevention); and clinical guidelines on falls, pressure ulcers, nutrition support, dementia, surgical site infection, venous thromboembolism, delirium and osteoporosis: assessing the risk of fragility fracture.

1.1 Imaging options in occult hip fracture

1.1.1 Offer magnetic resonance imaging (MRI) if hip fracture is suspected despite negative X-rays of the hip of an adequate standard. If MRI is not available within 24 hours or is contraindicated, consider computed tomography (CT). **[2011, amended 2014]**

1.2 Timing of surgery

1.2.1 Perform surgery on the day of, or the day after, admission. **[2011]**

1.2.2 Identify and treat correctable comorbidities immediately so that surgery is not delayed by:

- anaemia

- anticoagulation
- volume depletion
- electrolyte imbalance
- uncontrolled diabetes
- uncontrolled heart failure
- correctable cardiac arrhythmia or ischaemia
- acute chest infection
- exacerbation of chronic chest conditions. **[2011]**

1.3 Analgesia

1.3.1 Assess the patient's pain:

- immediately upon presentation at hospital **and**
- within 30 minutes of administering initial analgesia **and**
- hourly until settled on the ward **and**
- regularly as part of routine nursing observations throughout admission. **[2011]**

1.3.2 Offer immediate analgesia to patients presenting at hospital with suspected hip fracture, including people with cognitive impairment. **[2011]**

1.3.3 Ensure analgesia is sufficient to allow movements necessary for investigations (as indicated by the ability to tolerate passive external rotation of the leg), and for nursing care and rehabilitation. **[2011]**

1.3.4 Offer paracetamol every 6 hours preoperatively unless contraindicated. **[2011]**

1.3.5 Offer additional opioids if paracetamol alone does not provide sufficient preoperative pain relief. **[2011]**

1.3.6 Consider adding nerve blocks if paracetamol and opioids do not provide sufficient preoperative pain relief, or to limit opioid dosage. Nerve blocks should

be administered by trained personnel. Do not use nerve blocks as a substitute for early surgery. [2011]

1.3.7 Offer paracetamol every 6 hours postoperatively unless contraindicated. [2011]

1.3.8 Offer additional opioids if paracetamol alone does not provide sufficient postoperative pain relief. [2011]

1.3.9 Non-steroidal anti-inflammatory drugs (NSAIDs) are not recommended. [2011]

1.4 Anaesthesia

1.4.1 Offer patients a choice of spinal or general anaesthesia after discussing the risks and benefits. [2011]

1.4.2 Consider intraoperative nerve blocks for all patients undergoing surgery. [2011]

1.5 Planning the theatre team

1.5.1 Schedule hip fracture surgery on a planned trauma list. [2011]

1.5.2 Consultants or senior staff should supervise trainee and junior members of the anaesthesia, surgical and theatre teams when they carry out hip fracture procedures. [2011]

1.6 Surgical procedures

1.6.1 Operate on patients with the aim to allow them to fully weight bear (without restriction) in the immediate postoperative period. [2011]

1.6.2 Offer replacement arthroplasty (total hip replacement or hemiarthroplasty) to patients with a displaced intracapsular hip fracture. [2017]

1.6.3 Offer total hip replacement rather than hemiarthroplasty to patients with a displaced intracapsular hip fracture who:

- were able to walk independently out of doors with no more than the use of a stick **and**
- are not cognitively impaired **and**

- are medically fit for anaesthesia and the procedure. **[2017]**

1.6.4 Use a proven femoral stem design rather than Austin Moore or Thompson stems for arthroplasties. Suitable designs include those with an Orthopaedic Data Evaluation Panel rating of 10A, 10B, 10C, 7A, 7B, 5A, 5B, 3A or 3B. **[2011]**

