

Guidelines

Guideline for the management of hip fractures 2020

Guideline by the Association of Anaesthetists

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Summary

We convened a multidisciplinary Working Party on behalf of the Association of Anaesthetists to update the 2011 guidance on the peri-operative management of people with hip fracture. Importantly, these guidelines describe the core aims and principles of peri-operative management, recommending greater standardisation of anaesthetic practice as a component of multidisciplinary care. Although much of the 2011 guidance remains applicable to contemporary practice, new evidence and consensus inform the additional recommendations made in this document. Specific changes to the 2011 guidance relate to analgesia, medicolegal practice, risk assessment, bone cement implantation syndrome and regional review networks. Areas of controversy remain, and we discuss these in further detail, relating to the mode of anaesthesia, surgical delay, blood management and transfusion thresholds, echocardiography, anticoagulant and antiplatelet management and postoperative discharge destination. Finally, these guidelines provide links to supplemental online material that can be used at readers' institutions, key references and UK national guidance about the peri-operative care of people with hip and periprosthetic fractures during the COVID-19 pandemic.

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Accepted: 27 September 2020

Keywords: Hip fracture, anaesthesia; Hip fracture, guidelines; Hip fracture, peri-operative management; Hip fracture, anticoagulation; Hip fracture, mortality; Hip fracture, complications

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This is a consensus document produced by expert members of a Working Party established by the Association of Anaesthetists of Great Britain and Ireland. It has also been seen and approved by the Board of Directors of the Association of Anaesthetists. It has also been endorsed by the British Geriatric Society.

Recommendations

The Working Party endorses the International Fragility Fracture Network's consensus statement on the principles of anaesthesia for older patients with fragility hip fracture [1]:

- 1 Anaesthesia is integral to the multidisciplinary care of hip fracture patients.
- 2 Anaesthesia (and surgery) for hip fracture should be undertaken by an appropriately experienced anaesthetist (and surgeon).
- 3 Anaesthetists should participate in developing formal institutional hip fracture care pathways, particularly with regard to preparation for theatre and pain management.
- 4 Anaesthetists should facilitate surgery within 36 h of hip fracture.
- 5 Anaesthesia should be administered according to agreed standards at each hospital, using age-appropriate drug doses, with the aims of facilitating early patient remobilisation, re-enablement and rehabilitation.
- 6 Anaesthetists should participate routinely in standardised peri-operative data collection about people with hip fracture, focusing on commonly agreed outcomes in the first 5 postoperative days.
- 7 All trainee anaesthetists should receive specific training in providing peri-operative care for people with hip fracture.

The Working Party recommends that these principles should apply to the peri-operative management of older (> 65 years) and/or frailer people with other long bone and periprosthetic fractures.

What other guideline statements are available on this topic?

This guideline provides an updated version of the 2011 Association of Anaesthetists' guidance on the peri-operative management of people with hip fracture [2]. As such, it avoids repeating recommendations that still relate to the contemporary management of people with hip fracture, but highlights changes to the 2011 recommendations resulting from new evidence or consensus.

The 2011 guidelines informed the 2018 International Fragility Fracture Network's consensus statement on the principles of anaesthesia for patients with hip fracture, the summary recommendations of which the Working Party endorse (see above) [1].

Other recent Association of Anaesthetists' guidelines on peri-operative care of the elderly [3], bone cement implantation syndrome [4] and dementia [5] are applicable to the peri-operative care of people with hip fracture.

The COVID-19 pandemic intervened during the synthesis of these guidelines. Members of the Working Party were involved in the development of English/Welsh guidelines on the peri-operative care of people with hip and major fragility fractures (including periprosthetic fractures) during the COVID-19 pandemic [6, 7].

Why was this guideline developed?

Since the publication of the 2011 guidelines, there have been several large observational studies published (although few randomised controlled trials (RCT)), which together with data from three UK national hip fracture databases [8–10] have better informed the original consensus recommendations.

How and why does this statement differ from existing guidelines?

The incorporation of new knowledge derived from observational and audit data has contributed to a decline in national 30-day mortality after hip fracture surgery in England and Wales, from 10.9% in 2007 to 6.1% in 2018 [8]. However, there remain wide variations in some standards of care delivered, especially in anaesthesia. The Working Party recommends greater standardisation of anaesthetic management for people requiring hip fracture surgery [11], in line with international consensus guidance [2].

These guidelines contain more specific recommendations about controversial areas of patient management than were made in 2011, particularly with reference to anaemia, anticoagulation, valvular heart disease and type of anaesthesia.

This has been a multidisciplinary collaboration between anaesthetists and other clinicians on further improving hip fracture services in the UK. Although the guidance is specific to hip fracture, the Working Party

suggests that the principles contained in this update are applicable to older/frail people with other long bone and periprosthetic fractures, in line with recent advice from the British Orthopaedic Association [12].

