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Venous thromboembolism

Reducing the risk of venous thromboembolism (deep vein thrombosis and pulmonary embolism) in inpatients undergoing surgery)

NICE clinical guideline 46

Developed by the National Collaborating Centre for Acute Care

NICE clinical guideline 46

Venous thromboembolism: reducing the risk of venous thromboembolism (deep vein thrombosis and pulmonary embolism) in inpatients undergoing surgery)

Ordering information

You can download the following documents from www.nice.org.uk/CG046

- The NICE guideline (this document) – all the recommendations.
- A quick reference guide – a summary of the recommendations for healthcare professionals.
- ‘Understanding NICE guidance’ – information for patients and carers.
- The full guideline – all the recommendations, details of how they were developed, and summaries of the evidence they were based on.

For printed copies of the quick reference guide or ‘Understanding NICE guidance’, phone the NHS Response Line on 0870 1555 455 and quote:

- N1216 (quick reference guide)
- N1217 (‘Understanding NICE guidance’).

This guidance is written in the following context

This guidance represents the view of the Institute, which was arrived at after careful consideration of the evidence available. Healthcare professionals are expected to take it fully into account when exercising their clinical judgement. The guidance does not, however, override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with the patient and/or guardian or carer.

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Introduction

Venous thromboembolism (VTE) is the formation of a blood clot (thrombus) in a vein which may dislodge from its site of origin to cause an embolism. Most thrombi occur in the deep veins of the legs; this is called deep vein thrombosis (DVT). Dislodged thrombi may travel to the lungs; this is called a pulmonary embolism (PE), and can be fatal. Thrombi can also cause long-term morbidity due to venous insufficiency and post-thrombotic syndrome, potentially leading to venous ulceration.

Formation of thrombi is associated with inactivity and surgical procedures. The risk rises with the duration of the operation and period of immobility.

This guideline examines the risk of VTE in inpatients undergoing surgical procedures.

This guideline has a section on each of the following inpatient surgical procedures:

- elective orthopaedic surgery (for example, total hip or knee replacement)
- hip fracture surgery
- general surgery
- gynaecological surgery (excluding caesarean section)
- cardiac surgery
- thoracic surgery
- urological surgery
- neurosurgery (including spinal surgery)
- vascular surgery.

There may be other surgical procedures requiring an inpatient stay and healthcare professionals should exercise their clinical judgement when making decisions on the appropriateness of VTE prophylaxis.

This guideline assesses the evidence for the effectiveness of risk reduction measures. It provides recommendations on the most clinically and cost-effective measures to reduce the risk of VTE in inpatients having surgery.

Patient-centred care

This guideline offers best practice advice on reducing the risk of VTE in inpatients undergoing surgery.

Treatment and care should take into account patients' needs and preferences. People undergoing surgery that requires an inpatient stay should have the opportunity to make informed decisions about their care and treatment, in partnership with their healthcare professionals. If patients do not have the capacity to make decisions, healthcare professionals should follow the Department of Health guidelines – 'Reference guide to consent for examination or treatment' (2001) (available from www.dh.gov.uk). From April 2007 healthcare professionals will need to follow a code of practice accompanying the Mental Capacity Act (summary available from www.dca.gov.uk/menincap/bill-summary.htm).

Good communication between healthcare professionals and patients is essential. It should be supported by evidence-based written information tailored to the patient's needs. Treatment and care, and the information patients are given about it, should be culturally appropriate. It should also be accessible to people with additional needs such as physical, sensory or learning disabilities, and to people who do not speak or read English.

Carers and relatives should have the opportunity to be involved in decisions about the patient's care and treatment, unless the patient specifically excludes them.

Carers and relatives should also be given the information and support they need.