1.6.5 Use cemented implants in patients undergoing surgery with arthroplasty[1]. **[2011]**

1.6.6 Consider an anterolateral approach in favour of a posterior approach when inserting a hemiarthroplasty. **[2011]**

1.6.7 Use extramedullary implants such as a sliding hip screw in preference to an intramedullary nail in patients with trochanteric fractures above and including the lesser trochanter (AO classification types A1 and A2). **[2011]**

1.6.8 Use an intramedullary nail to treat patients with a subtrochanteric fracture. **[2011]**

1.7 Mobilisation strategies

1.7.1 Offer patients a physiotherapy assessment and, unless medically or surgically contraindicated, mobilisation on the day after surgery. **[2011]**

1.7.2 Offer patients mobilisation at least once a day and ensure regular physiotherapy review. **[2011]**

1.8 Multidisciplinary management

1.8.1 From admission, offer patients a formal, acute, orthogeriatric or orthopaedic ward-based Hip Fracture Programme that includes all of the following:

- orthogeriatric assessment
- rapid optimisation of fitness for surgery
- early identification of individual goals for multidisciplinary rehabilitation to recover mobility and independence, and to facilitate return to pre-fracture residence and long-term wellbeing

- continued, coordinated, orthogeriatric and multidisciplinary review
- liaison or integration with related services, particularly mental health, falls prevention, bone health, primary care and social services
- clinical and service governance responsibility for all stages of the pathway of care and rehabilitation, including those delivered in the community. [2011]

1.8.2 If a hip fracture complicates or precipitates a terminal illness, the multidisciplinary team should still consider the role of surgery as part of a palliative care approach that:

- minimises pain and other symptoms **and**
- establishes patients' own priorities for rehabilitation **and**
- considers patients' wishes about their end-of-life care. [2011]

1.8.3 Healthcare professionals should deliver care that minimises the patient's risk of delirium and maximises their independence, by:

- actively looking for cognitive impairment when patients first present with hip fracture
- reassessing patients to identify delirium that may arise during their admission
- offering individualised care in line with NICE's guideline on delirium. [2011]

1.8.4 Consider early supported discharge as part of the Hip Fracture Programme, provided the Hip Fracture Programme multidisciplinary team remains involved, and the patient:

- is medically stable **and**
- has the mental ability to participate in continued rehabilitation **and**
- is able to transfer and mobilise short distances **and**
- has not yet achieved their full rehabilitation potential, as discussed with the patient, carer and family. [2011]

1.8.5 Only consider intermediate care (continued rehabilitation in a community hospital or residential care unit) if all of the following criteria are met:

- intermediate care is included in the Hip Fracture Programme **and**
- the Hip Fracture Programme team retains the clinical lead, including patient selection, agreement of length of stay and ongoing objectives for intermediate care **and**
- the Hip Fracture Programme team retains the managerial lead, ensuring that intermediate care is not resourced as a substitute for an effective acute hospital Programme. **[2011]**

1.8.6 Patients admitted from care or nursing homes should not be excluded from rehabilitation programmes in the community or hospital, or as part of an early supported discharge programme. **[2011]**

1.9 Patient and carer information

1.9.1 Offer patients (or, as appropriate, their carer and/or family) verbal and printed information about treatment and care including:

- diagnosis
- choice of anaesthesia
- choice of analgesia and other medications
- surgical procedures
- possible complications
- postoperative care
- rehabilitation programme
- long-term outcomes
- healthcare professionals involved. **[2011]**

[1] The Association of Anaesthetists of Great Britain and Ireland, British Orthopaedic Association and British Geriatric Society have produced a safety guideline on reducing the risk from cemented hemiarthroplasty for hip fracture (2015). This safety guideline is not NICE accredited.

Putting this guideline into practice

NICE has produced tools and resources to help you put this guideline into practice.

Putting recommendations into practice can take time. How long may vary from guideline to guideline, and depends on how much change in practice or services is needed. Implementing change is most effective when aligned with local priorities.

Changes recommended for clinical practice that can be done quickly – like changes in prescribing practice – should be shared quickly. This is because healthcare professionals should use guidelines to guide their work – as is required by professional regulating bodies such as the General Medical and Nursing and Midwifery Councils.