Introduction

The original Association of Anaesthetists' guidance was published in response to considerable national concern about the perceived poor peri-operative management of people with hip fracture [2].

Since 2011, standardised, multidisciplinary pathways of care have led to significant progress in hip fracture management in the UK, with an associated reduction in mortality, length of stay and time to orthogeriatric assessment, operation and remobilisation. By undertaking co-ordinated research and standardising care based on the evidence accumulated, surgeons have narrowed the range of surgeries performed for hip fracture repair and the prostheses used, and orthogeriatricians have been instrumental in re-enabling and rehabilitating people promptly after fracture. These gains have reduced the relative financial burden of hip fracture to the NHS, and the personal burden to patients and their families/carers [11].

In comparison, national data suggest that 'anaesthesia' has been slower in adopting standardised practice. Anaesthetic care is variable and appears to be affected by national policy as much as by clinical expediency. According to published National Hip Fracture Database data [13], for example, the number of nerve blocks co-administered with general or spinal anaesthesia improved from 2015 to 2017, but has declined since (Table 1). This may have occurred because, anecdotally, anaesthetists are reluctant to repeat more prevalent nerve blocks administered on admission to hospital. However, the decline in co-administration also coincided with the omission of peri-operative nerve blocks as a clinical quality standard from updated 2016 National Institute for Health and Care Excellence guidance (Quality Standard 16 [14]), compared with their original 2011 guidance (Clinical Guideline 124 [15]). Nevertheless, there remains the broadest possible range (0–100%) in variation between hospitals in providing nerve blocks to prolong

postoperative analgesia, even within the same health region.

At the time of writing (July 2020), it is uncertain what the effect of COVID-19 will be on the provision and outcomes of fragility hip fracture care in the UK. Anecdotally, similar numbers of people have presented for hip fracture surgery, but some have faced long delays before their operation. Specific NHS England [6], and Royal College of Anaesthetists' Faculty of Intensive Care Medicine, Intensive Care Society and Association of Anaesthetists' [7] COVID-19 pandemic guidance recommends prompt (< 24 h), consultant-delivered surgical and anaesthesia care, preferring spinal anaesthesia if possible, co-administered with nerve block and minimal/no sedation. Compliance with this guidance, and its effects on outcome, should become clearer when the National Hip Fracture Database publishes its 2020 data in 2021.

Spinal or general anaesthesia?

The Working Party considers that the slow adoption of standardisation in anaesthesia has resulted from a relative dearth of new research evidence for changing practice. Much of the research currently been undertaken on the anaesthetic management of hip fracture remains focused on determining whether regional or general anaesthesia provides better outcomes after hip fracture surgery [16–18]; negative results will fail to resolve this issue, and positive results will be at odds with large, observational studies [19, 20] and mixed-methods meta-analyses [21].

The Working Party considers that any difference in outcome between anaesthesia types is likely to be small in comparison with the effects on outcome of trauma, surgery, orthogeriatric care and patient factors (age, frailty, cognitive impairment) for people with hip fracture. This may be because there is genuinely no difference between types of anaesthesia, or – more likely – because the outcomes traditionally measured after hip fracture anaesthesia (mortality, length of stay, return to residence) are too variably defined and temporally disconnected to be attributable to a single 1–2 h episode of anaesthesia.

This is not to suggest that anaesthesia does not play a crucial role in the management of people with hip fracture,

Table 1 Proportion of nerve blocks co-administered with general or spinal anaesthesia for hip fracture surgery in England and Wales, by year. Figures represent proportion of general/spinal anaesthetics.

Year	2019	2018	2017	2016	2015
General anaesthesia + nerve block	57.2%	56.7%	70.7%	64.1%	58.6%
Spinal anaesthesia + nerve block	39.8%	38.5%	50.1%	40.2%	33.0%

particularly their peri-operative care. However, the Working Party considers the careful delivery of anaesthesia may be of greater importance than the type of anaesthesia delivered.

Observational research from the Anaesthesia Sprint Audit of Practice (ASAP)-1 and -2 studies suggests that aspects of anaesthetic management for hip fracture surgery are associated with differences in outcome. Intra-operative hypotension, for example, is common [19] and progressively associated with significant increases in 5- and 30-day postoperative mortality [20]. This echoes other recent observational associations found between death and hypotension in the general surgical population [22].

