

## QUALITY IMPROVEMENT REPORT

# Quality improvement for patients with hip fracture: experience from a multi-site audit

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**Problem:** The first East Anglian audit of hip fracture was conducted in eight hospitals during 1992. There were significant differences between hospitals in 90-day mortality, development of pressure sores, median lengths of hospital stay, and in most other process measures. Only about half the survivors recovered their pre-fracture physical function. A marked decrease in physical function (for 31%) was associated with postoperative complications.

**Design:** A re-audit was conducted in 1997 as part of a process of continuing quality improvement. This was an interview and record based prospective audit of process and outcome of care with 3 month follow up. Seven hospitals with trauma orthopaedic departments took part in both audits. Results from the 1992 audit and indicator standards for re-audit were circulated to all orthopaedic consultants, care of the elderly consultants, and lead audit facilitators at each hospital.

**Key measures for improvement:** Processes likely to reduce postoperative complications and improve patient outcomes at 90 days.

**Strategy for change:** As this was a multi-site audit, the project group had no direct power to bring about changes within individual NHS hospital trusts.

**Results:** Significant increases were seen in pharmaceutical thromboembolic prophylaxis (from 45% to 81%) and early mobilisation (from 56% to 70%) between 1992 and 1997. There were reduced levels of pneumonia, wound infection, pressure sores, and fatal pulmonary embolism, but no change was recorded in 3 month functional outcomes or mortality.

**Lessons learnt:** While some hospitals had made improvements in care by 1997, others were failing to maintain their level of good practice. This highlights the need for continuous quality improvement by repeating the audit cycle in order to reach and then improve standards. Rehabilitation and long term support to improve functional outcomes are key areas for future audit and research.

## BACKGROUND

The lifetime risk of hip fracture in industrialised societies is 18% in women and 6% in men.<sup>1</sup> The number of patients with hip fractures has been rising annually for some years as the result of a combination of an increasingly elderly population and a continued increase in the age specific incidence.<sup>2,3</sup> In 1997/8 66 000 people in England and Wales were treated in hospital for a hip fracture.<sup>4</sup> Three quarters of those affected were aged over 75 and 80% were women.

Outcomes for patients with hip fracture are poor with one in three patients dying in the first year after the fracture.<sup>5</sup> One in four survivors require a higher level of long term care and those who do return to the community have increased difficulties with activities of daily living.<sup>6</sup> Acute hospital costs are substantial and are expected to continue to rise.<sup>7</sup> The long term costs of rehabilitation and extra care in the community are even greater.<sup>8,9</sup> Against this background, a number of initiatives have aimed to improve acute care for patients with hip fractures.<sup>10–13</sup>

Most patients with hip fractures in the UK are treated by the National Health Service with very few patients seeking treatment privately. Patients are admitted to their local hospi-

tal for treatment. The 10 hospitals within East Anglia each serve the local town/city in which they are situated as well as the surrounding area and in 1997/8 they admitted about 2500 patients with hip fractures. Following treatment within the acute hospital, the patient may be transferred to another ward for rehabilitation or transferred to an outlying hospital or community hospital or discharged home. Following discharge from hospital a number of agencies are available to support the patient at home. Services available are essentially the generic primary care services of the UK National Health Service and local authority social services, and include home care assistants, physiotherapy, and some nursing care.

In 1992 the East Anglian audit of hip fracture was one of the first audits to compare hospitals on a regional basis.<sup>14–17</sup> Audit indicators were chosen from recommendations by the Royal College of Physicians<sup>18</sup> and by local consultants in orthopaedics, care of the elderly, and public health (box 1). Standards were set at 100% of hospitals for indicators 1, 2, 3, 4 and 5 and 100% of patients for indicators 6, 7, 8 and 9. Information on recommended aspects of good practice or important patient outcomes was also collected (box 2). Many, but not all, of the recommended good practice measures are now supported by research evidence.<sup>6,19</sup>

## THE PROBLEM

The first East Anglian audit of hip fracture was conducted in eight hospitals during 1992. Principal findings included significant differences between hospitals in 90-day mortality (overall 18%, range 5–24%),<sup>15</sup> development of pressure sores (overall 22%, range 11–36%), median lengths of hospital

The aim of quality improvement reports is to answer the following questions:

- What was trying to be accomplished?
- What makes a change an improvement?
- What was the mechanism for change?
- What lessons have been learnt?
- What are the next steps?

