Managing osteoporosis in patients with fragility fractures: did the British Orthopaedic Association guidelines have any impact?

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ABSTRACT

INTRODUCTION The incidence of fragility fractures could double in the next 50 years. Effective treatments for osteoporosis exist and the British Orthopaedic Association (BOA) has guidelines governing how to manage underlying osteoporosis in patients with fragility fractures. This study assessed how well two trauma units treat underlying osteoporosis and whether the BOA guidelines made any impact.

PATIENTS AND METHODS Case notes of patients with a fracture of their proximal femur admitted during January and February in 2003, 2004 and 2005 were reviewed. The results were analysed for differences between site and year.

RESULTS A total of 602 case notes were reviewed. There was a significant difference in the number of patients discharged on osteoporosis medication between the two sites (27% at LRI, 8% at KGH; $P < 0.001$), but not between 2003 and 2005 (22% and 16%; $P = 0.16$). Of the patients started on treatment, 83% were started on calcium and/or vitamin D₃ supplements.

CONCLUSIONS The number of patients who had their underlying osteoporosis addressed was low and the type of treatment sub-optimal. This suggests the BOA guidelines have not made an impact and further work is required to improve the management of these patients.

KEYWORDS

Osteoporosis – Fragility fracture – Proximal femur – Orthopaedics – Treatment – Guidelines

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Fragility fractures are a fracture that occurs following a fall from standing height or less, and occur as a consequence of bone weakness and an increased tendency to fall. Fractures of the proximal femur are one of the most common fragility fractures and are associated with prolonged hospital admissions, a loss of independence and have a 1-year mortality of around 30%. In the UK, they are a massive financial burden on the National Health Service with an estimated £2 billion spent annually on the treatment of osteoporosis and osteoporotic fractures. Over the next 40 years, the number of people over 60 years old is expected to increase by 40% and the number over 90 years old is expected to double.¹ Currently, one in three women is expected to sustain an osteoporotic fracture within their life-time² and the least pessimistic estimates calculate this figure to double by 2066.¹

It is essential that not only the acute fracture is managed appropriately, but also secondary prevention of bone fragility and any tendency to fall are addressed. Orthopaedic surgeons play a central role in this management, as not only are fractures the key pathological consequence, but they are often the first presenting sign. Professional bodies, including the Royal College of Physicians,³ the British Orthopaedic Association (BOA)⁴ and, most recently, the National Institute for Clinical Excellence (NICE)⁵ have all produced guidelines for the management of falls and osteoporosis following a fragility fracture.

Although calcium and vitamin D₃ supplements alone have been proven to be beneficial in frail, institutionalised patients,⁶ it has recently been shown to be less use in the general population.⁷ The NICE guidelines,⁵ therefore, recommend starting all patients who sustain a fragility fracture

on a bisphosphonate as well as calcium and vitamin D₃ supplements (raloxifene and teriparatide are second-line treatments if patients cannot tolerate bisphosphonates). Patients over 75 years of age can have the diagnosis of a fragility fracture made without the need for assessment of the bone mineral density. Those under 75 years require a DEXA scan to confirm osteoporosis, and treatment stopped if this is not proved. Amongst the recommendations in the NICE guidelines for the prevention of falls in the elderly is that underlying causes should be sought in any fall that results in injury.⁸

The BOA guidelines, published in September 2003, addressed several ways that the care of fragility fracture patients could be improved. They suggested that medical care should be increasingly led by orthogeriatricians with early transfer from acute trauma wards to step-down facilities; in addition, research should be made into the development of new implants and any correctable bone fragility or tendency to fall should be identified and treated. The employment of a dedicated Osteoporosis Liaison Nurse was suggested as a model of addressing some of these issues. The published guidelines became known as 'the blue book' and were distributed to all members of the BOA and made available via the internet.

These guidelines highlighted the numerous ways that delivery of care to these patients could be improved, and this study was designed to assess how well one of the aspects of the BOA guidelines was being addressed – how well orthopaedic units are treating the underlying osteoporosis in patients with fragility fractures.

Patients and Methods

This study was designed to assess the management of underlying osteoporosis in fragility fracture patients admitted to trauma wards. The management of fragility fractures seen as an out-patient in fracture clinic were not assessed in this study. Fractures of the proximal femur (including all inter-trochanteric, neck and intracapsular fractures) were audited as they are a common fragility fracture that nearly always requires in-patient admission. Because such patients are not normally followed up as an out-patient, any intervention to treat osteoporosis should, therefore, be done whilst on the trauma wards.