Changes should be implemented as soon as possible, unless there is a good reason for not doing so (for example, if it would be better value for money if a package of recommendations were all implemented at once).

Different organisations may need different approaches to implementation, depending on their size and function. Sometimes individual practitioners may be able to respond to recommendations to improve their practice more quickly than large organisations.

Here are some pointers to help organisations put NICE guidelines into practice:

1. **Raise awareness** through routine communication channels, such as email or newsletters, regular meetings, internal staff briefings and other communications with all relevant partner organisations. Identify things staff can include in their own practice straight away.

2. **Identify a lead** with an interest in the topic to champion the guideline and motivate others to support its use and make service changes, and to find out any significant issues locally.

3. **Carry out a baseline assessment** against the recommendations to find out whether there are gaps in current service provision.

4. **Think about what data you need to measure improvement** and plan how you will collect it. You may want to work with other health and social care organisations and specialist groups to compare current practice with the recommendations. This may also help identify local issues that will slow or prevent implementation.

5. **Develop an action plan**, with the steps needed to put the guideline into practice, and make sure it is ready as soon as possible. Big, complex changes may take longer to implement, but some may be quick and easy to do. An action plan will help in both cases.

6. **For very big changes** include milestones and a business case, which will set out additional costs, savings and possible areas for disinvestment. A small project group could develop the action plan. The group might include the guideline champion, a senior organisational sponsor, staff involved in the associated services, finance and information professionals.

7. **Implement the action plan** with oversight from the lead and the project group. Big projects may also need project management support.

8. **Review and monitor** how well the guideline is being implemented through the project group. Share progress with those involved in making improvements, as well as relevant boards and local partners.

NICE provides a comprehensive programme of support and resources to maximise uptake and use of evidence and guidance. See our into practice pages for more information.

Also see Leng G, Moore V, Abraham S, editors (2014) Achieving high quality care – practical experience from NICE. Chichester: Wiley.

Context

Hip fracture refers to a fracture occurring in the area between the edge of the femoral head and 5 centimetres below the lesser trochanter (see figure 1 in the 2011 full guideline). These fractures are generally divided into two main groups. Those above the insertion of the capsule of the hip joint are termed intracapsular, subcapital or femoral neck fractures. Those below the insertion are extracapsular. The extracapsular group is split further into trochanteric (inter- or pertrochanteric and reverse oblique) and subtrochanteric.

Hip fracture is a major public health issue due to an ever increasing ageing population. About 65,000 hip fractures occur each year and the annual cost (not including the considerable cost of social care) for all UK hip fracture cases is about £1 billion. About 10% of people with a hip fracture die within 1 month and about one-third within 12 months. Most of the deaths are due to associated conditions and not to the fracture itself, reflecting the high prevalence of comorbidity. Because the occurrence of fall and fracture often signals underlying ill health, a comprehensive multidisciplinary approach is required from presentation to subsequent follow-up, including the transition from hospital to community.

This guideline covers the management of hip fracture from admission to secondary care through to final return to the community and discharge from specific follow-up. It assumes that anyone clinically suspected of having a hip fracture will normally be referred for immediate hospital assessment. It excludes (other than by cross-reference) aspects covered by parallel NICE guidance, most notably primary and secondary prevention of fragility fractures, but recognises the importance of effective linkage to these closely related elements of comprehensive care. Although hip fracture is predominantly a phenomenon of later life (the National Hip Fracture Database reports the average age of a person with hip fracture as 84 years for men and 83 for women), it may occur at any age in people with osteoporosis or osteopenia, and this guidance is applicable to adults across the age spectrum. Management of hip fracture has improved through the research and reporting of key skills, especially by collaborative teams specialising in the care of older people (using the general designation 'orthogeriatrics'). These skills are applicable in hip fracture irrespective of age, and the guidance includes recommendations that cover the needs of younger patients by drawing on such skills in an organised manner.