**Box 1 Audit indicators 1992**

- (1) In each health district there should be a person or team with specific responsibility for reviewing local services for hip fractures, for producing a strategy, and for monitoring standards of care and outcome.
- (2) Postoperative care should be carried out by a multidisciplinary team.
- (3) There should be established links between departments of orthopaedics and geriatrics.
- (4) Patients should be assessed preoperatively. This should involve technical examination of the fracture and a general examination including assessment of medical problems, mental function, and social circumstances.
- (5) Plans for mobilisation, rehabilitation, and discharge or transfer should be made for all patients within 4 days of the operation.
- (6) Patients should be discharged when they are medically fit for discharge.
- (7) At 3 months after admission the patient's medical condition and social functioning should be as good as before admission.
- (8) At 3 months after admission patients should not require additional community resources beyond those needed before the fracture.
- (9) At 3 months after admission patients should be satisfied with the care which they received.

**Box 2 Recommended aspects of good practice and important outcomes****Recommended aspects of good practice**

- Administration of prophylactic antibiotics
- Administration of pharmacological thromboprophylactic agents
- Operation within 24 hours of admission to hospital
- Operation by senior grades of staff
- Operation by day
- Early mobilisation
- Appropriate length of stay in hospital

**Outcomes**

- Death
- Hip joint infection
- Wound infection
- Myocardial infarction
- Pulmonary embolism
- Thromboembolic disease
- Pneumonia
- Development of pressure sores
- Urinary tract infection
- Re-operation
- Pain
- Patients' view of their recovery

stay,<sup>16</sup> and in many other process measures.<sup>15</sup> There were no significant differences between hospitals in the characteristics of patients on admission, so differences between hospital processes and outcomes were unlikely to be the result of case mix factors alone. Only about half the surviving patients recovered their pre-fracture ability to perform basic activities of daily living, with no significant differences between hospitals. A marked decrease in physical function (for 31% of survivors) was found to be associated with postoperative complications such as pressure sores and hip joint infection.<sup>17</sup> On the basis of these findings, it was concluded that action to reduce specific postoperative complications should improve patient outcome at 3 months.

**Key measures for improvement**

A second audit was undertaken in 1997, 5 years after the original audit, as part of a process of continuing quality

**Table 1** Audit indicators for 1997 (standards were based on best quartile performance for 1992)

Audit indicator	Standard
Process measures (% patients)	
Operation within 48 hours of admission (fit patients only)	91
Use of prophylactic anticoagulation	91*
Use of prophylactic antibiotics	98
Mobilisation within 48 hours of surgery	68
Seen by a geriatrician	43
Standard risk assessment for pressure sores on admission to orthopaedic ward	100
Outcome measures at 3 months (% surviving patients)	
Little or no hip pain	79
Return to pre-fracture activities of daily living	32†
Return to pre-fracture level of accommodation	83
Outcome measures within 3 months (% patients)	
Mortality	16
Pneumonia	6
Pulmonary embolism	0
Myocardial infarction	0
Wound and hip joint infection	4
Pressure sore grade II or worse	14

\*Standard was set for all thromboprophylaxis, mechanical and pharmaceutical.

†Standard set using modified Townsend activities of daily living (ADL) score.

improvement. Audit indicators were chosen from processes likely to reduce postoperative complications and improve patient outcomes at 90 days. Audit standards for 1997 were based on the best hospital performances in 1992. The results were compared for each of the eight hospitals and the best quartile result for each indicator was calculated (table 1). Crudely, this represents the compliance rates achieved by the top two hospitals in 1992 for each indicator.