Pragmatically, the Working Party recommends that future research comparing the types of anaesthesia should focus first on identifying best practice within each type, then comparing outcomes between best practices. Best practice is likely to involve age-appropriate (lower) doses of anaesthetic agent with co-administration of supplemental nerve blockade, and careful management of intra-operative blood pressure. The Working Party supports the use of recently published, standardised core outcomes derived by Delphi consensus in future hip fracture anaesthesia research [23]. Furthermore, the Working Party suggests that individual hospitals develop preferred, standardised anaesthesia techniques (through a process of multidisciplinary consensus) that are administered to the majority of their patients, in order to improve both the predictability and successful management of that technique's postoperative complications by orthogeriatricians and allied rehabilitation professionals.

Finally, the Working Party supports the use of continuous quality improvement initiatives such as the National Hip Fracture Database 'dashboards' [13] for monitoring peri-operative performance and the effects of introducing changes in practice.

The aims of anaesthesia management for hip fracture

In updating these guidelines, the Working Party reconsidered the aims of anaesthesia in hip fracture management, beyond the relative merits of general/spinal administration, towards its integrated role within standardised multidisciplinary care pathways.

The Working Party considers that there are four key aims of anaesthesia in hip fracture management.

Pre-operative preparation

Prehabilitation describes the involvement of anaesthetists in patient management after hospital admission but before

operating theatre admission, in order to facilitate prompt (< 36 h) access to surgery. Common themes include analgesia; fluid resuscitation; communication within multidisciplinary pre-operative meetings; the provision of daily trauma lists that prioritise hip fracture surgery; and standardised pre-operative assessment guided by codified treatment plans for common medical conditions. These themes are addressed more comprehensively in the 2011 guidelines.

Remobilisation

Based on National Institute for Health and Care Excellence (NICE) guidance [20], the National Hip Fracture Database has adopted patient remobilisation on the day of or day after surgery as a Key Performance Indicator. Approximately 20% of patients (approximately 13,400) failed to achieve this target in 2018 in the UK (except Scotland) due to pain and/or hypotension [8]; delirium and anaemia also prevent early remobilisation [24]. Echoing the findings of an audit by the Chartered Society of Physiotherapy, the National Hip Fracture Database suggests that (pain and hypotension) are "*factors that might have been anticipated by clear peri-operative protocols and closer working between surgical and anaesthetic colleagues*" [8].

Re-enablement

Re-enablement describes the process of the person recommencing their activities of daily living usually between days 2 and 5 after surgery, which can be interrupted or delayed by ongoing pain and hypotension, but also by bowel (constipation, diarrhoea, nausea, vomiting, poor eating), bladder (retention) and cognitive issues (delirium, fatigue), all of which may be consequent to anaesthetic management [3, 5].

Rehabilitation

This describes the longer term resumption of normal living and return to pre-admission place of residence after surgery. Although influenced as much by organisational as clinical factors, 'anaesthetic' complications that prolong the trajectory of patient's recovery can delay their rehabilitation. For example, poor peri-operative analgesia might lead to relative opioid toxicity and subsequent aspiration, with prolonged recovery from consequent chest infection.

The Working Party strongly recommends the involvement of anaesthetists beyond the person leaving the post-anaesthesia care unit (PACU) after surgery. Ideally, anaesthetists should review their own patients the day after hip fracture surgery, but where this is not practicable,

departments of anaesthesia should develop protocols for reviewing and managing these patients, in order to support ongoing orthogeriatric care, and also to learn from successes and problems as part of continuous quality improvement. An anaesthetic representative should attend regular multidisciplinary hip fracture management meetings and feed back any relevant learning points to departments of anaesthesia/individual anaesthetists, as appropriate.

Specific changes to the 2011 guidance

In the light of recent research evidence, the Working Party recommends a number of minor changes to the 2011 guidance.

Analgesia

Randomised controlled trials [25, 26], observational studies [19], consensus opinion [2], national audit initiatives [8] and systematic review [27] all support the widespread use of peripheral nerve blocks for analgesia on admission to hospital and in the early postoperative period. These are effective at reducing pain and quadriceps spasm at rest and on movement; reduce time to remobilisation; reduce opioid administration (to a patient population 40% of who have renal dysfunction and are at greater risk of postoperative delirium); and are not contra-indicated in anticoagulated patients [28].

The Working Party recommends that:

- 1 Single shot nerve blocks should be provided in the Emergency Department and at the time of surgery (provided 6 h has passed between blocks) [27]. There is some evidence for their efficacy in providing pre-hospital analgesia [29];
- 2 Femoral or fascia iliaca blocks should be used, the latter possibly providing better incisional analgesia after surgery. Pericapsular nerve group blocks have not been compared with either fascia iliaca or femoral nerve blocks in trials to date, and do not provide analgesia to the surgical incision site;
- 3 Ultrasound-guided placement may increase accuracy and therefore the adequacy of analgesia;
- 4 Peripheral nerve blocks should be used routinely to supplement general or spinal anaesthesia. Their administration before positioning for spinal anaesthesia may reduce the need for additional sedation or intravenous analgesia;
- 5 The benefits of high volume, low concentration pericapsular/periosteal infiltration of local anaesthetic agents have not been formally assessed in the hip

fracture population. These techniques are recommended only when posterior surgical approaches to the hip are used, which may not be amenable to incisional analgesia by blocking the lateral cutaneous nerve of the thigh;

- 6 There is little evidence at present for the use of continuous nerve block techniques in UK practice, which may delay remobilisation.

