Secondary and tertiary prevention in the management of low-trauma fracture

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A significant risk factor for osteoporotic fracture is a previous atraumatic fracture. The objective of this study was to investigate whether patients with Colles fracture from minimal trauma were subsequently identified, assessed and treated for their elevated risk of fracture. Medical records at Sir Charles Gairdner Hospital in Perth, Western Australia, from August 1999 to July 2000 were audited and 111 patients who had sustained a Colles fracture from minimal trauma were identified. Questionnaires were subsequently posted to participants to determine whether any assessment or treatment was undertaken outside the hospital system. According to documentation in the medical records, 9% (10/111) had their bone mineral density assessed, 15% (17/111) were receiving medical therapy for osteoporosis, 7% (8/111) had their falls risk assessed and 51% (58/111) were seen by a physiotherapist. Of the 58 who received physiotherapy, 76% (44/58) received upper limb exercises and 19% (11/58) received lower limb or balance exercises. Follow-up questionnaires one to two years after the fracture were returned by 43% (48/111) of the sample. By this time, 37% (18/48) had BMD assessed and 27% (13/48) were receiving medical therapy for osteoporosis. Thirty-five per cent (17/48) of patients recalled being advised to increase their calcium intake. Of those who reported more than one fall during the past 12 months, 62% (8/13) had been seen by a physiotherapist, 46% (6/13) reported having their balance assessed and 54% (7/13) reported having a home visit for assessment of rails etc. Despite the availability of effective treatments, a substantial proportion of patients with Colles fracture from minimal trauma are not being identified, assessed or treated for their elevated risk of subsequent osteoporotic fracture. **[Myers TA and Briffa NK (2003): Secondary and tertiary prevention in the management of low-trauma fracture. *Australian Journal of Physiotherapy* 49: 25-29]**

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Introduction

Osteoporosis is an increasingly common health concern that affects both men and women. It manifests as fractures following minimal trauma. Lifetime fracture risk in a person aged 60 years and over is 56% for females and 29% for males (Jones et al 1994). Risk factors for osteoporotic fracture include low bone mineral density (BMD) and exposure to trauma, often as a fall (Cummings et al 1995, Earnshaw et al 1998, Greenspan et al 1994, Nguyen et al 1993).

Low BMD can be accurately identified using dual energy x-ray absorptiometry (DXA; Kanis 1994). There is good evidence that pharmacological intervention is effective in treating low BMD. Effective medical therapies include hormone replacement therapy (HRT; Recker et al 1999), bisphosphonates (Karpf et al 1997), raloxifene (Ettinger et al 1999), and calcium and vitamin D (Reid 1998). Calcitriol is also used by some physicians although the data regarding its efficacy are less clear-cut (Delmas 2002). For some of these medical therapies, large controlled trials have shown that alendronate, risedronate, and raloxifene substantially reduce fracture risk (Delmas 2002). Choice of medical therapy depends on age, BMD and the presence or absence of prevalent fractures (Delmas 2002). Another strategy that has shown to be effective in increasing bone mass is exercise, particularly weight bearing exercise or resistance training, although the magnitude of change in BMD is much smaller in response to exercise than to medical therapy (Kerr et al 2001).

Skeletal trauma in the aged is caused predominantly by falls and thus an elevated risk for falls is a risk factor for fracture. Thirty-three per cent of vertebral fractures are associated with falls (Cooper et al 1992). Approximately one third of the population aged 65 years and over fall each year and about 5% of these falls result in fractures (Tinetti et al 1994). Risk factors for falls include a previous history of falls, visual impairments, use of a walking aid and an elevated perceived risk of falling (Hill et al 2000). Many of these risk factors can be favourably modified with simple interventions. For example, exercises such as Tai Chi and balance training have been shown, in randomised controlled trials, to significantly reduce the risk of falling (Wolf et al 1996). Practice guidelines suggest individually tailored exercise programs conducted by qualified professionals should be established for high risk groups (Feder et al 2000) and that balance training should be one of the components (American Geriatrics Society et al 2001). As modifiable risk factors for falls are numerous, a multifactorial approach that targets specific risk factors for each individual has been shown to be very effective in reducing risk of falling (Tinetti et al 1994). Consequently, it has been recommended that programs that include more

than one intervention should be prioritised (Feder et al 2000).