**Strategy for change**

This was a multi-site audit, so the project group had no direct power to bring about changes within individual NHS hospital trusts. Results from the 1992 audit were disseminated by sending the final audit report<sup>14</sup> to all orthopaedic consultants, care of the elderly consultants, the regional medical audit team, ethics committees, directors of service units (orthopaedics and geriatrics), and clinical directors of the hospital trusts. Presentations were given at numerous health service and scientific meetings both locally and nationally, as well as directly to clinicians both in trusts and at regional speciality meetings. All orthopaedic and geriatric staff had at least one opportunity to attend and discuss these results with members of the team.

In 1997 the audit indicators and associated standards (table 1) were circulated to all orthopaedic consultants, care of the elderly consultants, and lead audit facilitators in each hospital together with a request that they take part in re-audit. Due to NHS reorganisation in 1997, there were 10 acute hospitals in the new NHS region and audit took place in nine of these hospitals during 1997 (re-audit in seven and a new audit in two). One hospital which took part in the 1992 audit declined to participate in the 1997 audit.

**DESIGN OF STUDY****Recruitment plan**

Recruitment was organised by local hospital audit staff whom we trained specifically for this project, in collaboration with ward clerks and nursing staff. We aimed to recruit 100 consecutive hip fracture patients aged  $\geq 60$  years from each participating hospital. The criterion for inclusion was a diagnosis of acute fracture of the proximal femur. Exclusion

**Box 3 Data collected to support audit indicators****Patient interviews (in hospital and at 90-day follow up)**

- Age
- Sex
- Residential status
- Activities of daily living
- Pain at 3 months

**Hospital records (medical, nursing, physiotherapy, surgical, anaesthesia)**

- Date and time of admission
- Date and time of operation
- Use of prophylactic anticoagulation
- Use of prophylactic antibiotics
- Date of mobilisation
- Date seen by a geriatrician
- Evidence of risk assessment for pressure sores
- Discharge details

**Hospital records and letter to GP (admission to 90-day follow up)**

- Mortality
- Myocardial infarction
- Pneumonia
- Pressure sore (grade II or worse)
- Pulmonary embolism
- Wound or hip joint infection

criteria were age <60 years or admission because of failure of treatment or complications arising from a previous hip fracture.

**Data collection**

Trained audit staff in each hospital collected data, overseen by one of the team (CF) who also conducted the follow up. Standard data collection forms were designed to permit both comparison with the 1992 audit and participation in the Standardised Audit of Hip Fracture in Europe.<sup>13</sup> The data collected to compare audit indicators are listed in box 3.

Audit staff identified consecutively admitted patients with hip fracture by regular contact with and visits to appropriate wards commencing on a specific start date. Patients were interviewed within 7 days of admission (median 4 days) about their pre-fracture status and were followed up by telephone at 90 days. Standard interviews collected data on activities of daily living (ADL),<sup>20</sup> pain,<sup>21</sup> and residential status. In 1992 ADL was measured using a modified Townsend score (scale range 0–38).<sup>22</sup> In 1997 we used a simpler ADL score developed by Katz *et al*<sup>20</sup> (scale range 0–10) to compare the results with a target setting study for the Department of Health.<sup>23</sup> A basic ADL score (scale range 0–8) was computed to allow direct comparison of the two audits using four activities common to both scales (dressing, bathing, using the toilet, and transfer).

In-hospital process data were obtained from clinical notes. Data on postoperative complications and mortality were obtained from hospital records, follow up contacts, and letters to general practitioners.

**Statistical analysis**

Parametric and non-parametric tests as appropriate were performed using SPSS 8.0 for Windows. All tests were conducted with a 5% level of significance with one degree of freedom unless otherwise specified. Yates's correction was used when appropriate. Mortality was modelled using forward stepwise logistic regression with response being 90-day survival. Overall results used to compare process and outcome measures between audits were weighted by hip fracture admission rates for each hospital to account for differences in hospital size.