Deprivation of liberty standards/liberty protection safeguards

Deprivation of Liberty Standards and their proposed update, Liberty Protection Safeguards, is an amendment to the Mental Capacity Act 2005, and apply to people in care homes and hospitals in England and Wales to whom proportionate restrictions and restraints may need to be applied in their best interests. In circumstances where a person's liberty might be deprived (e.g. using frequent physical or chemical 'restraint' to help a person with hip fracture through a period of postoperative delirium), a hospital can apply for a standard authorisation from a local authority to have a third party appointed with legal powers to represent that person, provided six criteria are met. The representative appointed will usually be a family member or friend but may be court-appointed deputy.

Anaesthetists do not have to be experts about whether proportionate restraint may or may not be a deprivation of liberty, but do need to understand that their actions may deprive a person with hip fracture of their liberty and take consequent action (normally discussion with orthogeriatric colleagues or their hospital's legal representative) [30].

Do not attempt resuscitation decisions

In 2016, guidance issued jointly by the British Medical Association, the Resuscitation Council (UK) and the Royal College of Nursing updated the framework concerning anticipatory decisions about whether or not cardiopulmonary resuscitation should be attempted [31]. The guidance was published in response to professional and public debate about better transparency, communication and recording in and about the decision-making process. Recommendations issued within the Association of Anaesthetists' 2017 guidance on *Consent for Anaesthesia* support the British Medical Association/Resuscitation Council (UK)/Royal College of Nursing position [32].

Although immediate peri-operative death is relatively uncommon in the often elderly, frail and comorbid population requiring hip fracture surgery, it can occur (e.g.

caused by bone cement implantation reactions [4]). The Working Party recommends that the resuscitation status of all hip fracture patients is reconfirmed during the WHO sign-in undertaken before commencement of an operating list, and anaesthetists routinely ascertain and record the patient's resuscitation status before administering anaesthesia, along with supporting information concerning any relevant advance decisions or ReSPECT (recommended summary plan for emergency care and treatment) documents [33].

Patient information

The provision of good quality information for patients is a key component of the consent process and is fundamental to good practice, as detailed by the General Medical Council [34] and Association of Anaesthetists [32]. A Delphi consensus process undertaken by a James Lind Alliance Priority Setting Partnership in 2018 highlighted the need for research into better information provision about peri-operative care and recovery after hip fracture [35]. The Working Party continues to recommend that departments of anaesthetists involve themselves in regular review of institutional patient information leaflets provided for people with hip fracture and their families/carers.

Risk assessment

The population of people who fall and sustain a hip fracture already has an appreciable background mortality rate associated with their age, frailty, comorbidities and polypharmacy. Many of these risk factors are non-modifiable at presentation. It remains unclear what additional mortality risk is caused by the trauma of fracture, surgery and anaesthesia, and peri-operative complications of these.

Background and additional risks vary significantly between patients, and anaesthetists should try to provide realistic, specific risk assessment for hip fracture patients and their families/carers. Risk assessment also helps clinicians determine individual patient management and its organisation (e.g. access to intensive/high dependency care), and compare care quality longitudinally, over time, and laterally, between hospitals.

Numerous risk assessment tools exist. The Nottingham Hip Fracture Score [36, 37] and the similar National Hip Fracture Database tool (Clinical Effectiveness Unit 17 'CEU17') [38, 39] are the most accurately predictive of mortality among the hip fracture population, if not necessarily on an individual basis. Frailty scores can predict discharge destination [40]. Organ-specific assessment tools

can be used to detect postoperative delirium (e.g. the 4 'A's Test (4AT) score [5, 41]) and acute kidney injury (e.g. the Nottingham Hip Fracture-Risk Score for Kidney Injury (NH-RISK) score [42]).

The Working Party recommends that hospitals risk assess all hip fracture patients using at least the Nottingham Hip Fracture Score, a frailty score and the 4AT delirium score. Future research is needed to determine whether the combination of these, or their integration into a new assessment tool, might improve individual/group risk stratification across the range of core outcomes after hip fracture [23].

