

# Reducing mortality from hip fractures: a systematic quality improvement programme

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## Abstract

Hip fracture is one of the most serious consequences of falls in the elderly, with a mortality of 10% at one month and 30% at one year. Elderly patients with hip fractures have complex medical, surgical, and rehabilitation needs, and a well-coordinated multidisciplinary team approach is essential for the best outcome.

The model of best practice for hip fracture care is set out in the Orthopaedic Blue Book and is incentivised by the best practice tariff. In 2009 to 2010, only 39.6% of our patients were being operated on within 36 hours, 19% achieved best practice tariff [1], and mortality was 7.8%. We were ranked as one of the worst hospitals to achieve best practice tariff [1] and our mortality was average.

The orthogeriatrics team at Ashford & St Peter's NHS Trust (SPH) was implemented in 2010. Through a system redesign, regular governance meetings, audits and quality improvement projects, we have managed to improve care for our patients and reduce mortality.

Over the last three years we have successfully achieved best care for our hip fracture patients, demonstrating a steady improvement in our attainment of the best practice tariff and a reduction in mortality to 5.3% in 2013, which ranks us amongst the best trusts nationally.

## Problem

Hip fracture is the commonest cause of injury related death [1] and is associated with excess mortality that extends beyond the period of injury. A lot of patients sustaining hip fractures are frail with multiple comorbidities and death might not be preventable. It is increasingly recognised that hip fracture patients have predominantly medical needs and therefore should have senior medical input from admission. It is now widely accepted that prompt effective, multidisciplinary management with a fully integrated orthogeriatrician is the best model of care.[2]

Key elements of good care include:

- Prompt admission to orthopaedic care
- Rapid comprehensive assessment: medical, surgical, and anaesthetic
- Minimal delay to surgery
- Accurate and well-performed surgery
- Prompt mobilisation
- Early multidisciplinary rehabilitation
- Early supported discharge and ongoing community rehabilitation
- Secondary prevention, combining bone protection and falls assessment.

Advantages of such collaborative care include:

- Overall improvement in standards of medical care
- Minimal delay to surgery caused by medical problems
- Improved management of perioperative medical complications
- Better coordination of multidisciplinary team work
- Improved communication with patients and relatives
- Reduction in adverse events, including preventable deaths.

There are various models of care for hip fracture patients. These are grouped into four main categories[3]:

1. Orthopaedic ward and geriatric consultants service at request
2. Orthopaedic ward and daily consultative service
3. Geriatric and rehabilitation ward and orthopaedic consultant service
4. Orthopaedic ward and integrated care with geriatrician.

Worldwide, different countries have adopted different approaches to managing these patients. In Australia, "The Orthogeriatric Model of Care" [4] emphasises the need for care of these patients by an orthogeriatrician in an integrated service, and also early surgery within 24 hours if the patient is medically stable.[5] Similarly, in the USA, a geriatric fracture centre where hip fracture patients are co-managed by geriatricians and orthopaedic surgeons led to better

outcomes in terms of shorter times to surgery, fewer post operative infections, but showed no difference in in-hospital mortality.[6] In Spain, early multidisciplinary daily geriatric care reduces in-hospital mortality and medical complications in elderly patients with hip fracture, but there is not a significant effect on length of hospital stay or long-term functional recovery[7] Historically, this group of patients are cared for in our trust by the orthopaedic team with little or no input from the medical team. There is generally poor prioritisation and coordination of care with little appreciation of the frail nature of these patients.

The orthopaedic ward and integrated care with geriatrician showed a trend in favour of showing the lowest in-hospital mortality, lowest length of stay, and lowest mean time to surgery.[3] This vision of orthogeriatric care is now being promoted by the Fragility Fracture Network (FFN), globally focusing on the optimal multidisciplinary management of the patients with a fragility fracture.