**RESULTS OF THE 1997 AUDIT****Recruitment and follow up**

A total of 898 patients aged  $\geq 60$  years recruited between 7 January 1997 and 31 October 1997 were included in the re-audit analysis. 90-day follow up interviews were conducted with 659 (91%) of the 728 surviving patients or their carers. The mean time from admission to follow up was 94 days. All 69 patients who were not interviewed were confirmed to be alive by their general practice. At 120–145 days follow up a further 32 of the 69 patients were interviewed but were too late to be included in this analysis; four had died and the remaining 33 were non-responders.

**Patient characteristics**

Table 2 shows the characteristics of patients in the 1992 audit and of those included in the 1997 re-audit. There were no significant differences between hospitals in patient age (ANOVA,  $F=0.80$ ,  $df=8$ ,  $p=0.60$ ), sex ( $\chi^2=7.50$ ,  $df=8$ ,  $p=0.48$ ), residential status ( $\chi^2=10.04$ ,  $df=8$ ,  $p=0.26$ ), or ability to perform daily activities (Kruskal Wallis,  $H=15.36$ ,  $df=8$ ,  $p=0.05$ ).

**Surgical management**

Thirty eight (4%) of the 898 patients received non-surgical treatment and the remaining 860 (96%) were surgically treated. Data on both treatment and fracture type were available for 870 patients. Intracapsular fractures were mainly treated by hemiarthroplasty (303/467, 65%) or multiple screws (71/467, 15%). Extracapsular fractures were primarily fixed by dynamic hip screw (322/403, 80%). There were significant differences between hospitals in the recorded grade of surgeon performing these operations ( $\chi^2=491$ ,  $df=24$ ,  $p<0.001$ ). Consultants performed 20% (inter-hospital range 3–41%), staff grade/associate specialists 20% (range 0–69%), registrars 50% (range 0–79%), and senior house officers 10% (range 4–21%) of all operations. There was no statistically significant association between grade of surgeon and any outcome measure.

The recorded grades of anaesthetist also differed significantly between hospitals ( $\chi^2=345$ ,  $df=24$ ,  $p<0.001$ ): consultants 31% (range 5–56%), associate specialists 15% (range 1–44%), registrars 16% (range 7–35%), and senior house officers 37% (range 14–77%). Anaesthetic type differed significantly between hospitals ( $\chi^2=405$ ,  $df=16$ ,  $p<0.001$ ) with 43% (range 13–71%) patients receiving a general anaesthetic and 40% (range 7–66%) having spinal anaesthesia; 15% had a general anaesthetic in addition to spinal or local block anaesthesia and 2% were recorded as having had a local block alone. There was no significant association between the type of anaesthetic and any patient outcome.

**Other processes**

Significant differences were found between hospitals for surgery within 48 hours of admission ( $\chi^2=38.05$ ,  $df=8$ ,  $p<0.001$ ), thromboembolic prophylaxis ( $\chi^2=397$ ,  $df=8$ ,  $p<0.001$ ), mobilisation within 48 hours of surgery ( $\chi^2=88.91$ ,  $df=8$ ,  $p<0.001$ ), assessment by a geriatrician on the orthopaedic ward ( $\chi^2=265$ ,  $df=8$ ,  $p<0.001$ ), and standard risk assessment for pressure sores ( $\chi^2=299$ ,  $df=8$ ,  $p<0.001$ ; table 3). Differences between hospitals in the use of prophylactic antibiotics did not reach statistical significance ( $\chi^2=13.36$ ,  $df=8$ ,  $p=0.100$ ).