Bone cement implantation syndrome

Peri-operative cardiorespiratory complications occur in about 20% of hip fracture patients for whom a cemented prosthesis is used; severe complications occur in a further 2%, and cardiorespiratory arrest in a further 0.5%. Some patients are at greater risk of developing these complications. Specific multidisciplinary communication and management can reduce the likelihood and severity of cement reactions (further observational study is required to quantify the efficacy of these approaches).

The Working Party recommends that all anaesthetists providing care for hip fracture patients read and implement the 2015 safety guideline on reducing the risk of cemented hemiarthroplasty for hip fracture, issued jointly by the Association of Anaesthetists, British Orthopaedic Association and British Geriatric Society [4].

Regional review networks

Annually in England, Wales and Northern Ireland, the National Hip Fracture Database identifies hospitals with 30-day postoperative mortality rates above the 95% control limits that might indicate the provision of poor overall care for hip fracture patients. These hospitals are invited to request a multidisciplinary service review from the British Orthopaedic Association to identify potential areas for service improvement and help redistribute institutional organisation and finance to support the changes needed. These hospitals have found this a useful process that has enabled them to improve their hip fracture service towards that provided by other hospitals locally and nationally.

Extending this peer review process, several healthcare regions have set up continuous, informal multidisciplinary service review programmes, as a way of usefully monitoring care quality, and disseminating knowledge.

The Working Party supports the utility of these initiatives and encourages anaesthetists to involve

themselves in implementing or continuing these in each healthcare region in the UK.

Controversies

The Working Party considers that the 2011 guidelines clarified many of the recurrent controversies that arose in hip fracture care. However, the emergence of new therapies and research in the interim requires further clarification.

Delaying surgery

Based on meta-analyses [43, 44], the 2011 guidelines and Fragility Fracture Network guidelines proposed that people should receive corrective surgery within 48 h of sustaining a hip fracture (< 36 h in the UK).

The Working Party continues to recommend a 36-h limit from fracture to surgery in the UK.

The international HIP ATTACK (hip fracture accelerated surgical treatment and care track) RCT reported in February, 2020 [45]. This study found that accelerated surgery (within a goal of 6 h after diagnosis) did not improve either mortality or non-fatal major complications (myocardial infarction, stroke, venous thromboembolism, sepsis, pneumonia, life-threatening bleeding and major bleeding) 90 days later among 1487 people with hip fracture, compared with a similar number ($n = 1483$) who received standard care (median time from diagnosis to surgery of 24 h (IQR 10–42). Accelerated surgery did not harm patients, even for those with acute medical conditions. Interestingly, accelerated surgery significantly reduced both the prevalence of postoperative delirium (9% vs. 12%, HR 0.72 (95%CI 0.58–0.92), $p = 0.0089$) and length of inpatient stay, and improved the speed of postoperative mobilisation. The Working Party considers these data reassuring and clinically important for patients but acknowledge that the resource implications of accelerated surgery need to be calculated before recommending its adoption into current UK practice.

The 2011 guidelines list seven 'acceptable' reasons for delaying surgery:

- 1 Haemoglobin < 80 g.l⁻¹
- 2 Plasma sodium concentration < 120 or > 150 mmol.l⁻¹ and potassium concentration < 2.8 or > 6.0 mmol.l⁻¹
- 3 Uncontrolled diabetes
- 4 Uncontrolled or acute onset left ventricular failure.
- 5 Correctable cardiac arrhythmia with a ventricular rate > 120.min⁻¹
- 6 Chest infection with sepsis
- 7 Reversible coagulopathy

The Fragility Fracture Network guidance states "surgery should be delayed only if the benefits of additional medical treatment outweigh the risks of delaying surgery".

In many cases, the risks of delay associated with pain and immobility contribute to poor outcomes to a far greater extent than correction of an abnormality to a particular numerical value. Rather than cancelling surgery on the day of operation in reaction to one of the seven abnormalities listed, the Working Party considers that 36 h (or less) provides sufficient time for the proactive involvement of anaesthetists in correcting medical obstacles to surgery. In the (rare) event of cancellation for medical reasons, patients should be kept under 12-hourly assessment by anaesthetic teams. Anaesthetists should work with orthogeriatricians to optimise the person for surgery as soon as possible, communicate with the hip fracture care team what needs to happen to avoid repeated cancellation and delay, and document any decisions clearly in the person's medical notes.

Peri-operative blood management and transfusion thresholds

The 2011 guidelines indicated that peri-operative haemoglobin concentrations should be kept above 90 g.l⁻¹ or 100 g.l⁻¹ for patients with a history of ischaemic heart disease, anticipating a mean decrease of 25 g.l⁻¹ peri-operatively (or more in patients with complex/periprosthetic fractures).