Analysis was done at two sites – the Leicester Royal Infirmary (LRI) and at Kettering General Hospital (KGH) – to compare different methods of addressing the problem. The LRI is a teaching hospital that, although it has no implemented protocol on the management of osteoporosis for patients with fragility fractures, has a consultant-led orthogeriatric team that is having increasing input into their care. Kettering on the other hand is a smaller DGH with a dedicated osteoporosis nurse.

Suitable patients were identified retrospectively by computer coding at the two hospitals. Prescribing habits were audited during January and February in 2003, 2004 and 2005. Analysis of data in 2003 was done to assess prescribing habits before publication of the BOA guidelines, and in 2004 and 2005 to see if the guidelines had any immediate or later impact on the management of underlying osteoporosis.

Information about osteoporosis treatment regimens was obtained by reviewing the patients' admission drug chart, medical clerking, discharge drug chart and discharge letter. This allowed us to calculate the following information on osteoporosis treatment:

1. Class of drug prescribed: categorised into calcium and/or vitamin D₃ supplements, bisphosphonates and second-line treatments (*e.g.* HRT, raloxifene, teriparatide or strontium ranulate).
2. Admission medication: osteoporosis treatment taken at admission.
3. Discharge medication: osteoporosis treatment prescribed at discharge from the trauma wards.
4. Medication started on the trauma wards: patients either commenced or having osteoporosis treatment 'stepped-up' whilst an in-patient (*e.g.* a bisphosphonate was commenced in a patient already taking calcium and vitamin D₃ supplements).

In addition, demographic information about the patients' age, sex, side and type of fracture, operative management, length of time awaiting surgery and discharge, discharge destination and hospital mortality was also collected.

Patients who died during their in-patient admission were excluded from analysis as many had a protracted illness during which they had many of their medications discontinued. Percentages of those started or discharged on treatment were calculated according to the number of surviving patients. Results were analysed using SPSS v.9 and Microsoft Excel with chi-squared, Mann-Whitney U-tests, *t*-tests and Pearson's correlation.

Results

In total, 602 case notes were reviewed, 345 from the LRI (110 in 2003, 118 in 2004 and 117 in 2005) and 257 from KGH (78 in 2003, 90 in 2004 and 89 in 2005). All patients had adequate data for analysis of admission drugs and 592 (98%) had adequate data for discharge information.

Demographic details

The patients' ages were normally distributed with a mean age of 81 years (range, 52–104 years), 76% were female, 52% had a left-sided fracture and 52% had an intracapsular

Figure 1 Differences in pre-operative wait.

fracture. There was no significant difference in these demographics between the different hospitals and years of analysis. Overall, 15% of patients died in hospital, 35% were discharged home, 24% were transferred to another ward or hospital, 22% were discharged to a residential or nursing home. The outcome was not known in 4% of patients.

Pre-operative wait

There was a significant difference between the two sites regarding pre-operative wait, with a mean of 1.3 days wait (range, 0–9 days) at KGH compared to 5.0 days (range, 0–23 days) at the LRI ($P < 0.001$, MWU; Fig. 1). The pre-operative wait

was reduced between 2003 and 2005 at both hospitals (1.4 to 1.1 days at KGH; $P = 0.08$; 6.3 to 4.6 days at LRI; $P < 0.01$; t -test).

Postoperative stay

There was also a difference between the two sites regarding postoperative stay, with a median stay of 13 days at KGH (range, 0–139 days) compared to 17 days at the LRI (range, 0–158 days; $P < 0.01$, MWU). There was only a weak correlation between pre- and postoperative stay ($r = 0.17$, Pearson's correlation), but in a large group of 602 patients, this relationship was significant ($P < 0.001$). The equation for the best fit line is: postoperative stay = $0.9 \times$ pre-operative wait + 18 days. Thus, for each day delay to theatre, the

Figure 2 Type of treatment started by hospital and year.

postoperative stay increases by 0.9 days and the total hospital stay by 1.9 days. Pre-operative wait did not influence mortality, with no significant difference in pre-operative wait between those who died and those who did not (4.1 versus 3.2 days, respectively; $P = 0.10$, t -test).