Although not a structured service delivery evaluation, the Guideline Development Group was required to extend its remit to cover essential implications for service organisation within the NHS where these are fundamental to hip fracture management, and this has been done.

The NICE surveillance review identified new studies that were consistent with the current recommendations. However, because of a low level of compliance (around 30% nationally) with the recommendation to offer total hip replacement to people with displaced intracapsular hip fractures, we have updated this part of the guideline. The 2017 update also covers interventions for undisplaced intracapsular hip fractures, which were not covered in the original guideline.

The guideline will assume that prescribers will use a drug's summary of product characteristics to inform decisions made with individual patients.

More information

You can also see this guideline in the NICE pathway on hip fracture.

To find out what NICE has said on topics related to this guideline, see our web page on trauma.

See also the guideline committee's discussion and the evidence reviews (in the full guideline and addendum), and information about how the guideline was developed, including details of the committee.

Recommendations for research

In 2011 the guideline committee made the following recommendations for research. The committee's full set of research recommendations is detailed in the full guideline.

As part of the 2017 update, the standing committee removed the research recommendation on displaced intracapsular hip fractures and made an additional research recommendation on undisplaced intracapsular hip fractures. It is listed here and full details can be found in the addendum.

1 Imaging options in occult hip fracture

In patients with a continuing suspicion of a hip fracture but whose radiographs are normal, what is the clinical and cost effectiveness of computed tomography (CT) compared to magnetic resonance imaging (MRI), in confirming or excluding the fracture?

Why this is important

The Guideline Development Group's consensus decision to recommend CT over a radionuclide bone scan as an alternative to MRI to detect occult hip fractures reflects current NHS practice but assumes that advances in technology have made the reliability of CT comparable with that of MRI. If modern CT can be shown to have similar reliability and accuracy to MRI, then this has considerable implications because of its widespread availability out of hours and lower cost. It is therefore a high priority to confirm or refute this assumption by direct randomised comparison. The study design would need to retain MRI as the 'gold standard' for cases of uncertainty and to standardise the criteria, expertise and procedures for radiological assessment. Numbers required would depend on the degree of sensitivity and specificity (the key outcome criteria) set as target requirement for comparability, but need not necessarily be very large. **[2011]**

2 Anaesthesia

What is the clinical and cost effectiveness of regional versus general anaesthesia on postoperative morbidity in patients with hip fracture?

Why this is important

No recent randomised controlled trials were identified that fully address this question. The evidence is old and does not reflect current practice. In addition, in most of the studies the patients are sedated before regional anaesthesia is administered, and this is not taken into account when

analysing the results. The study design for the proposed research would be best addressed by a randomised controlled trial. This would ideally be a multi-centre trial including 3000 participants in each arm. This is achievable given that there are about 70,000 to 75,000 hip fractures a year in the UK. The study should have three arms that look at spinal anaesthesia versus spinal anaesthesia plus sedation versus general anaesthesia; this would separate those with regional anaesthesia from those with regional anaesthesia plus sedation. The study would also need to control for surgery, especially type of fracture, prosthesis and grade of surgeon.

A qualitative research component would also be helpful to study patient preference for type of anaesthesia. **[2011]**

3 Undisplaced intracapsular hip fractures

For people with undisplaced (or non-displaced) intracapsular hip fracture, what features should be used to characterise the injury and what are the optimal clinical and cost-effective management strategies?

Why this is important

Between 5% and 15% of people with an intracapsular hip fracture will have an undisplaced fracture. There is variation in the UK in how undisplaced intracapsular hip fractures are recognised, resulting in some people not being offered the most appropriate treatment. Research is needed to help healthcare professionals understand the clinical characteristics of people who have undisplaced hip fracture (on anterior-posterior and lateral X-rays) and how this relates to the effectiveness of different treatment strategies.