In contrast to these liberal transfusion thresholds, Carson et al. found no difference in mortality or ability to walk across a room without human assistance 60 days [46] and 3 years [47] postoperatively among 2016 older patients with hip fracture and cardiovascular disease, randomly assigned 3 days postoperatively to receive either a liberal transfusion strategy (Hb threshold < 100 g.l⁻¹) or a restrictive transfusion strategy (symptoms of anaemia/physician discretion if Hb < 80 g.l⁻¹). Systematic Cochrane reviews in 2012 [48] and 2016 [49] reiterated Carson et al.'s finding that blood transfusions can be avoided in most patients with Hb > 70–80 g.l⁻¹.

However, in a 2016 context-specific systematic review and meta-analysis of RCTs, restrictive strategies seemed to significantly increase the risk of events reflecting inadequate oxygen supply, mortality and composite events (myocardial infarction; arrhythmia; unstable angina; stroke; acute kidney injury; mesenteric ischaemia; peripheral ischaemia; and mortality (occurring within 30 days)) in seven studies of 3465 older (but not critically ill) patients requiring orthopaedic procedures [50]. However, these

findings were at odds with a further 2015 Cochrane review of six RCTs involving 2722 hip fracture patients [51], but which were heavily weighted by Carson et al.'s data (2016/2722 (74%) of the patients included in the review).

Importantly, anaemia may impair functional mobility in older people after hip fracture surgery [52], particularly in the frailest [53].

The Working Party recommends that the risks of anaemia-related organ ischaemia (heart, brain, kidneys) need to be balanced against the immunosuppressive effects of blood transfusion in older hip fracture patients, approximately 40% of who will already be anaemic before their fracture. This multidisciplinary assessment needs to take place before, during and after surgery, on a per patient basis.

Although younger, fitter hip fracture patients may be able to tolerate lower peri-operative Hb, the Working Party has modified its 2011 guidance, to recommend that peri-operative Hb in frailer patients should be kept above approximately 90 g.l⁻¹, or approximately 100 g.l⁻¹ for patients with a history of ischaemic heart disease or who fail to remobilise on the first postoperative day due to fatigue or dizziness. In accordance with the Fragility Fracture Network guidelines, the Working Party recommends that the recognition and management of peri-operative anaemia, and the administration of blood, should proceed according to an agreed hospital protocol.

There is no good evidence that tranexamic acid improves hip fracture patient outcomes. However, it has been shown to reduce transfusion requirements following hip fracture and there is no strong evidence of increased risk of thrombosis. The Working Party recommends that multidisciplinary teams agree local policies on the use of tranexamic acid following hip fracture. Anaesthetists must ensure that tranexamic acid is not administered intrathecally as it is neurotoxic. The Working Party recommends that tranexamic acid is not drawn up until after spinal anaesthesia is administered.

Echocardiography

Valvular heart disease occurs in approximately 10% hip fracture patients in the UK [19]. However, delay to hip fracture surgery for diagnostic echocardiography also increases postoperative mortality.

The 2011 guidelines stated *"most clinicians favour proceeding to surgery with modification of their technique towards general anaesthesia and invasive blood pressure monitoring, with the proviso that (hip fracture patients with*

suspected valvular heart disease) should undergo echocardiography in the early postoperative period".

Several studies since 2011 have provided conflicting results on outcome benefits and treatment decisions after pre-operative (focused) transthoracic echocardiography in hip fracture patients [54–56]. Group separation in a recent pilot study suggests that a larger, multicentre RCT comparing mortality/composite outcomes after focused echocardiography is feasible [57, 58].

The Working Party acknowledges that valvular heart disease can contribute to postoperative complications and mortality [59], and that echocardiography can be used to quantify the nature of the disease and the degree of cardiac impairment, particularly in suspected ventricular impairment or when the patient's symptoms have deteriorated significantly since any previous echocardiograph. However, the treatment of any valvular disease is very unlikely to precede surgery in the surgical population with hip fracture, and it remains unlikely that the results of echocardiography will inform a change in the anaesthetic management of patients with suspected valvular heart disease. The Working Party does not recommend delaying surgery pending echocardiography. Instead, management should continue to involve carefully administered, (invasively) monitored general or spinal anaesthesia, which aims to maintain coronary and cerebral perfusion pressures, with possible short-term admission to a higher-level care unit postoperatively.

Anticoagulation and antiplatelet therapy

Approximately 30–40% of people with hip fracture in the UK are taking anticoagulant/antiplatelet medications pre-operatively. This requires anaesthetists to balance the four main risks of these medications to their peri-operative care, namely surgical bleeding and vertebral canal haematoma (related to spinal anaesthesia) vs. abrupt cessation of medication and delay to surgery.