Osteoporosis management at different hospitals

Patients admitted to the LRI were more likely to be admitted on osteoporosis treatment than at KGH (11% versus 5%; $P = 0.007$, χ^2). Patients discharged from the LRI were much more likely to be discharged on osteoporosis treatment (27% at the LRI versus 8% at KGH; $P < 0.001$, χ^2). Although this difference could partially be explained by the increase in patients admitted on treatment between the two sites, 19% of patients at the LRI compared to 4% at KGH were started on treatment as an in-patient on the trauma wards ($p < 0.001$, χ^2).

Osteoporosis treatment during different years

There was an increase in patients admitted on osteoporosis medication between 2003, 2004 and 2005 (8%, 10% and 11%, respectively; $P = 0.03$, χ^2). Fewer patients were recorded to have been started on osteoporosis treatment by the time of discharge between 2003, 2004 and 2005 (19%, 14% and 7%, respectively; $P = 0.048$, χ^2). After adjustment for mortality, the overall percentage of patients discharged on osteoporosis treatment (including those admitted on treatment) decreased from 26% in 2003, to 20% in 2004 and 16% in 2005 ($P = 0.018$, χ^2). This trend was seen in both hospitals – at the LRI, 33% were discharged on treatment in 2003, 27% in 2004 and 25% in 2005 ($P = 0.31$, χ^2); at KGH 18% in 2003, 12% in 2004 and 5% in 2005 ($P = 0.15$, χ^2). This would suggest that BOA guidelines have not made a significant impact on how well orthopaedic trauma units treat underlying osteoporosis in patients with fractures of their neck of femur.

Class of drug used

Of those started on treatment, the majority (69%) were started on calcium and vitamin D₃ supplements, 14% were started on calcium supplements alone and 17% were started on a bisphosphonate. No one was prescribed HRT or a second-line drug.

Discussion

Risk of re-fracture

After a fracture of the proximal femur, the risk of sustaining a further fracture on the other side is 7.6% in the first year and 10.6% in total. This carries a 30-day mortality that is double that of primary fractures (30% versus 13%).⁹ It is, therefore, vital to address any treatable cause for fracturing such as a tendency to fall or underlying osteoporosis. There

are several medical treatments for osteoporosis that have been proven to increase bone mineral density and reduce the incidence of fractures, it would be considered good clinical practice to address this issue whilst the patient is an in-patient. After a fragility fracture, patients that are suspected of having osteoporosis can be started on appropriate treatment, without the need for bone mineral density assessment.^{3,5} In younger patients, a DEXA scan is needed to confirm the diagnosis, but treatment can still be commenced at the time of fracture, to be discontinued, if necessary, after their scan.

This study shows that although the number of patients with fragility fractures that receive treatment for underlying osteoporosis in these orthopaedics centres is low (27% at the LRI and 8% at KGH), it compares reasonably well to previous reports of 16% in Manchester, UK¹⁰ and 6.2% in Denmark.¹¹ We found no significant improvement in prescribing habits between 2003, 2004 and 2005, which implies that the BOA guidelines have not yet made an impact on how we treat bone fragility.

We found significant differences between hospitals with regard to delay to surgery. This is likely to be due to the number of admissions to each unit, and the availability of operating time. The reduction in waiting time before surgery, particularly at the LRI (6.3 days in 2003 to 4.6 days in 2005) is likely to be due to the increase in resources made available as part of the National Service Framework for Older People.

Choice of drug

The type of drug prescribed is also in question, as the vast majority of patients were prescribed only calcium and vitamin D₃ supplements. This is a cheap, well-tolerated drug that is commonly used as an adjunct to other drugs in trials. Despite some studies showing clear fracture prevention in elderly institutionalised patients,⁶ more recent studies have shown such a benefit is not seen in the broader population.⁷ It would, therefore, be better practice to prescribe either one of the established treatments such as the bisphosphonates, or one of newer drugs such as raloxifene, teriparatide and strontium ranelate. These drugs are effective in increasing bone mineral density and appear to reduce the risk of further fractures, but do have a higher side-effect profile.⁵ The conservative approach to treatment seen in this study may be because many patients were elderly (mean age, 81 years) and the majority were not discharged to their own home (65%). It should be mentioned, however, that few trials use non-axial fragility fractures as entry criteria and re-fracture rate as the primary end-point, choosing to look at surrogate markers such as bone mineral density and bone turnover markers and vertebral fractures instead. One of the limitations of this study is that, being a retrospective review, it was

difficult to evaluate whether drug tolerability or physician or patient choice influence the choice of medication.