Given the pathophysiology of osteoporotic fracture, it is not surprising that an important predictor of osteoporotic fracture is a previous osteoporotic fracture (Kanis 1994). Colles fracture is frequently a fracture of osteoporotic bone and most often results from a fall. Interestingly, Colles fracture is likely to occur on average about 15 years earlier than hip fracture (Mallmin et al 1993). Consequently, patients with Colles fracture from minimal trauma constitute a group that is suitable for screening to identify any other risk factors amenable to treatment, such as low BMD and risk of falling.

The purpose of this study was to determine whether patients presenting with a Colles fracture from minimal trauma were subsequently identified as candidates for secondary prevention and consequently assessed and treated for osteoporosis and risk of falling.

Methods

Subjects Subjects were men and women treated for a Colles fracture during the 12-month period from August 1999 to July 2000 at Sir Charles Gairdner Hospital (SCGH). Cases were identified from the SCGH databases using ICD code S52.0-S52.8 and medical records were subsequently audited. Three hundred and sixteen patients were eligible for the study, however patients were excluded if they were less than 55 years old (170), if the fracture was the result of trauma more substantial than a fall from standing height (12), if the fracture was pathological (3), or if the wrist fracture was not a Colles fracture (20). The remaining 111 records were examined to extract data regarding date of birth, past medical history, medications, history of a previous fracture, whether BMD was assessed, whether falls risk was assessed and whether the participant was seen by a physiotherapist following their Colles fracture.

As follow-up care is often provided outside the hospital system, the medical record audit was supplemented with a simple questionnaire posted to the 111 individuals who met the inclusion criteria. The questionnaire sought information regarding medications and the prevalence of risk factors for osteoporotic fractures such as history of previous fracture and falls, use of a walking aid, and perceived risk of falling. It was also of interest whether or not physiotherapy was received after the Colles fracture, specifically whether balance, falls history and home environment had been assessed. Prior to distribution, this questionnaire was tested in a small pilot study. Five volunteers aged at least 55 were tested to ensure the questions were correctly interpreted by the respondent and the answer provided addressed the intended question. All subjects correctly interpreted the questions and provided appropriate responses.

Table 1. Proportion of patients receiving medical therapy as documented in the medical records and according to responses on self-completed questionnaire.

Medical Therapy	Hospital Records N = 111		Patient Questionnaire N = 48	
	%	n	%	n
Any treatment	15.3	(17)	27.1	(13)
Hormone replacement therapy	2.7	(3)	2.1	(1)
Bisphosphonates	1.8	(2)	4.2	(2)
Calcitriol	2.7	(3)	4.2	(2)
Calcium	7.2	(8)	14.6	(7)
Vitamin D	8.1	(9)	10.4	(5)

The study was approved by the Curtin University and SCGH Human Research Ethics Committees and procedures accorded with committee requirements.

Data analyses were primarily descriptive with differences in proportion tested with the chi square procedure and Fisher's exact test where expected frequencies were small. Significance was inferred where $p < 0.05$.

Results

Medical record audit The study group was predominantly female (95%) with a median (IQR) age of 81 (11) years. The median age of the five men in the study group was comparable at 82 (9.3) years. In view of the relatively small number of men in the study group, no comparison of treatment between men and women was made. All the fractures were the result of a fall from standing height or less and 45 patients required inpatient admission for treatment of the fracture. Thirty-one had a previous fracture and three patients were on oral prednisolone.