**Outcomes**

One hundred and seventy (18.9%) of the 898 patients died during the 3 months following admission (table 4). Functional recovery for surviving patients was poor. Only 296 of 656 patients (45%) recovered their basic ADL and a third reported moderate to severe pain in their hip. There were few significant differences between hospitals in patient outcomes, the notable exception being in the proportion of patients who

**Table 2** Patient characteristics

	1992 audit		1997 re-audit	
	Regional value	Inter-hospital range	Regional value	Inter-hospital range
Hospitals* (total)	8		9	
Patients (total)	580		898	
Mean (SD) age (years)	80.3 (10.4)	79–82	82.6 (8.12)	82–84
Sex (% female)	80	76–86	79	73–86
Residential (% in own home)	75	66–88	72	66–81
Status (% in institution)	25	13–34	28	19–34
Basic ADL score (median)†	1	0–2	1	0–2

\*Seven hospitals took part in both audits. †Scale range 0–8; a higher score represents poorer function.

suffered a pressure sore ( $\chi^2=78.21$ ,  $df=8$ ,  $p<0.001$ ). Overall, 129 of 889 patients (15%) were recorded as having a pressure sore of grade II or worse.

### CHANGES IN PROCESS AND OUTCOME BETWEEN 1992 AND 1997

A comparison was made of the process and outcome measures in the seven hospitals that took part in both audits. Results for process and outcome measures are weighted by admission rates to facilitate comparison of overall results for each audit. For individual hospitals unweighted data are presented (tables 3 and 4).

#### Patient characteristics

The characteristics of the 1992 and 1997 audit populations were similar in all aspects except for age (table 2) with the population in the 1997 audit being slightly older (mean age 83 years) than those in the 1992 audit (mean age 80 years,  $t=4.77$ ,  $df=1470$ ,  $p<0.001$ ).

#### Process

##### Thromboprophylaxis

The use of prophylactic anticoagulation increased significantly from 40% of patients in 1992 to 74% in 1997. This reflects a change in practice in three of four hospitals that did not routinely anticoagulate in 1992 (table 3).

##### Prophylactic antibiotics

There was a significant reduction in use of prophylactic antibiotics from 93% in 1992 to 86% in 1997 (95% CI of difference -11 to -4).

#### Early mobilisation

The proportion of patients who were mobilised within 48 hours of surgery had increased by 19% (95% CI 14 to 25). Early mobilisation is important because of its potential to reduce pneumonia, thromboembolism, and pressure sores.

#### Operation within 48 hours of admission

Operation within 48 hours was calculated for those patients who had no recorded clinical reasons for delay. The percentage of patients operated within 48 hours was similar in both audits (85%, 87%) but this masks changes in individual hospitals. One hospital had increased the proportion of patients undergoing early operation dramatically while, in some hospitals, the levels had stayed the same or deteriorated (table 3).

#### Care of the elderly

Although little overall change was seen between audits in number of patients recorded as seeing a geriatrician, one hospital had increased this process from 27% to 95% patients. During re-audit only two hospitals had recorded more than 60% of patients as seeing a geriatrician on the orthopaedic ward. Both these hospitals have a system of care for hip fracture that involves a geriatrician in preoperative patient assessment.

#### Outcomes

For the seven hospitals that took part in both audits there were no changes in the number of patients returning home or pain-free at 3 months (table 4). However, there was a fall in the percentage of patients returning to pre-fracture basic ADL

**Table 3** Hip fracture audits: process measures (% patients)

Process measures	Hospital number										% weighted regional data for 7 hospitals involved in both audits	% (95% CI) weighted regional difference between 1992 and 1997	
	1	2	3	4	5	6	7	8	9	10			
Operation within 48 hours of admission (fit patients only)													
1997	84	–	96	80	86	95	75	94	76	76	87		2 (-2 to 6)
1992	97	64	59	90	88	96	79	91	–	–	85		
Use of prophylactic anticoagulation													
1997	92	–	71	96	25	93	97	96	95	89	74		34 (29 to 39)*
1992	68	68	20	91	11	86	26	10	–	–	40		
Use of prophylactic antibiotics													
1997	87	–	87	93	80	88	86	85	94	90	86		-8 (-11 to -4)*
1992	92	91	90	96	95	99	99	81	–	–	93		
Mobilisation within 48 hours of surgery													
1997	79	–	92	58	89	52	60	62	51	84	75		19 (14 to 25)*
1992	47	80	50	60	62	71	65	34	–	–	56		
Seen by a geriatrician (all patients)													
1997	48	–	31	1	27	2	95	35	23	64	33		3 (-3 to 9)
1992	38	19	72	18	8	11	27	45	–	–	30		
Standardised risk assessment for pressure sores on admission to orthopaedic ward													
1997	91	–	100	91	23	95	98	87	70	66	78		–