The committee also noted a paucity of evidence for 2 of the interventions (total hip replacement and hemiarthroplasty) that could potentially be useful for people with undisplaced intracapsular hip fracture. A randomised controlled trial comparing these interventions would be beneficial. **[2017]**

4 Intensive rehabilitation therapies after hip fracture

What is the clinical and cost effectiveness of additional intensive physiotherapy and/or occupational therapy (for example progressive resistance training) after hip fracture?

Why this is important

The rapid restoration of physical and self care functions is critical to recovery from hip fracture, particularly where the goal is to return the patient to preoperative levels of function and residence. Approaches that are worthy of future development and investigation include progressive resistance training, progressive balance and gait training, supported treadmill gait re-training, dual task training, and activities of daily living training. The optimal time point at which these interventions should be started requires clarification.

The ideal study design is a randomised controlled trial. Initial studies may have to focus on proof of concept and be mindful of costs. A phase III randomised controlled trial is required to determine clinical effectiveness and cost effectiveness. The ideal sample size will be around 400 to 500 patients, and the primary outcome should be physical function and health-related quality of life. Outcomes should also include falls. A formal sample size calculation will need to be undertaken. Outcomes should be followed over a minimum of 1 year, and compare if possible, either the recovery curve for restoration of function or time to attainment of functional goals. **[2011]**

5 Early supported discharge in care home patients

What is the clinical and cost effectiveness of early supported discharge on mortality, quality of life and functional status in patients with hip fracture who are admitted from a care home?

Why this is important

Residents of care and nursing homes account for about 30% of all patients with hip fracture admitted to hospital. Two-thirds of these come from care homes and the remainder from nursing homes. These patients are frailer, more functionally dependent and have a higher prevalence of cognitive impairment than patients admitted from their own homes. One-third of those admitted from a care home are discharged to a nursing home and one-fifth are readmitted to hospital within 3 months. There are no clinical trials to define the optimal rehabilitation pathway following hip fracture for these patients and therefore represent a discrete cohort where the existing meta-analyses do not apply. As a consequence, many patients are denied structured rehabilitation and are discharged back to their care home or nursing home with very little or no rehabilitation input.

Given the patient frailty and comorbidities, rehabilitation may have no effect on clinical outcomes for this group. However, the fact that they already live in a home where they are supported by trained care staff clearly provides an opportunity for a systematic approach to rehabilitation. Early multidisciplinary rehabilitation based in care homes or nursing homes would take advantage of the

day-to-day care arrangements already in place and provide additional NHS support to deliver naturalistic rehabilitation, where problems are tackled in the patient's residential setting.

Early supported multidisciplinary rehabilitation could reduce hospital stay, improve early return to function, and affect both readmission rates and the level of NHS-funded nursing care required.

The research would follow a two-stage design: (1) an initial feasibility study to refine the selection criteria and process for reliable identification and characterisation of those considered most likely to benefit, together with the intervention package and measures for collaboration between the Hip Fracture Programme team, care-home staff and other community-based professionals, and (2) a cluster randomised controlled comparison (for example, with two or more intervention units and matched control units) set against agreed outcome criteria. The latter should include those specified above, together with measures of the impact on care-home staff activity and cost, as well as qualitative data from patients on relevant quality-of-life variables. [2011]

Update information

May 2017: Recommendations have been updated on the surgical management of hip fracture. These are marked as **[2017]**. A footnote was added to recommendation 1.6.5 on cemented implants to highlight safety guidance.

Where recommendations end **[2011]** or **[2011, amended 2014]**, the evidence has not been reviewed since the original guideline.

March 2014: The introduction to the full guideline and the wording of recommendation 1.1.1 have been amended to clarify how an occult fracture is identified and when an MRI scan should be done.