## Background

A hip fracture is one of the most serious consequences of falls in the elderly, with a mortality of 10% at one month and 30% at one year.[8] There is also significant morbidity associated with hip fractures, with only 50% returning to their previous level of mobility and 10 to 20% of patients being discharged to a residential or nursing care placement.[9] The current UK incidence of hip fractures is between 70,000 to 75,000, and the annual cost of medical and social care for these patients is estimated to be over £2 billion.[9] 75% of those suffering such fractures are female and the average age of sufferers is over 80 years old.[1] Due to an ever-increasing ageing population, it is projected that the incidence will increase to 91,500 by 2015 and to 101,000 by 2020.[2] With hip fracture incidence rapidly rising, it is pivotal that optimal therapy is delivered to ensure the best possible outcomes. Elderly patients with hip fractures have complex medical, surgical, and rehabilitation needs so a well-coordinated multidisciplinary team approach is essential for the best outcome.

Three major initiatives in the UK recently had led to improved care of this group of frail elderly patients:

1. The publication of the BOA/BGS jointly sponsored Blue Book, providing guidelines to the care of patients with fragility fractures in 2005
2. The National Hip Fracture Database (NHFD): a web based audit tool launched in 2007 which allows trusts to monitor the quality and outcome of care provided to the individual patient
3. The best practice tariff for hip fractures: introduced in April 2010, this incentivises individual trusts financially for providing gold-standard care, defined by the following criteria:
  - a. Time to theatre within 36 hours
  - b. Geriatrician review within 72 hours
  - c. Admitted under joint care and assessed using a joint protocol

agreed by geriatricians, orthopaedic surgeons, and anaesthetists

d. Geriatrician led multiprofessional rehabilitation

e. Falls and bone health assessment.

As a result, the mortality from hip fracture is improving. The overall 30 day mortality rate nationally for hip fractures is around 8.2% (case mix adjusted analysis).[1] However, there is still a wide variation in 30 day mortality between different trusts.

Excess mortality associated with hip fractures is well documented, with older adults having a five to eight fold increased risk in all-cause mortality during the first three months after a hip fracture.[10] Patients who sustain a hip fracture are more likely to be elderly, institutionalised, and frail, with multiple co-morbidities. The functional reserve for these patients is poor and they are less likely to tolerate physiological stresses associated with a hip fracture and its surgical fixation.[11] Designing a system which caters for frailty, including early geriatric input[12], has been a significant factor in reducing mortality in hip fracture patients.

Up to 20% of patients with hip fractures will develop a postoperative complication, with chest infections (9%) and heart failure (5%) being the most common.[13] Developing heart failure following a hip fracture has a very poor prognosis, with a one year mortality of 92% and a 30 day mortality of 65%. For chest infections, the one year mortality is 71% and 43% within 30 days.[13] Preventing the development of these complications should be a priority in units looking to improve mortality from hip fractures.

The effect of timing of surgical intervention on mortality remains a controversial topic. Various studies have demonstrated an improvement in mortality following early surgical intervention [14,15] but other studies did not.[16,17,18] However, there is widespread evidence that early operative intervention does improve outcomes, including morbidity (especially infections), pressure sores, pain, and length of stay.[19] This consensus is reflected in the current guidelines on the management of hip fractures; the British Orthopaedic Association guidelines "The Blue Book" recommends that surgery should not be delayed beyond 48 hours unless there are clearly reversible medical conditions.[2] The Scottish Intercollegiate Guidelines Network (SIGN) advocates surgery as soon as possible for the medically fit within safe operating hours, after the patient presents to hospital.[20] Currently, one of the requirements for attainment of the best practice tariff is surgery within 36 hours.

## Baseline measurement

We had 390 hip fracture patients from March 2009 to April 2010 and our 30 day mortality rate was 7.8%.

See supplementary file: ds3349.docx - "Table showing baseline measurements"

## Design

## Avoiding delays to theatre

Prior to 2010, hip fracture patients at St Peter's Hospital were cared for exclusively by the orthopaedic team with input from the medical team, often only in the context of managing a deteriorating patient. In 2010, two geriatricians were integrated into the multidisciplinary team.

At the outset, the new department set out the ambitious aim of being one of the best orthogeriatric units in the country by focusing on achieving the six core care standards outlined in the Blue Book for each individual patient. Providing gold standard care routinely should reduce perioperative complications, and hence mortality. We use 30 day mortality as an overall "barometer" of care that we provide to our patients, along with measuring other key performance indicators such as time to surgery, falls, bone health assessment, and attainment of the best practice tariff.