\*Confidence intervals of the difference that do not include zero suggest significant changes.



**Table 4** Hip fracture audit outcome measures (%)

Outcome measures at 3 months	Hospital number										Weighted regional data for 7 hospitals involved in both audits (% overall)	Weighted regional difference between 1992 and 1997 (% (95% CI))	
	1	2	3	4	5	6	7	8	9	10			
Little or no hip pain†													
1997	72	–	72	68	63	69	68	58	66	65	67		
1992	75	90	65	51	58	63	74	80	–	–	66		1.8 (–4.3 to 7.9)
Return to pre-fracture basic activities†													
1997	39	–	54	51	49	40	51	37	44	39	47		
1992	53	65	54	42	62	48	59	47	–	–	54		–6.5 (–12.8 to –0.2)*
Return to pre-fracture level of accommodation†													
1997	78	–	88	84	78	80	81	68	80	77	80		
1992	78	74	84	77	73	79	91	68	–	–	78		2.0 (–3.1 to 7.0)
Mortality													
1997	24	–	20	19	17	18	16	17	16	24	19		
1992	24	21	20	24	15	5	18	19	–	–	18		1.2 (–3.1 to 5.5)
Pneumonia													
1997	8	–	4	3	4	4	3	6	7	12	4.6		
1992	6	13	13	11	3	7	11	13	–	–	8.3		–3.7 (–6.5 to –1.0)*
Pulmonary embolism													
1997	2	–	1	1	2	0	1	1	3	1	1.3		
1992	0	4	3	0	4	0	3	6	–	–	2.3		–1.0 (–2.5 to 0.5)
Myocardial infarction													
1997	4	–	2	3	0	3	0	0	2	3	1.7		
1992	1	4	0	5	0	1	1	3	–	–	1.3		0.5 (–0.8 to 1.7)
Wound and hip joint infection													
1997	8	–	8	8	4	2	5	9	8	9	6.2		
1992	13	14	11	15	5	7	11	5	–	–	9.3		–3.2 (–6.1 to –0.2)*
Pressure sore grade II or worse													
1997	28	–	3	10	2	3	11	26	25	25	10		
1992	20	25	30	36	13	11	28	17	–	–	21		–11.2 (–15.2 to –7.1)*

\*Confidence intervals of the difference that do not include zero suggest significant changes.

†Percentage surviving patients.

score (–6.5%). There were significant reductions between 1992 and 1997 in the reported incidence of wound or hip joint infection (–3.2%), pressure sores (–11.2%), pneumonia (–3.7%), and fatal pulmonary embolism (–1.7%).

### 3 month mortality

There was no change in the overall 3 month mortality rate between 1992 (18%) and 1997 (19%). In 1992 one hospital had higher survival (95%) than the others,<sup>15</sup> but this was not replicated in 1997 (table 4).

In both audits forward stepwise logistic regression revealed that being older, being male, and having a higher level of dependence before fracture were all predictors of death within 90 days (table 5). In 1992 the analysis showed that admission to hospital 6 was protective against death. At re-audit mobilisation within 48 hours of surgery was a protective factor associated with halving the risk of death. Between audits the proportion of patients mobilised within 48 hours of surgery in

hospital 6 had decreased by 19%, while the regional average had increased by 19%.