Only 9% (10/111) of the patients in this study group had documentation of BMD measurement in their hospital records. Fifteen per cent (17/111) were on medical therapy for osteoporosis. Table 1 shows the proportion of patients receiving medical therapy for osteoporosis. Some patients were receiving more than one therapy, five were receiving calcium and vitamin D and one was receiving calcium and calcitriol. One of the five men in the group was receiving treatment for osteoporosis, specifically calcium and vitamin D. There was no significant difference in the proportion of patients with previous fracture receiving medical therapy (22.5%) compared with those without a previous fracture (12.5%; Fisher's exact $p = 0.23$). Nor was

there a significant difference in proportion of patients aged 80 years and over taking medical therapy (21.4%) compared with those less than 80 years (9.1%; Fisher's exact $p = 0.11$). Of the three patients on oral prednisolone, none were receiving medical therapy for osteoporosis.

Eight of the patients had been identified by nursing staff using an "in-house" checklist of risk factors for falls as having an increased falls risk, and all of these were seen by a physiotherapist. An additional three patients were referred to the SCGH falls clinic. Fifty-two per cent of patients (58/111) were seen by a physiotherapist during either their hospitalisation or rehabilitation. Of these, 76% (44/58) received treatment to the upper limb including one or more of shoulder/elbow/wrist exercises and passive mobilisation. Lower limb exercises or balance retraining, either of which may conceivably be considered to address elevated risk of falling, were received by only 19% (11/58) of those receiving physiotherapy. Four patients received ambulation as their only documented physiotherapy treatment.

Questionnaire Follow up questionnaires were sent approximately one to two years after the fracture, depending on the date of fracture, to investigate any further treatment that may have taken place outside the hospital system. Forty-eight patients completed and returned the questionnaire, six were returned for deceased patients and three were no longer at that address (51% returned). There were no significant differences between responders and non-responders in terms of age (80.5 (11) vs 79 (15.7) years respectively $p = 0.49$); proportion of males (2% vs 6% $p = 0.38$); or proportion requiring inpatient admission for management of their fracture (43% vs 37% $p = 0.57$).

Of the 48 questionnaires returned, 37.5% (18/48) reported having their BMD assessed, and of these, 50% (9/18) were receiving medical therapy for osteoporosis. Overall, 27% (13/48) were taking some form of medical therapy for osteoporosis (Table 1). Thirty-five per cent (17/48) of patients recalled being advised to increase their calcium intake, and of these, 12 were making a conscious effort to do so.

Twenty-seven per cent (13/48) of those who returned the questionnaire had fallen more than once in the preceding 12 months. Moreover, 41% (17/48) rated their risk of falling in the next six months as moderate or high. Of those with multiple falls (13), 62% (eight) had been seen by a physiotherapist, 46% (six) recalled having their balance tested, and 54% (seven) had been visited at home for assessment of rails etc. However, the proportion of patients receiving each of these assessments did not differ according to their history of falling ($p > 0.2$). Of the eight patients who had their falls risk assessed by nursing staff, four returned their follow-up questionnaire, and of these two had more than one fall during the follow-up period despite receiving physiotherapy for balance/muscle strength of the lower limbs.

Discussion

Individuals with a fracture from minimal trauma are, by virtue of that fracture, known to have an elevated risk for subsequent osteoporotic fracture (Mallmin et al 1993). Therefore, they constitute a high-risk group, ideal candidates for secondary prevention including further assessment and treatment for other risk factors for osteoporotic fracture. However, this study highlights that only a small proportion of those with a Colles fracture from minimal trauma were receiving secondary prevention. These findings are consistent with those of a recent Canadian study that found fewer than 20% of patients with fractures typical of osteoporosis report receiving investigation or treatment for osteoporosis (Hajcsar et al 2000)