The project required a redesign of the whole system pathway and in September of 2010, we organised a LEAN improvement programme (EQuIP – efficiency, quality, innovation, and productivity programme). The aim of the event was to understand the current pathway for patients with hip fractures and to target key areas for improvement. The project team, which included all stakeholders involved in hip fracture care, was tasked with mapping out the current pathway of a typical patient. This allowed us to analyse the waste issues throughout the pathway in greater detail. The major issues identified included:

Poor prioritisation of hip fracture patients

Lack of theatre time over the weekend

Poor access to senior medical input for preoperative optimisation

Poor access to physiotherapy over the weekend

Difficulty getting the patients to the ward and availability of pressure relieving equipment.

The team developed a range of solutions to be implemented across the entire pathway:

The Saturday theatre list was split to two half-day lists over the weekend to improve access to theatre.

Historically, these frail patients were given poor priority, often being operated on at the end of the day. This is partly cultural, whereby hip fracture patients are seen as high risk patients with a poor prognosis and therefore not seen as "attractive" surgical candidates. The frail nature of these patients meant that any delay to theatre is likely to result in a negative outcome. In order to achieve timely surgical intervention, a cultural shift was required to prioritise these patients before more robust children and younger adults. Our EQuIP programme allowed us to agree a "priority theatre pyramid" to ensure that patients with hip fractures are prioritised accordingly. These patients are now prioritised ahead of acute paediatrics and only second to life or limb trauma.

A new hip fracture clerking proforma which included falls and bone health assessments. The majority of clinical delays to theatre resulted from inadequate optimisation of the patient. It is essential that the process of optimisation of the patients occurs as soon as they are admitted. The admitting doctor is usually a junior doctor with limited medical experience. We therefore introduced an A-Z guide to management of common preoperative issues to help junior doctors optimise patients at presentation to prevent delays to theatre. Five day routine access to consultant geriatrician input ensured continuing medical education for the junior doctors and appropriate senior back up for more complex issues:

The use of a fast bleep to reduce delays to ward

Extra pressure mattress to be kept on the ward

Seven day provision of physiotherapy

Surgery done/supervised by experienced surgeon.

Preventing post operative complications

To sustain improvement, a monthly multidisciplinary governance meeting was set up. The aims of the meeting include:

1. Charting progress using a performance dashboard
2. Identify key areas for improvement
3. Root cause analysis of delays to theatre
4. Morbidity and mortality review.

In 2011 to 2012, there was a slight increase in our mortality rates. Our mortality reviews confirmed that chest infections and cardiac failure were the main causes of mortality. Further audits revealed that mortality was associated with a raised preoperative C-reactive protein (CRP) [21] and a low haemoglobin.[22]

It has been postulated that the high incidence of chest infections in hip fracture patients is a result of the patient being in pain (reducing their ability to cough) and being immobile.[8] Early surgical fixation and better pain management with routine involvement of the acute pain team should reduce pain and allow early mobilisation. Greater emphasis was placed on provision of seven day physiotherapy and nursing patients at 30 degrees to prevent aspiration of gastric contents. Some patients may already have subclinical infections prior to their fracture [23]; antibiotics are given to patients with a high preoperative CRP and lowering the threshold for initiating antibiotics in the post operative period.

Up to a quarter of patients with hip fractures have pre-existing cardiovascular disease.[13] The physiological stress associated with a hip fracture can induce myocardial ischaemia and precipitate cardiac failure. Moreover, delays to surgery can result in the vulnerable patient receiving unnecessary intravenous fluids, increasing the risk of cardiac decompensation. Pre or post operative anaemia can also increase cardiac workload. Early intervention with surgery will result in better pain management and lower the physiological stress. Cessation of intravenous fluids within 24 hours post operatively is now routine, unless clinically indicated.

We introduced a point of care haemoglobin estimation system (Hemocue) to identify patients with anaemia intraoperatively to reduce delays to transfusion. Patients returning from theatre will now have their haemoglobin checked on arrival back to the ward, especially in patients with extracapsular fractures, which often results in greater blood loss. We are also advocating the use of early ionotropes in a high dependency setting (HDU) for these susceptible patients so we can limit the amount of fluid given to them.