However, it is important to remember that, while early mobilisation is associated with mortality, causation is not implied. Delayed mobilisation may reflect poor postoperative health due to a number of different factors and does not cause death per se. Logistic regression was performed on 3 month mortality data from hospital 6 for both audits, adjusting for factors known to be associated with mortality (age, sex, pre-fracture ADL, cardiovascular disease, and mobilisation within 48 hours). This analysis showed a significant increase in mortality between audits ( $p=0.0154$ ) that was not explained by any of the above factors.

When postoperative complications were added to the 1997 model for all hospitals, three additional factors were found to be associated with death at 3 months: stroke (odds ratio (OR) 3.35,  $p=0.0046$ ), pneumonia (OR 4.43,  $p=0.0002$ ), and pressure sores (OR 2.21,  $p=0.0055$ ).

**Table 5** Final model of mortality from forward stepwise logistic regression of predictors of survival at 90 days after hip fracture

Patient characteristics	1992		1997	
	Odds ratio (95% CI)	p value	Odds ratio (95% CI)	p value
Increase (per year) in age	1.07 (1.03 to 1.11)	0.0005	1.06 (1.03 to 1.10)	0.0003
Increase (per unit) ADL*	1.07 (1.04 to 1.10)	<0.0001	1.18 (1.10 to 1.27)	<0.0001
Female	1.00	0.001	1.00	<0.0001
Male	2.88 (1.53 to 5.43)		3.11 (1.81 to 5.38)	
No cardiovascular disease	1.00	0.0054	Not in model	
Cardiovascular disease	2.13 (1.25 to 3.64)			
Not admitted to hospital 6	1.00	0.0016	Not in model	
Admitted to hospital 6	0.14 (0.04 to 0.48)			
Not mobilised early	Not in model		1.00	0.0162
Mobilised within 48 h of surgery			0.56 (0.35 to 0.90)	
Preoperative Hb >10 g/dl	Not recorded		1.00	0.0366
Preoperative Hb <10 g/dl			2.05 (1.05 to 4.03)	

\*1992 scale 0–38, 1997 scale 0–10.

## LESSONS LEARNT

The Anglian audits of hip fracture have shown that it is possible to carry out large scale multi-site audit of the management and care of hip fracture patients. In both the Anglian audits there were no significant differences between hospitals in patients' age, sex, residential status, or ability to perform daily activities. Thus, any differences in outcome were not explicable by these aspects of case mix differences. The only recorded difference in patient characteristics between audits was an increase in age by 3 years.

Since the previous audit and despite an older population sample, reductions had occurred in the incidence of wound and joint infections, pressure sores, pneumonia, and fatal pulmonary embolism. Nevertheless, there was no overall change in the 3 month pain-free or functional impairment outcomes, nor in mortality rate.

Changes in process during the 5 years between the audits included increases in the use of pharmaceutical thromboprophylaxis and in the number of patients mobilised within 48 hours of surgery. Lack of overall change in the number of patients who had early surgery or who saw a geriatrician masked considerable improvements in one or two hospitals. Many hospitals that did less well in 1992 had made real efforts to improve aspects of the care they provided—for example, efforts to perform surgery within 48 hours of admission in hospital 3. Not every hospital was successful in this with some improving (hospitals 5 and 7) and others deteriorating (hospitals 1 and 4). A few hospitals focused on liaison between the geriatric and orthopaedic departments and achieved considerable improvement in the percentage of patients having a specialist Department of Medicine for the Elderly consultation/assessment (hospitals 5 and 7). Paradoxically, the overall use of prophylactic antibiotics decreased, perhaps reflecting concerns of overuse,<sup>24,25</sup> but nonetheless there was a decrease in wound and hip joint infection rates. There was a considerable increase in the use of pharmacological thromboprophylaxis, although this remains contentious and not universally accepted as good practice.