Dual energy x-ray absorptiometry has been recommended as the optimal measurement of BMD for predicting hip fractures (Kanis 1994). Indeed, clinical pathways recently established for the medical management of patients with low-trauma fracture recommend DXA scans among the additional diagnostic examinations to be included in the pathway (Chevally et al 2002). Although in Australia DXA scanning is not required prior to prescribing medications for fracture prevention if a minimal trauma fracture has already occurred, DXA scanning is recommended (Delmas 2002). This is particularly so for non-vertebral fractures such as Colles fracture, where determination of skeletal fragility is considered an integral part of the clinical decision making process (Delmas 2002). Despite this, just 9% of patients had documentation in the medical records of BMD measurement. One to two years after the index fracture, 37% of respondents reported having BMD assessed. The proportion who had still not been assessed is high, particularly as DXA measurements are safe, comparatively inexpensive and widely available.

There is now good evidence that pharmacological intervention is effective in treating low BMD and reducing the risk of fracture (Ettinger et al 1999, Karpf et al 1997, Recker et al 1999, Reid 1998). Even so, a surprisingly small proportion of patients in this study were receiving medical therapy for osteoporosis. Similar findings were reported in a study that found patients with hip or Colles fracture did not show a statistically significant increase in the use of medical therapy compared with age-matched controls (Torgerson and Dolan 1998). In that study, medical therapy for osteoporosis was increased among only those with a vertebral fracture. It is of interest that none of the patients with vertebral fracture were receiving any of the therapies that have been shown to decrease vertebral fracture incidence (Torgerson and Dolan 1998), which further highlights that osteoporosis is not always treated optimally.

Our study did not examine the proportion of patients who were offered medical therapy but declined treatment. However, with various intervention strategies available, it is

reasonable to assume that those who have BMD measured but decline treatment would be advised on other, albeit less effective, forms of anti-fracture treatment, such as increasing dietary calcium intake. Yet in this study, only 61% of those who had their BMD measured recalled being advised to increase calcium in their diet. These results differ from a recent study that reported 90% of those who were diagnosed as having osteoporosis were advised to increase calcium intake (Hajcsar et al 2000). The mean age for men and women in that study was 64 years, compared with a median of 81 and 82 years for men and women in our study. The difference may reflect an age-related decline in recall or alternatively, in view of their older age, health professionals may consider it is too late to be worth initiating therapy.

Cost is another possible reason for the small proportion of patients receiving medical therapy. However, medical therapy, specifically calcium and vitamin D, targeted at those at high risk has been shown to reduce overall health care costs (Torgerson and Kanis 1995). Considering the cost of osteoporotic fractures in Australia in 1992 was $779 million and this is expected to increase more than two-fold by 2025 (Randell et al 1995), the cost of investigation and treatment of osteoporosis seems justified.

Physiotherapists are also failing to respond to the increased fracture risk in patients with Colles fracture, as indicated by the small proportion of patients (7%) assessed for falls risk. Risk factors for falls are well established, one being a previous history of falling (Tinetti et al 1994). Practice guidelines for falls prevention recommend that older persons who present for medical attention because of a fall should have a fall evaluation performed by a clinician with appropriate skills and experience (American Geriatrics Society et al 2001). All of the Colles fractures in this study were the result of a fall, thus all of the patients have an increased risk for falling and meet the criteria for evaluation, yet apparently few were assessed or received treatment to reduce their risk of falling.