2010 39.6% Not available pre BPT

2011 73% (61%)

2012 88% (67%)

2013 84% (71%)

Table 2 - Attainment of best practice tariff

## Weekend effect

Trust (National average)

The so called "weekend effect" for surgical patients has now been well publicised and debated in the public forum. We set out to investigate whether this effect applied to our patients. We audited over 1000 patients from April 2009 to September 2011 to compare mortality in our unit between weekday and weekends. There was no significant difference between our weekday and weekend mortality, although it was surprising that patients admitted on a Wednesday had the highest mortality at 9.2%. Patients admitted on a Wednesday to our trust are normally operated on a Thursday. The patients are not routinely reviewed by the junior doctors post operatively due to teaching. These patients may decompensate over the weekend since they are not seen by the physiotherapists or doctors; historically we prioritise those patients who are day one post-op for review over the weekend.

2010 28% (28%)

2011 73% (31%)

2012 88% (47%)

2013 83% (55%)

The use of the fast bleep and the extra mattress on the ward meant that we were able to get the patients up to the ward within four hours. This has helped to reduce our pressure ulcers from 5.4% in 2010 to 3.2% in 2013

We implemented a quality improvement programme from 2012 to 2013 with the following interventions [24]:

There is now seven day provision of physiotherapy, and 75% of patients are now mobilised within 24 hours compared to 41% in July 2010. Streamlining of transfer protocols, as well as the discharge process itself, have resulted in a moderate reduction in the acute length of stay from 25.2 to 21.8 days despite sending less patients to community hospital due to the closure of rehabilitation beds.

1. Physiotherapist to review our day two post-op (patient admitted on Wednesday) patients at weekends
2. Nurses to sit up these patients at weekends
3. Email trail highlighting these patients
4. Junior doctors to return to ward from teaching to review same day post-op, and we also implemented a change in our proforma to allow same day post op review for all our patients
5. Poster chart to remind the juniors

Following the quality improvement programme in 2012, our Wednesday mortality has reduced from 9.2% to 1.69% with still no difference between our weekday and weekend mortality, OR 1.58 (0.62, 3.99).

Table 3 - Mortality at 30 days

Trust (National average)

2010 7.8% (7.7%)

2011 6.0% (8.4%)

2012 7.0% (8.1%)

2013 5.3% (8.2%)

See supplementary file: ds3898.docx - "Results"

## Strategy

PDSA cycle 1: Reducing delays to theatre

PDSA cycle 2: Preventing post operative complications

PDSA cycle 3: Improving mortality for patients admitted on a Wednesday

## Results

Following the EQuIP programme, we are now operating on most of our patients within 36 hours.

## Lessons and limitations

Elderly patients with hip fractures have complex needs and the model of best care requires the engagement of the whole multidisciplinary team. The frailty of these patients needs to be taken into account when redesigning the system of care. Prioritisation of these patients for early surgical fixation and

Table 1 - time to surgery within 36 hours (NHFD 2010-2013)

Trust (National average)

mobilisation, along with routine geriatrician input, is the key to success.

Mortality rate is an important surrogate marker of quality but it can be affected by age and casemix. Care must be taken in interpreting a single measurement, but a consistent trend will inform us as to whether a unit is doing all they can in terms of preventable deaths.

Despite delivering better care, we have only reduced our acute length of stay moderately from 25.2 to 21.8 days. This is likely due to the shortage of community rehabilitation beds.

The slight drop in achieving best practice tariff and time to surgery was due to recent NICE guidelines [3] which suggested total hip replacement (THR) for displaced intracapsular fractures if cognitively intact and able to walk outdoors. We have improved our THR from 13% in 2012 to 30% in 2013. (National average 2013 -20%).[1] Hence, these patients sometimes have to wait longer for a hip surgeon to do this operation.

## Conclusion

Our team has transformed the way we care for hip fracture patients in our trust. We now are among the best trusts to obtain best practice tariff and have one of the lowest mortality nationally.

Stakeholder engagement along the whole care pathway at the outset followed by regular audits and quality improvements projects has enabled us to achieve this.

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## Declaration of interests

Nothing to declare.

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