Key priorities for implementation

- Patients should be assessed to identify their risk factors for developing venous thromboembolism (VTE; see box 1).
- Healthcare professionals should give patients verbal and written information, before surgery, about the risks of VTE and the effectiveness of prophylaxis.
- Inpatients having surgery should be offered thigh-length graduated compression/anti-embolism stockings from the time of admission to hospital unless contraindicated (for example, in patients with established peripheral arterial disease or diabetic neuropathy). If thigh-length stockings are inappropriate for a particular patient for reasons of compliance or fit, knee-length stockings may be used as a suitable alternative.
- The stocking compression profile should be equivalent to the Sigel profile, and approximately 18 mmHg at the ankle, 14 mmHg at the mid-calf and 8 mmHg at the upper thigh.
- Patients using graduated compression/anti-embolism stockings should be shown how to wear them correctly by healthcare professionals trained in the use of that product. Stocking use should be monitored and assistance provided if they are not being worn correctly.
- Intermittent pneumatic compression or foot impulse devices may be used as alternatives or in addition to graduated compression/anti-embolism stockings while surgical patients are in hospital.
- In addition to mechanical prophylaxis, patients at increased risk of VTE because they have individual risk factors (see box 1) and patients having orthopaedic surgery should be offered low molecular weight heparin (LMWH). Fondaparinux, within its licensed indications, may be used as an alternative to LMWH.
- LMWH or fondaparinux therapy should be continued for 4 weeks after hip fracture surgery.
- Regional anaesthesia reduces the risk of VTE compared with general anaesthesia. Its suitability for an individual patient and procedure should be

considered, along with the patient's preferences, in addition to any other planned method of thromboprophylaxis.

- Healthcare professionals should encourage patients to mobilise as soon as possible after surgery.

1 Guidance

The following guidance is based on the best available evidence. The full guideline ('Venous thromboembolism: reducing the risk of venous thromboembolism [deep vein thrombosis and pulmonary embolism] in inpatients undergoing surgery') gives details of the methods and the evidence used to develop the guidance (see section 5 for details).

This guidance refers to inpatients having surgery. The term mechanical prophylaxis covers graduated compression/anti-embolism stockings, intermittent pneumatic compression devices and foot impulse devices.

1.1 *Assessment of risk and patient advice*

1.1.1 Patients should be assessed to identify their risk factors for developing venous thromboembolism (VTE; see box 1).

Box 1. Patient-related risk factors for VTE

- Active cancer or cancer treatment
- Active heart or respiratory failure
- Acute medical illness
- Age over 60 years
- Antiphospholipid syndrome
- Behcet's disease
- Central venous catheter in situ
- Continuous travel of more than 3 hours approximately 4 weeks before or after surgery
- Immobility (for example, paralysis or limb in plaster)
- Inflammatory bowel disease (for example, Crohn's disease or ulcerative colitis)
- Myeloproliferative diseases
- Nephrotic syndrome
- Obesity (body mass index ≥ 30 kg/m²)
- Paraproteinaemia

- Paroxysmal nocturnal haemoglobinuria
- Personal or family history of VTE
- Pregnancy or puerperium
- Recent myocardial infarction or stroke
- Severe infection
- Use of oral contraceptives or hormonal replacement therapy
- Varicose veins with associated phlebitis
- Inherited thrombophilias, for example:
 - High levels of coagulation factors (for example, Factor VIII)
 - Hyperhomocysteinaemia
 - Low activated protein C resistance (for example, Factor V Leiden)
 - Protein C, S and antithrombin deficiencies
 - Prothrombin 2021A gene mutation.

- 1.1.2 Healthcare professionals should give patients verbal and written information, before surgery, about the risks of VTE and the effectiveness of prophylaxis.
- 1.1.3 Healthcare professionals should inform patients that the immobility associated with continuous travel of more than 3 hours in the 4 weeks before or after surgery may increase the risk of VTE.
- 1.1.4 Healthcare professionals should advise patients to consider stopping combined oral contraceptive use 4 weeks before elective surgery.
- 1.1.5 Healthcare professionals should give patients verbal and written information on the following, as part of their discharge plan.
- The signs and symptoms of DVT and PE.
 - The correct use of prophylaxis at home.
 - The implications of not using the prophylaxis correctly.