Of the patients who did receive physiotherapy, the majority (76%) received upper limb exercises that included one or more of shoulder, elbow or wrist passive and active exercises. A considerably smaller proportion (19%) received lower limb strengthening or balance training, even though numerous studies have demonstrated that balance training is effective in reducing falls risk (Tinetti et al 1994, Wolf et al 1996). However, evidence-based practice guidelines recommend multifaceted interventions including balance training for at-risk older individuals (American Geriatrics Society et al 2001, Feder et al 2000). Even of those patients who reported a history of multiple falls, and thus have an easily identifiable elevated risk for falls (Tinetti et al 1994), fewer than half were treated for balance. The results of this study suggest that physiotherapists are focusing primarily on fracture care, rather than a holistic treatment program for this group of patients. This may reflect a failure to recognise the importance of secondary prevention in this group or may relate to limited resources resulting in physiotherapists being compelled to prioritise workloads in such a way that some patients do not receive potentially beneficial assessment and treatment. It would be of interest to further explore whether physiotherapists are cognisant of their potentially important role in secondary prevention of osteoporotic fracture. Better understanding of the rationale used for prioritisation of physiotherapy treatment, particularly in the public sector, and the longer term implications of the decisions made, would also be worthwhile.

Although overall the numbers in this study are relatively small, the participants and their management are likely to be typical of that in large teaching hospitals anywhere in Australia or New Zealand. However, caution would need to be applied in generalising the results from this study of those receiving treatment for their Colles fracture in the public hospital system to those receiving treatment elsewhere. Reference to Australian fracture incidence data suggests that younger individuals may be under-represented in our sample (Sanders et al 1999). A strength of the study is that by limiting the sample to those who fractured between 1999 and 2000, the results represent contemporary practice while allowing sufficient time for implementation of secondary prevention. Unfortunately only approximately half of the questionnaires were completed and returned, so knowledge about treatment outside the hospital system is incomplete. Moreover, there is no way of knowing whether patients may have been offered treatment but declined.

Our data support anecdotal impressions that many patients with Colles fracture are not receiving secondary prevention for osteoporotic fracture. Consequently they remain at unnecessarily elevated risk for subsequent osteoporotic fracture and the associated cost, morbidity, mortality and reduced quality of life. The development of a clinical pathway for use in fracture clinics may assist in improving this aspect of the management of patients with fracture from minimal trauma.

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References

American Geriatrics Society, British Geriatrics Society and American Academy of Orthopaedic Surgeons Panel on Falls Prevention (2001): Guideline for the prevention of falls in older persons. *Journal of the American Geriatrics Society* 49: 664-672.

Cooper C, Atkinson E, Fallon W and Melton L (1992): Incidence of clinically diagnosed vertebral fractures: A population-based study in Rochester, Minnesota, 1985-1989. *Journal of Bone and Mineral Research* 7: 221-227.

Cummings SR, Nevitt MC, Browner WS, Stone K, Fox KM, Ensrud KE, Cauley J, Black D and Vogt TM (1995): Risk factors for hip fracture in white women. Study of Osteoporotic Fractures Research Group. *New England Journal of Medicine* 332: 767-773.

Delmas PD (2002): Treatment of postmenopausal osteoporosis. *Lancet* 359: 2018-2026.

Earnshaw SA, Cawte SA, Worley A and Hosking DJ (1998): Colles fracture of the wrist as an indicator of underlying osteoporosis in postmenopausal women: a prospective study of bone mineral density and bone turnover rate. *Osteoporosis International* 8: 53-60.

Ettinger B, Black DM, Mitlak BH, Knickerbocker RK, Nickelsen T, Genant HK, Christiansen C, Delmas PD, Zanchetta JR, Stakkestad J, Gluer CC, Krueger K, Cohen FJ, Eckert S, Ensrud KE, Avioli LV, Lips P and Cummings SR (1999): Reduction of vertebral fracture risk in postmenopausal women with osteoporosis treated with raloxifene: results from a 3-year randomized clinical trial. Multiple Outcomes of Raloxifene Evaluation (MORE) Investigators. *JAMA* 282: 637-45.

Feder G, Cryer C, Donovan S and Carter Y (2000): Guidelines for the prevention of falls in people over 65. *BMJ* 321: 1007-1011.

Greenspan SL, Myers ER, Maitland LA, Resnick NM and Hayes WC (1994): Fall severity and bone mineral density as risk factors for hip fracture in ambulatory elderly. *JAMA* 271: 128-133.