Bisphosphonates and fracture healing

In the past, there has been concern that bisphosphonates may effect fracture healing. In patients with an intracapsular fracture treated with a hemi-arthroplasty, this is clearly not an issue; however, in patients treated with bone preservation, it is hypothesised that the bisphosphonate-mediated osteoclasts inhibition would affect bone remodelling and union. A number of studies have been done over the last 20 years addressing this issue, using a variety of models, a variety of end-points and a variety of drugs at different doses.^{12–21} This heterogeneity makes it hard to reach absolute conclusions, but all studies showed minimal effect on fracture healing. Many studies showed an increase in callus size and a tendency for increased callus mineralisation, but no studies showed an increase in fracture non-union. Only one of the 10 studies showed an effect on the biomechanical properties of bone, an increase in stiffness and ultimate load.¹⁶ Despite these studies, it is possible that the misconception that bisphosphonates impair fracture healing persists, and this may be one of the reasons for the low use of bisphosphonates in fragility fracture patients.

How should the problem be addressed?

We found a significant difference in prescribing practice between the two hospitals, with nearly 5-times as many patients being started on osteoporosis treatment in Leicester compared to Kettering. Although Kettering has a dedicated osteoporosis nurse, whose role is to liaise between various specialities, the nurse only has an input when specifically referred to. In Leicester, orthogeriatricians are becoming increasingly involved in the management of elderly patients with fractures. The majority of the patients had their osteoporosis treatment started by this team, when they were being reviewed for other reasons.

Osteoporosis is a rapidly developing sub-speciality and it would be unreasonable to expect all orthopaedic surgeons to keep up to date with all advances. However, as orthopaedic surgeons are often the only specialists to see a patient with a fragility fracture, it is reasonable for them to be the patient's advocate, and if not commence treatment, to at least refer to the appropriate speciality. It may be that the best way to address the problem would be to employ a dedicated Osteoporosis Nurse who reviews all fragility fractures and using the BOA or NICE guidelines, liaises between the various specialities to investigate and treat underlying problems such as osteoporosis and a tendency to fall. Several reports have shown that commencing a local protocol significantly improves the management of these patients.^{22,25}

How should it be funded

In a thinly resourced NHS, any additional expense needs to be justified. The NICE guidelines reviewed the economic implications of managing osteoporotic fractures and favoured drug therapy in the elderly (over 75 years) and further investigation of underlying causes of osteoporosis in the younger patients. It has been shown that simple measures like patient education will increase awareness of the condition and leads to increased treatment by primary care physicians.²² In a previous (unpublished) audit, the cost of diagnosing and commencing osteoporosis treatment in busy trauma unit in Leicester that sees over 700 proximal femur fractures a year was estimated to be around £20,000. This compares to conservative estimates of the cost of a fractured neck of femur to the hospital being around £4700 in 1995.²⁴ With life-time re-fracture rates of 10.6%,⁹ it does not take long before starting osteoporosis treatment becomes cost-effective. Now that NICE has released guidelines, it may not be long before failure to address such problems results in costly litigation.

Conclusions

This study has highlighted that, despite the introduction of the BOA guidelines, treatment of underlying osteoporosis in patients with a fractured neck of femur is still low and more needs to be done to address this issue.