ISBN: 978-1-4731-2449-3

Accreditation

Clinical Guideline

ADULT TRAUMA AND ORTHOPAEDIC SURGERY PROPHYLACTIC ANTIBIOTIC GUIDELINES

SETTING Bristol Royal Infirmary

FOR STAFF Prescribers (Medical and Non-medical)

PATIENTS Adult patients

Antimicrobial Prescribing at UHBristol

MICRO
Microbiology empirical guidelines
Indication stated on chart
Cultures and sensitivities
Review / stop date on chart
Oral switch from IV

GUIDANCE

- **Document on the anaesthetic chart the antibiotics received, the time given, and the knife to skin time.**
- **Document on the 'once only' section of the drug chart the antibiotics received.**
- **If the patient is colonised or infected with multi-resistant organisms, discuss with Microbiology prior to surgery to discuss prophylaxis**
- **Consider further intra-operative dose of Co-amoxiclav if surgery lasts more than 3 hours**
- (N Eng J Med (1992); 326: 281-286).
- **If greater than 1500 millilitres of blood are lost during surgery, consider giving an additional dose of antibiotics.**
- **If a tourniquet is to be applied then the intravenous antibiotic prophylaxis must be administered at least 15-minutes minutes prior to the tourniquet application to ensure adequate tissue levels.**
- **All doses assume patients with normal renal function**

Meticillin Resistant *Staphylococcus aureus* (MRSA)

Elective surgery:

- Screen for Meticillin resistant *Staphylococcus aureus* at pre-operative assessment.
- Patients identified as being colonised with MRSA should have a 5-day course of topical therapy of **Mupirocin** 2% nasal ointment tds to anterior nares and **Chlorhexidine gluconate** 4% washes daily with re-swab as per MRSA topical eradication guideline.
- Surgery should be scheduled for the 5th day of topical decolonisation.
- If recent or previous MRSA colonisation, use the MRSA colonised regime.

Emergency surgery:

- Screen for Meticillin resistant *Staphylococcus aureus* on admission.
- Treat all patients with topical eradication therapy of **Mupirocin** 2% nasal ointment tds to anterior nares and **Chlorhexidine** 4% wash daily for 5 days as per the MRSA topical eradication guideline until a negative screen result is obtained.
- If the patient tests negative for MRSA, the topical therapy can be stopped prior to the 5 days.
- If the patient tests positive for MRSA, continue the topical eradication for the full five days, irrespective of the day that surgery occurred and re-swab as per the guideline.
- Patients who are known to be colonised with or at high risk (e.g. admitted from nursing / residential home) of colonisation with MRSA should follow the MRSA positive prophylaxis recommendation if screening results are not available prior to surgery.

Indication		Antibiotic	Further Doses	Additional comments
Fixation of fracture		**Co-amoxiclav** 1.2grams IV within 30 minutes of knife to skin to time	For intra-medullary nails two further doses of **Co-amoxiclav** 1.2grams IV at 8 hourly intervals	Single dose on induction for extra-medullary fixation.
	Penicillin allergic or MRSA colonised or high risk patient	**Teicoplanin** 400mg IV plus **Gentamicin** 1.5mg/kg IV within 30 minutes of knife to skin time	For intra-medullary nails one further dose of **Teicoplanin** 400mg IV after 12 hours	Do not administer Teicoplanin and Gentamicin together; ensure the cannula is flushed between drugs. Single dose on induction for extra-medullary fixation. Review doses if impaired renal function .
Insertion of Prosthetic Device **Joint procedure**)		**Co-amoxiclav** 1.2grams IV within 30 minutes of knife to skin to time	Two further doses of **Co-amoxiclav** 1.2grams IV at 8 hourly intervals	
	Penicillin allergic or MRSA colonised or high risk patient	**Teicoplanin** 400mg IV plus **Gentamicin** 1.5mg/kg IV within 30 minutes of knife to skin time	One further dose of **Teicoplanin** 400mg IV after 12 hours	Do not administer Teicoplanin and Gentamicin together; ensure the cannula is flushed between drugs. Review doses if impaired renal function.
Removal of Prosthetic Device for infection		**Teicoplanin** <70kg: 400mg IV >70kg: 600mg IV plus **Gentamicin** 5mg/kg IV within 30 minutes of knife to skin time	Continue **Teicoplanin** < 70kg: 400mg IV 12 hourly for a further 24hours then od > 70kg: 600mg IV 12 hourly for a further 24hours then od	Do not administer Teicoplanin and Gentamicin together; ensure the cannula is flushed between drugs. Give antibiotic prophylaxis after sampling.
Amputation of Limb		**Co-amoxiclav** 1.2grams IV within 30 minutes of knife to skin to time	-	If residual infected tissue after amputation see treatment section
	Penicillin allergic or MRSA colonised or high risk patient	**Teicoplanin** 400mg IV plus **Gentamicin** 1.5mg/kg IV within 30 minutes of knife to skin time	-	