Hajcsar EE, Hawker G and Bogoch ER (2000): Investigation and treatment of osteoporosis in patients with fragility fractures. *Canadian Medical Association Journal* 163: 819-822.

Hill K, Smith R, Murray K, Sims J, Gough J, Darzins P, Vrantsidis F and Clark R (2000): An analysis of research on preventing falls and falls injury in older people: community, residential aged care and acute care settings. Melbourne: National Ageing Research Institute.

Jones G, Nguyen T, Sambrook PN, Kelly PJ, Gilbert C and Eisman JA (1994): Symptomatic fracture incidence in elderly men and women: the Dubbo Osteoporosis Epidemiology Study (DOES). *Osteoporosis International* 4: 277-282.

Kanis JA (1994): Assessment of fracture risk and its application to screening for postmenopausal osteoporosis: synopsis of a WHO report. WHO Study Group. *Osteoporosis International* 4: 368-381.

Karpf DB, Shapiro DR, Seeman E, Ensrud KE, Johnston CC, Jr, Adami S, Harris ST, Santora AC, Hirsch LJ, Oppenheimer L and Thompson D (1997): Prevention of nonvertebral fractures by alendronate. A meta-analysis. *JAMA* 277: 1159-1164.

Kerr D, Ackland T, Maslen B, Morton A and Prince R (2001): Resistance training over 2 years increases bone mass in calcium-replete postmenopausal women. *Journal of Bone and Mineral Research* 16: 175-181.

Mallmin H, Ljunghall S, Persson I, Naessen T, Krusemo UB and Bergstrom R (1993): Fracture of the distal forearm as a forecaster of subsequent hip fracture: a population-based cohort study with 24 years of follow-up. *Calcified Tissue International* 52: 269-272.

Nguyen T, Sambrook P, Kelly P, Jones G, Lord S, Freund J and Eisman J (1993): Prediction of osteoporotic fractures by postural instability and bone density. *BMJ* 307: 1111-1115.

Randell A, Sambrook PN, Nguyen TV, Lapsley H, Jones G, Kelly PJ and Eisman JA (1995): Direct clinical and welfare costs of osteoporotic fractures in elderly men and women. *Osteoporosis International* 5: 427-432.

Recker RR, Davies KM, Dowd RM and Heaney RP (1999): The effect of low-dose continuous estrogen and progesterone therapy with calcium and vitamin D on bone in elderly women. A randomized, controlled trial. *Annals of Internal Medicine* 130: 897-904.

Reid IR (1998): The roles of calcium and vitamin D in the prevention of osteoporosis. *Endocrinology and Metabolism Clinics of North America* 27: 389-398.

Sanders KM, Seeman E, Ugoni AM, Pasco JA, Martin TJ, Skoric B, Nicholson GC and Kotowicz MA (1999): Age- and gender-specific rate of fractures in Australia: A population-based study. *Osteoporosis International* 10: 240-247.

Tinetti ME, Baker DI, McAvay G, Claus EB, Garrett P, Gottschalk M, Koch ML, Trainor K and Horwitz RI (1994): A multifactorial intervention to reduce the risk of falling among elderly people living in the community. *New England Journal of Medicine* 331: 821-827.

Torgerson DJ and Dolan P (1998): Prescribing by general practitioners after an osteoporotic fracture. *Annals of the Rheumatic Diseases* 57: 378-379.

Torgerson DJ and Kanis JA (1995): Cost-effectiveness of preventing hip fractures in the elderly population using vitamin D and calcium. *QJM* 88: 135-139.

Wolf SL, Barnhart HX, Kutner NG, McNeely E, Coogler C and Xu T (1996): Reducing frailty and falls in older persons: an investigation of Tai Chi and computerized balance training. Atlanta FICSIT Group. Frailty and Injuries: Cooperative Studies of Intervention Techniques. *Journal of the American Geriatrics Society* 44: 489-497.