The 2011 guidance advised that surgery should not be delayed in patients taking aspirin, clopidogrel or warfarin, provided vitamin K-assisted reversal of the latter reduced the international normalised ratio below 2 for surgery and 1.5 for spinal anaesthesia. Direct oral anticoagulants (DOAC), such as rivaroxaban, apixaban and dabigatran, were introduced into the UK in 2008, but their prescription increased more markedly after 2012 and so were not considered in the 2011 guidance. Approximately 2% of UK hip fracture patients currently take DOACs.

Data suggest that the use of anticoagulants/antiplatelet therapies is associated with a slightly increased risk of peri-

operative transfusion in hip fracture patients but no increase in mortality [60–62].

The incidence of vertebral canal haematoma after neuraxial anaesthesia in general UK practice is very small, at 1:118,000 [63, 64]. The incidence of vertebral canal haematoma in older patients undergoing (emergency) hip fracture repair is likely to be even lower [63]. The extent to which this very small risk of vertebral canal haematoma is increased in (hip fracture) patients taking anticoagulants/antiplatelet medications is unquantifiable, but likely to be small [28]. The risk may be increased further in patients with spinal deformity and those undergoing repeated attempts at spinal needle insertion.

For many people taking anticoagulant/antiplatelet medications, general anaesthesia avoids the risk of vertebral canal haematoma from neuraxial blockade. For some patients taking anticoagulant/antiplatelet medications, the risk of vertebral canal haematoma may be (very considerably) less than the risk of general anaesthesia. The Association guidelines recognise this balancing of risks and benefits [28].

Permanent neurological damage after vertebral canal haematoma can be reduced significantly by prompt recognition. Back pain with radicular distribution, motor or sensory impairment and altered bowel or bladder function progressing rapidly within the first 24 h after surgery should alert clinicians to the possibility of vertebral canal haematoma, and the necessity for urgent magnetic resonance imaging [28, 63].

Antiplatelet/anticoagulant medication should alert the anaesthetist to serious underlying cardiovascular pathology in people with hip fracture. Abrupt cessation of such medication and failure to restart it postoperatively can expose the person to increased risks of cardiac ischaemia and stent occlusion, cerebrovascular accident [65] and limb ischaemia. This is particularly relevant for patients taking dual antiplatelet therapy, or when treatment is discontinued soon after treatment initiation (normally within 6 months), when their thrombotic risk is still high [66, 67].

There are significant and progressive mortality and morbidity risks associated with delay to surgery beyond 24 (–48) h in hip fracture patients [68, 69]. In 2018, approximately 3% of hip fracture patients in England and Wales were delayed > 36 h before surgery as a result of their DOAC therapy or for warfarin reversal; virtually all patients taking DOACs were delayed > 36 h before surgery [6].

Mindful of these risks and in recognition of other Association of Anaesthetists' guidance, the Working Party has developed comprehensive recommendations for the

management of patients with hip fracture who are taking antiplatelet/anticoagulant medication pre-operatively. These can be found in online Supporting Information, Appendix S1, together with a one-page summary that can be added to hospitals' patient care pathways or made available within operating theatres.

Postoperative discharge destination

Medical and surgical complications are very common after hip fracture surgery, related mainly to age, comorbidities, frailty, premorbid pathology and trauma. The large majority of these can be managed by orthogeriatricians in a ward setting. Occasionally, patients may require a period of monitoring +/- intervention in the PACU, HDU or ICU to support one (or occasionally two, or more) system temporarily after surgery [70]. This incurs significant cost [71], without necessarily improving outcomes in all patients [72].

The Working Party recommends that critical care facilities should be routinely available at hospitals in which hip fracture surgery is undertaken [2]. Access to higher-level care should not be denied purely on the basis of age or the presence of hip fracture.

Specific discharge criteria can be used to direct where the patient will be looked after on leaving the PACU, and to communicate intra-operative care with orthogeriatric colleagues and ward staff. These should be developed on an institutional basis. Suggested criteria are summarised in online Supporting Information, Appendix S1.

Research, audit and quality improvement recommendations

There remains a lack of good research evidence on which to base strong recommendations for much of peri-operative care in hip fracture. Major trials that are likely to report results during the lifetime of this guideline include those undertaken by Neuman et al. [16], Yeung [73], Kowark et al. [17], all of which compare outcomes (mainly mortality) between regional and general anaesthesia, and Li et al. [18], Leavey et al. [74] and Moppett et al. [75], all of which are investigating cognitive impairment after hip fracture surgery. The World Hip Trauma Evaluation hip fracture cohort study provides a pipeline of nested trials, with future peri-operative and rehabilitation studies expected [76].