Despite reductions in postoperative complication rates between audits, functional outcomes at 3 months remained poor and overall mortality rates had not declined. A third of patients reported clinically significant hip pain and less than half had recovered their reported pre-fracture ability to dress, bathe, toilet, and transfer. Given that most patients reported help with at least one basic daily activity before the fracture and two thirds of patients survived and returned to their own home, failure to recover basic function has considerable implications for primary care. There is a clear need to investigate what happens to patients with hip fractures after discharge from the orthopaedic ward and to audit rehabilitation. Rehabilitation and long term support of those who have fallen are identified as key interventions in standard 6 of the National Service Framework for Older People.<sup>26</sup> This will require increased input from experts in the care of elderly patients and better liaison between primary care, general practice, and orthopaedic departments.

We recommend that, whenever possible, patients are mobilised early because early mobilisation appears to be associated with a better prognosis and reduced risk of thromboembolism, pneumonia, and pressure sores. The National Service Framework for Older People also recommends "following surgery, older people with hip fracture repairs should be mobilised within 48 hours where appropriate".<sup>26</sup> Logistic regression suggests that early mobilisation is an important factor associated with reduced mortality, but the relationship may not be causal. Failure of an individual patient to mobilise early may be due to poor postoperative recovery which could be related to a number of factors that were not measured such as surgical competence, pain control, or patient variables not easily recognised such as overall frailty or compliance.

## Key learning points

- The Anglian audits of hip fracture have shown that it is feasible to carry out repeated multi-site audits of the management and care of hip fracture patients.
- By 1997, while some hospitals had made improvements in care, other hospitals were failing to maintain their level of good practice. This highlights the need for continuous quality improvement by repeating the audit cycle to reach and then improve standards.
- Five years after the first audit and despite a more aged population sample, reductions had occurred in the incidence of wound and joint infections, pressure sores, pneumonia and fatal pulmonary embolism.
- Despite these reductions in postoperative complication rates between audits, functional outcomes at 3 months remained poor and overall mortality rates had not declined.
- Rehabilitation and long term support to improve functional outcomes are key areas for future audit and research. These should examine the process variables and outcomes for the rehabilitation period after surgical management is completed.

In 1992 one hospital (hospital 6) had a fivefold difference in mortality compared with the other hospitals, but these differences were no longer evident in 1997. This could not easily be explained by changes in process or patient characteristics. In the 1992 audit we concluded that no one component of treatment explained the better mortality of patients treated in hospital 6. It appeared to be related to the cumulative effect of good performance in numerous aspects of the delivery and organisation of care in this hospital. By 1997 hospital 6 had lost its place of preeminence, perhaps partly because of the improvement of some of the other hospitals, but primarily because of failure to maintain and improve its own overall package of care. This highlights the need for continuous quality improvement by repeating the audit cycle to reach and then improve standards. It also reveals how it can be crucial to measure, not only the obvious aspects of the process and outcomes of care, but also to consider aspects of the structure of care which may clarify any effects that might emanate from therapeutic team structure and dynamics. We therefore recommend that hospitals continue to audit the care of patients with hip fractures.

This recommendation is endorsed by the Audit Commission in a follow up to their 1995 report on coordinating care for hip fracture patients.<sup>11</sup> The Audit Commission<sup>4</sup> examined changes that had taken place between 1995 and 1999 in 139 (70%) of the 199 acute trusts in England and Wales. Overall results in 1999 were similar to those in the 1997 Anglian audit—for example, 82% received their operation within 48 hours of admission (Anglia 85%) and 29% of patients were not mobilised within 48 hours of their operation (Anglia 30%). The Audit Commission also reported that "while some trusts have made improvements, performance overall remains static and recommended best practice is not always followed". Trusts are recommended to "find out how they compare with other similar trusts and where the greatest improvements in performance are needed. They should analyse the reasons for any shortfalls in the level of service provided and implement policies to overcome them".

Clearly, well planned regional clinical audits would provide a useful tool to implement such recommendations. Regional audits would also provide a method for implementing changes in order to meet standards set out in the National Service Framework for Older People.<sup>26</sup>

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