References

1. Khaw KT. How many, how old, how soon? *BMJ* 1999; **319**: 1350–2.
2. Boyce WJ, Vessey MP. Rising incidence of fracture of the proximal femur. *Lancet* 1985; **1**: 150–1.
3. Royal College of Physicians and Bone and Tooth Society of Great Britain. *Osteoporosis clinical guidelines for prevention and treatment*. Working Party Report on-line publication. London: Royal College of Physicians, 1999.
4. Marsh D, Simpson H, Wallace A. *The care of fragility fracture patients*. British Orthopaedic Association Guidelines. London: BOA, 2003.
5. National Institute for Clinical Excellence. *Guidelines on the treatment of osteoporosis in postmenopausal women*. London: NICE, 2005.
6. Chapuy MC, Arlot ME, Duboeuf F, Brun J, Crouzet B, Arnaud S *et al*. Vitamin D₃ and calcium to prevent hip fractures in the elderly women. *N Engl J Med* 1992; **327**: 1637–42.
7. Grant AM, Avenell A, Campbell MK, McDonald AM, MacLennan GS, McPherson GC *et al*; RECORD Trial Group. Oral vitamin D₃ and calcium for secondary prevention of low-trauma fractures in elderly people (Randomised Evaluation of Calcium Or vitamin D, RECORD): a randomised placebo-controlled trial. *Lancet* 2005; **365**: 1621–8.
8. National Institute for Clinical Excellence. *Guidelines on the prevention of falls and injuries in older people*. London: NICE, 2004.
9. Boston DA. Bilateral fractures of the femoral neck. *Injury* 1982; **14**: 207–10.
10. Charalambous CP, Kumar S, Tryfonides M, Rajkumar P, Hirst P. Management of osteoporosis in an orthopaedic department: audit improves practice. *Int J Clin Pract* 2002; **56**: 620–1.

11. Jacobsen IB, Wiboe L, Mogensen CB. Osteoporosis prevention in patients with low energy hip fractures hospitalised in the orthopaedic department [in Danish]. *Ugeskr Laeger* 2002; **164**: 3541–4.
12. Bauss F, Schenk RK, Hort S, Muller-Beckmann B, Sponer G. New model for simulation of fracture repair in full-grown beagle dogs: model characterization and results from a long-term study with ibandronate. *J Pharmacol Toxicol Methods* 2004; **50**: 25–34.
13. Hyvonen PM, Karhi T, Kosma VM, Liimola-Luoma L, Hanhijarvi H. The influence of dichloromethylene bisphosphonate on the healing of a long bone fracture, composition of bone mineral and histology of bone in the rat. *Pharmacol Toxicol* 1994; **75**: 384–90.
14. Koivukangas A, Tuukkanen J, Kippo K, Jamsa T, Hannuniemi R, Pasanen I *et al*. Long-term administration of clodronate does not prevent fracture healing in rats. *Clin Orthop* 2003; **408**: 268–78.
15. Lenehan TM, Balligand M, Nunamaker DM, Wood Jr FE. Effect of EHDP on fracture healing in dogs. *J Orthop Res* 1985; **3**: 499–507.
16. Li J, Mori S, Kaji Y, Mashiba T, Kawanishi J, Norimatsu H. Effect of bisphosphonate (incadronate) on fracture healing of long bones in rats. *J Bone Miner Res* 1999; **14**: 969–79.
17. Madsen JE, Berg-Larsen T, Kirkeby OJ, Falch JA, Nordsletten L. No adverse effects of clodronate on fracture healing in rats. *Acta Orthop Scand* 1998; **69**: 532–6.
18. Nyman MT, Paavolainen P, Lindholm TS. Clodronate increases the calcium content in fracture callus. An experimental study in rats. *Arch Orthop Trauma Surg* 1993; **112**: 228–31.
19. Nyman MT, Gao T, Lindholm TC, Lindholm TS. Healing of a tibial double osteotomy is modified by clodronate administration. *Arch Orthop Trauma Surg* 1996; **115**: 111–4.
20. Peter CP, Cook WO, Nunamaker DM, Provost MT, Seedor JG, Rodan GA. Effect of alendronate on fracture healing and bone remodelling in dogs. *J Orthop Res* 1996; **14**: 74–9.
21. Tarvainen R, Olkkonen H, Nevalainen T, Hyvonen P, Arnala I, Alhava E. Effect of clodronate on fracture healing in denervated rats. *Bone* 1994; **15**: 701.
22. Gardner MJ, Brophy RH, Demetrakopoulos D, Koob J, Hong R, Rana A *et al*. Interventions to improve osteoporosis treatment following hip fracture. A prospective, randomized trial. *J Bone Joint Surg Am* 2005; **87**: 3–7.
23. Sidwell AI, Wilkinson TJ, Hanger HC. Secondary prevention of fractures in older people: evaluation of a protocol for the investigation and treatment of osteoporosis. *Intern Med J* 2004; **34**: 129–32.
24. French F, Torgerson DJ, Porter RA. A cost analysis of hip fracture. *Age Ageing* 1995; **24**: 185–9.

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