1.2 *Reducing the risk of venous thromboembolism in all surgical specialities*

- 1.2.1 Inpatients having surgery should be offered thigh-length graduated compression/anti-embolism stockings from the time of admission to hospital unless contraindicated (for example, in patients with established peripheral arterial disease or diabetic neuropathy). If thigh-length stockings are inappropriate for a particular patient for reasons of compliance or fit, knee-length stockings may be used as a suitable alternative.
- 1.2.2 The stocking compression profile should be equivalent to the Sigel profile, and approximately 18 mmHg at the ankle, 14 mmHg at the mid-calf and 8 mmHg at the upper thigh.
- 1.2.3 In addition to mechanical prophylaxis, patients at increased risk of VTE because they have individual risk factors (see box 1) and patients having orthopaedic surgery should be offered low molecular weight heparin (LMWH). Fondaparinux, within its licensed indications, may be used as an alternative to LMWH.
- 1.2.4 Healthcare professionals should encourage patients to wear their graduated compression/anti-embolism stockings until they return to their usual level of mobility. Patients should be informed that this will reduce their risk of developing VTE.
- 1.2.5 Patients using graduated compression/anti-embolism stockings should be shown how to wear them correctly by healthcare professionals trained in the use of that product. Stocking use should be monitored and assistance provided if they are not being worn correctly.
- 1.2.6 Intermittent pneumatic compression or foot impulse devices may be used as alternatives or in addition to graduated compression/anti-embolism stockings while surgical patients are in hospital.

- 1.2.7 When used on the ward, intermittent pneumatic compression or foot impulse devices should be used for as much of the time as is possible and practical while the patient is in bed or sitting in a chair.
- 1.2.8 Vena caval filters should be considered for surgical inpatients with recent (within 1 month) or existing VTE and in whom anticoagulation is contraindicated.
- 1.2.9 The risks and benefits of stopping pre-existing established anticoagulation or antiplatelet therapy before surgery should be considered.
- 1.2.10 Regional anaesthesia reduces the risk of VTE compared with general anaesthesia. Its suitability for an individual patient and procedure should be considered, along with the patient's preferences, in addition to any other planned method of thromboprophylaxis.
- 1.2.11 If a regional anaesthetic technique is used, the timing of pharmacological prophylaxis should be carefully planned to minimise the risk of haematoma.
- 1.2.12 Healthcare professionals should not allow patients having surgery to become dehydrated during their stay in hospital.
- 1.2.13 Healthcare professionals should encourage patients to mobilise as soon as possible after surgery.
- 1.2.14 Healthcare professionals should arrange for immobilised patients to have leg exercises.

1.3 Reducing the risk of venous thromboembolism by type of surgery

There may be other surgical procedures requiring an inpatient stay that are not covered in this guideline. Healthcare professionals should exercise their clinical judgement when making decisions on the appropriateness of VTE prophylaxis.

Please see the appropriate summary of product characteristics for details on the timing and administration of pharmacological prophylaxis.

Elective orthopaedic surgery (spinal surgery is considered with neurosurgery)

- 1.3.1 Patients having elective orthopaedic surgery should be offered mechanical prophylaxis and either LMWH or fondaparinux.
- 1.3.2 Patients having hip replacement surgery with one or more risk factors for VTE (see box 1) should have their LMWH or fondaparinux therapy continued for 4 weeks after surgery.

Hip fracture surgery

- 1.3.3 Patients having surgery for hip fracture should be offered mechanical prophylaxis and either LMWH or fondaparinux.
- 1.3.4 LMWH or fondaparinux therapy should be continued for 4 weeks after hip fracture surgery.