The focus of research is moving away from traditional outcome metrics (mortality and length of stay) towards standardised [23], patient-relevant metrics, such as functional recovery and quality of life [35]. There is evidence that the quality of anaesthesia and peri-operative care influence these, providing important avenues for research [77, 78].

The Working Party has provided suggestions for 10 research priorities in the peri-operative care of older people with hip fracture, which can be found in online Supporting Information, Appendix S1, along with suggestions for important audit and quality improvement projects that anaesthetists can undertake at their hospitals.

Role of networks

The Working Party recommends that at least one anaesthetist in each hospital undertaking hip fracture surgery accesses each of the following organisational networks, acting as an institutional conduit for updated information and resources related to contemporary best practice management. These networks also provide potential participants for collaborative research, audit and quality improvement:

- The Hip Fracture Peri-operative Network [79] is an NHS-sponsored network. Its website includes freely available examples of database and annual report templates, ideas for research, specimen patient information leaflets, pre-operative care information for trainee surgeons and hip fracture care pathway pro formas. Allied networks, such as the Yorkshire Hip Fracture Anaesthesia network and Welsh Frailty Fracture Network, provide similar functions at a regional level;
- The Fragility Fracture Network [80] is a multinational, multidisciplinary network which holds an annual conference dedicated to improving the primary and secondary management of all types of fragility fracture. It has recently formed a UK chapter and an anaesthesia working group, which produced the 2018 Fragility Fracture Network consensus statement on the principles of anaesthesia for patients with hip fracture [2];
- The National Hip Fracture Database [81] is a collaboration between the British Orthopaedic Association and British Geriatrics Society, whose main aim is *"to focus attention on hip fracture both locally and nationally, benchmark its care across the country, and use continuous comparative data to create a drive for sustained improvements in clinical standards and cost effectiveness"*. All eligible hospitals in the UK (except Scotland) are registered and contribute data that are published regularly in online hospital performance charts and summarised annually in a national report. Regional equivalents exist in Ireland [82] and Scotland (Scottish Hip Fracture Audit) [83]. The National Hip Fracture Database develops and monitors key performance indicators, on which Best Practice Tariff reimbursements are made to hospitals fulfilling specific

criteria, currently (2018) concerned with prompt orthogeriatric assessment; prompt surgery; NICE compliant surgical approach; prompt mobilisation after surgery; delirium; and return to normal residence by 120 days. The National Hip Fracture Database and Scottish Hip Fracture Audit provide further resources for service development, which are free to download from their websites.

These guidelines complement and update the original Association advice from 2011, which was well received and informed the 2018 Fragility Fracture Network international consensus statement on the principles of anaesthesia for patients with hip fracture. This update acknowledges the wider role that anaesthesia now plays in the peri-operative medical care associated with patients after hip fracture. These guidelines highlight the success of close co-operation between all professionals involved in the management of this patient population. The Working Party emphasises that anaesthesia departments should try to standardise care per se, rather than particular anaesthetic techniques. Specifically, anaesthetists should aim to maintain physiological stability in the peri-operative period so that patients are able to mobilise the day after surgery.

Considerable improvements in care have taken place since 2011, but there is still much to achieve. Notably, an increasing number of patients are surviving hip fracture long enough to sustain subsequent periprosthetic fractures, which the Working Party suggests should also be treated according to the advice contained within this document.

Acknowledgements

The Working Party would like to acknowledge the advice and input received from A. Mayor and S. Dukka (Calderdale and Huddersfield NHS Foundation Trust). RG is a member of the Trauma and Research Network Major Trauma in the Elderly Group. He is a member of the NICE Hip, Knee and Shoulder Arthroplasty Guideline. He founded the NHS Hip Fracture Peri-operative Network and is an Advisory Board member of the National Hip Fracture Database. IM is a member of the NICE topic expert group for Quality Standards for hip fracture, Deputy Director of the Health Service Research Centre of the National Institute of Academic Anaesthesia and holds grants from the National Institute for Health Research (NIHR) and the Association of Anaesthetists and Royal College of Anaesthetists through the NIAA for trials in hip fracture. He is a member of the Scientific and Publications Committee and Advisory Group of the National Hip Fracture Database. He is a co-chair of the Peri-operative Specialist Interest Group of the

International Fragility Fracture Network. DH is the Chairman of the Welsh Frailty Fracture Network, Welsh Government Falls and Frailty Fracture Audit Programme Strategic Group member. SW sits on the Scientific and Publications Committees of the National Hip Fracture Database and the WHITE study. He led the Fragility Fracture Network specialist interest group for anaesthesia during the development and publication of the Fragility Fracture Network consensus guidelines. No other competing interests declared.

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Supporting Information

Additional supporting information may be found online via the journal website.

Appendix S1. Suggested management of hip fracture patients taking anticoagulant or antiplatelet medication.