Prophylaxis for open fractures

Antibiotic prophylaxis should be administered as soon as possible following the injury and certainly within 3 hours. For all open fractures a risk assessment should be made for immunity to tetanus (see table below)

Indication		Antibiotic	Course length	Additional comments
Open Fracture		**Co-amoxiclav** 1.2grams IV tds	**Gustilo grade 1 open fracture** 24 hours **Gustilo grade 2 or 3 open fracture** Until definitive soft tissue closure or 72 hours post injury - whichever is sooner.	**Surgical prophylaxis** At the time of first debridement: **Gentamicin** 1.5mg/kg IV on induction. At the time of skeletal stabilisation and definitive soft tissue closure: **Gentamicin** 1.5mg/kg IV and **Teicoplanin** 800mg IV within 30 minutes of knife to skin time.
	Penicillin allergic* not type 1 allergy	**Cefuroxime*** 1.5grams IV tds		
	Penicillin allergic* type 1 allergy	**Clindamycin** 600mg IV qds		

***Penicillin allergy** - patients with a history of anaphylaxis, urticaria or rash immediately after penicillin administration (type 1 allergy) should not receive a penicillin, cephalosporin or other β-lactam antibiotic.

Reference: Standards for the management of open factures of the lower limb. BAPRAS 2009
Gustilo classification of open fractures (J Bone Joint Surg (1976): 58A; 453-458)

Grade I - Open fracture with a skin wound less than 1 cm long and clean
Grade II - Open fracture with a laceration more than 1 cm long without extensive soft tissue damage, flaps or avulsions
Grade III - Either an open segmental fracture, an open fracture with extensive soft tissue damage, or a traumatic amputation

Tetanus Immunisation

IMMUNISATION STATUS	CLEAN WOUND	TETANUS-PRONE WOUND	
	Vaccine	Vaccine	Human tetanus immunoglobulin
Fully immunised i.e. has received a total of 5 doses of vaccine at appropriate intervals	✗	✗	Only if high risk*
Primary immunisation complete, boosters incomplete but up to date	✗	✗	Only if high risk*
Primary immunisation incomplete or boosters not up to date	✓	✓	✓
Not immunised or immunisation status not known or uncertain	✓	✓	✓

*High risk is regarded as heavy contamination with material likely to contain tetanus spores, and / or extensive devitalised tissue. Tetanus immunoglobulin: For prevention: 250 units by intramuscular injection, or 500 units if more than 24 hours have elapsed since injury or there is a risk of heavy contamination or following burns.

Tetanus prone wound includes:

- wounds or burns that require surgical intervention that is delayed for more than six hours
- wounds or burns that show a significant degree of devitalised tissue or a puncture-type injury, particularly where there has been contact with soil or manure
- wounds containing foreign bodies
- compound fractures
- wounds or burns in patients who have systemic sepsis

Reference: Immunisation Against Infectious Diseases – The Green Book. Chapter 30: Tetanus. Accessed online February 2013 http://immunisation.dh.gov.uk/green-book-chapters/chapter-30/

Prophylaxis for Urinary Catheter Changes

See Antibiotic guidelines for the treatment of urinary infections

---

RELATED DOCUMENTS All anti-infective documents

QUERIES Contact Microbiology x[redacted]