General surgery

- 1.3.5 Patients having general surgery should be offered mechanical prophylaxis.
- 1.3.6 Patients having general surgery with one or more risk factors for VTE (see box 1) should be offered mechanical prophylaxis and either LMWH or fondaparinux.

Gynaecological surgery (excluding caesarean section)

1.3.7 Patients having gynaecological surgery should be offered mechanical prophylaxis.

1.3.8 Patients having gynaecological surgery with one or more risk factors for VTE (see box 1) should be offered mechanical prophylaxis and LMWH.

Cardiac surgery

1.3.9 Patients having cardiac surgery should be offered mechanical prophylaxis.

1.3.10 Patients having cardiac surgery who are not otherwise receiving anticoagulation therapy and who have one or more risk factors for VTE (see box 1) should be offered mechanical prophylaxis and LMWH.

Thoracic surgery

1.3.11 Patients having thoracic surgery should be offered mechanical prophylaxis.

1.3.12 Patients having thoracic surgery with one or more risk factors for VTE (see box 1) should be offered mechanical prophylaxis and LMWH.

Urological surgery

1.3.13 Patients having urological surgery should be offered mechanical prophylaxis.

1.3.14 Patients having urological surgery with one or more risk factors for VTE (see box 1) should be offered mechanical prophylaxis and LMWH.

Neurosurgery (including spinal surgery)

1.3.15 Patients having neurosurgery should be offered mechanical prophylaxis.

- 1.3.16 Patients having neurosurgery with one or more risk factors for VTE (see box 1) should be offered mechanical prophylaxis and LMWH.
- 1.3.17 Patients with ruptured cranial or spinal vascular malformations (for example, brain aneurysms) should not be offered pharmacological prophylaxis until the lesion has been secured.

Vascular surgery

- 1.3.18 Patients having vascular surgery should be offered mechanical prophylaxis.
- 1.3.19 Patients having vascular surgery with one or more risk factors for VTE (see box 1) should be offered mechanical prophylaxis and LMWH.

2 Notes on the scope of the guidance

NICE guidelines are developed in accordance with a scope that defines what the guideline will and will not cover. The scope of this guideline is available from www.nice.org.uk/page.aspx?o=250362

2.1 What the guideline covers

This guideline covers adults (age 18 and older) undergoing inpatient surgical procedures that carry a high risk of VTE, including:

- orthopaedic surgery (for example, total hip or knee replacement, surgery for hip fracture)
- major general surgery
- major gynaecological surgery (but not including elective or emergency caesarean)
- urological surgery (including major or open urological procedures)
- neurosurgery
- cardiothoracic surgery
- major peripheral vascular surgery.

There may be other surgical procedures requiring an inpatient stay and healthcare professionals should exercise their clinical judgement when making decisions on the appropriateness of VTE prophylaxis.

2.2 What the guideline does not cover

This guideline does not cover patients aged under 18 years.

Additionally, this guideline does not cover adult patients who are at a high risk of developing VTE but are not undergoing surgery. For example, the following circumstances and patients are excluded from the guideline, unless patients are undergoing one of the surgical procedures listed above.

- Patients with acute myocardial infarction.
- Patients who have had an acute stroke.
- Patients with cancer, including those being treated with chemotherapy.

- Pregnancy and the puerperium.
- Use of oral contraceptives and hormone replacement therapy.
- Long-distance travel.

How this guideline was developed

NICE commissioned the National Collaborating Centre for Acute Care to develop this guideline. The Centre established a Guideline Development Group (see appendix A), which reviewed the evidence and developed the recommendations. An independent Guideline Review Panel oversaw the development of the guideline (see appendix B).

There is more information in the booklet: 'The guideline development process: an overview for stakeholders, the public and the NHS' (second edition, published April 2006), which is available from www.nice.org.uk/guidelinesprocess or by telephoning 0870 1555 455 (quote reference N1113).

3 Implementation in the NHS

The Healthcare Commission assesses the performance of NHS organisations in meeting core and developmental standards set by the Department of Health in 'Standards for better health', issued in July 2004. Implementation of clinical guidelines forms part of the developmental standard D2. Core standard C5 says that national agreed guidance should be taken into account when NHS organisations are planning and delivering care.

NICE has developed tools to help organisations implement this guidance (listed below). These are available on our website (www.nice.org.uk/CG046).

- *Slides* highlighting key messages for local discussion.
- Costing tools
 - *Costing report* to estimate the national savings and costs associated with implementation.
 - *Costing template* to estimate the local costs and savings involved.

- *Implementation advice* on how to put the guidance into practice and national initiatives which support this locally.
- *Audit criteria* to monitor local practice.

4 Research recommendations

The Guideline Development Group has made the following recommendations for research, based on its review of evidence, to improve NICE guidance and patient care in the future.

4.1 *Incidence of clinical deep vein thrombosis, confirmed pulmonary embolism, major bleeding, and other postoperative adverse outcomes in modern surgical practice*

What is the relevance of surgical procedure and patient risk factors to the incidence of clinical deep vein thrombosis (DVT), confirmed pulmonary embolism (PE), major bleeding, and other postoperative adverse outcomes (for example, myocardial infarction, stroke) in modern surgical practice?

The aim should be to recruit patients undergoing a range of surgical procedures with different levels of expected risk of VTE, ensuring coverage of the common operations currently performed in the NHS.

Baseline evaluation would aim to identify risk factors for VTE and for other adverse outcomes (for example, bleeding and occlusive vascular events). The study would also record any in-hospital drug treatment and discharge medication. Note, however, that this would be a large observational cohort study and would not be appropriate for determining the effects of treatment, because moderate effects cannot be assessed reliably by such studies.

The control (reference) group will be defined for each parameter (for example, age) by a category of patients at low risk of VTE (for example, age younger than 30 years).

Why this is important

The chief difficulty faced when formulating the present guideline was the absence of accurate estimates of VTE risk in the modern era. Although it was possible to estimate the relative risk reductions associated with particular interventions, it was not possible to estimate their associated absolute benefits. It is possible that the modern risks of VTE are much lower than is represented by the available trial evidence because of changes in anaesthetic practice and earlier mobilisation. Information on absolute risks of VTE (and other postoperative complications) needs to be obtained in order to assess cost effectiveness reliably.

Information from this study would help surgical teams to provide their patients with accurate information about the balance of benefit and risk associated with particular interventions.

This study could be performed easily if the design elements were kept simple, with one-sided forms that could be completed by junior staff at discharge, and follow-up through mailed questionnaires and tracking of mortality via the Office of National Statistics.

4.2 *Timing of administration of low molecular weight heparin*

What is the effectiveness of low molecular weight heparin (LMWH) started pre-operatively compared with LMWH started post-operatively, in reducing the risk of (objectively diagnosed) DVT or PE in adult patients undergoing inpatient surgical procedures?

All patients should be screened for the presence of DVT and/or PE.

Secondary outcomes of interest are costs, quality of life and other adverse events (for example, myocardial infarction, stroke, extracranial or intracranial bleeding).

Why this is important

The currently available randomised evidence is too limited to determine whether giving LMWH can be safely delayed until after surgery, or whether it

must be given preoperatively. This guideline recommends that LMWH is used for many patients at risk of VTE and is therefore non-specific about timing. This is a major gap in the evidence.

Although there may be only small differences in safety and efficacy between these two strategies, a policy of giving LMWH postoperatively may reduce the time that patients need to be in hospital before surgery and therefore have major benefits for patients.

As there is uncertainty around this question, it should be possible to find surgeons willing to randomise between these two strategies. The principal practical difficulty with this randomised trial would be the need for a very large sample size (with possibly more than 10,000 patients), because the likely differences in DVT/PE and bleeding rates are small.

4.3 *The effectiveness of combining methods of mechanical prophylaxis*

What is the effectiveness of graduated compression/anti-embolism stockings and either an intermittent pneumatic compression (IPC) device or a foot pump device, compared with graduated compression/anti-embolism stockings alone, in reducing the risk of (objectively diagnosed) DVT and/or PE in adult inpatients undergoing surgery? Patients may be at risk of VTE because of the procedure (for example, hip fracture), or because they have risk factors for such disease (for example, thrombophilia or age over 60 years).

All patients should be screened for the presence of DVT and/or PE.

Randomisation would be stratified into two groups.

- Patients in whom pharmacological prophylaxis is contraindicated (for example, because of an increased risk of bleeding).
- Patients in whom pharmacological prophylaxis is indicated, but the risk of VTE is very high.

Secondary outcomes would be costs, quality of life, skin problems, myocardial infarction, stroke and other adverse events (for example, bleeding).

Why this is important

Only a small number of randomised controlled trials have evaluated a combination of mechanical methods. These studies have shown promising results, but have involved small numbers of patients, and the large effect sizes observed in some of these studies suggest bias.

This trial would inform the management of two specific groups of patients in whom the available treatment options are restricted.

- Patients at high risk of VTE who cannot have LMWH because they are at increased risk of bleeding.
- Patients at very high risk of VTE who can be given pharmacological prophylaxis and who might benefit from combination mechanical thromboprophylaxis.

This trial would help extend the current NICE recommendations. There may be cost savings if the addition of a second mechanical method results in further risk reduction of VTE.

The proposed research is feasible but depends on the extent to which surgeons are certain about the value of combining two mechanical methods of thromboprophylaxis, because this would determine their willingness to randomise. Before any trial this issue would need to be explored in detail, possibly via a questionnaire.

5 Other versions of this guideline

5.1 *Full guideline*

The full guideline, 'Venous thromboembolism: reducing the risk of venous thromboembolism (deep vein thrombosis and pulmonary embolism) in inpatients undergoing surgery' contains details of the methods and evidence used to develop the guideline. It is published by the National Collaborating Centre for Acute Care, and is available from

www.rcseng.ac.uk/surgical_research_units/nccac, our website (www.nice.org.uk/CG046fullguideline) and the National Library for Health (www.nlh.nhs.uk).

5.2 *Quick reference guide*

A quick reference guide for healthcare professionals is also available from

www.nice.org/CG046quickrefguide

For printed copies, phone the NHS Response Line on 0870 1555 455 (quote reference number N1216).

5.3 *'Understanding NICE guidance'*

Information for patients and carers ('Understanding NICE guidance') is available from www.nice.org.uk/CG046publicinfo

For printed copies, phone the NHS Response Line on 0870 1555 455 (quote reference number N1217).

6 Related NICE guidance

NICE is developing the following guidance (details available from www.nice.org.uk):

- Thrombophilia screening for the diagnosis of individuals at high risk of thrombosis. NICE technology appraisal guidance. (Publication expected January 2008).

- Idraparinux sodium for the treatment of recurrent thromboembolism. NICE technology appraisal guidance. (Publication date to be confirmed).

7 Updating the guideline

NICE clinical guidelines are updated as needed so that recommendations take into account important new information. We check for new evidence two and four years after publication, to decide whether all or part of the guideline should be updated. If important new evidence is published at other times, we may decide to do a more rapid update of some recommendations.

Appendix A: The Guideline Development Group

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Appendix B: The Guideline Review Panel

The Guideline Review Panel is an independent panel that oversees the development of the guideline and takes responsibility for monitoring adherence to NICE guideline development processes. In particular, the panel ensures that stakeholder comments have been adequately considered and responded to. The Panel includes members from the following perspectives: primary care, secondary care, lay, public health and industry.

Mr Peter Robb (Chair)

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