Are patients receiving recommended bone protection therapy after a non-hip fracture? A retrospective study of the Fracture Liaison Service at Counties Manukau District Health Board

Ruveena Kaur, Sunita Paul, Elizabeth Prasad, Brandon Orr-Walker

ABSTRACT

AIM: To review the Fracture Liaison Service (FLS) recommendations for bone protection therapy and assess treatment implementation in the community.

METHOD: All patients screened from 1 January to 31 March 2019 at Counties Manukau District Health Board were evaluated. Exclusion criteria included death within six months following sentinel fracture, and hip fractures, which are studied elsewhere. Patient risk factors assessed included age, gender, type of fracture, history of previous fracture, and dual X-ray absorptiometry scan results if performed. If bone protection therapy was recommended, electronic dispensing records were utilised as a proxy for treatment initiation.

RESULTS: One hundred and sixty-nine of the 238 patients referred were included. Thirty-seven patients had evidence of a previous fragility fracture, with thirteen patients not on bone protection treatment following their prior fracture. Of the 99 patients in the study recommended bone protection therapy, 31.3% (n=31) did not have this dispensed at six months following written FLS assessment. Three of thirteen patients with a previous fragility fracture and not on bone protection treatment, still did not have this dispensed at six months.

CONCLUSION: A high proportion of patients recommended bone protection therapy did not receive this in a timely manner, including patients with a history of repeated fracture.

Fragility fracture due to underlying osteoporosis is a leading cause of morbidity and mortality in our ageing population. An estimated one in three women, and one in five men, will experience a fragility fracture in their lifetime. Bone mass and quality reduces from age thirty onwards, with a period of rapid decline in post-menopausal women as oestrogen is depleted, prior to returning to initial rates. Non-modifiable risk factors for fragility fracture include increasing age, female gender, early menopause, previous fragility fracture, and family history of fracture. Modifiable risk factors include low body weight, cigarette smoking, excess alcohol and sustained glucocorticoid use.

The purpose of a fracture liaison service (FLS) is to identify patients with a fracture, assess for osteoporosis, commence secondary prevention therapy, and if applicable, referral to a falls prevention program. A metanalyses demonstrated a doubling of one’s future risk of fracture upon initial fracture. FLS is a cost-effective, if not cost-saving, intervention at reducing risk of re-fracture, and is associated with a 3% absolute risk reduction in mortality compared to non-FLS controls (20% relative risk reduction in mortality).

In 2015, the FLS at Counties Manukau District Health Board (CMDHB) was formed. This service currently comprises two geriatricians (one of whom is the FLS lead clinician), one endocrinologist, a service manager, and an FLS coordinator. Referrals are received for patients with a fracture aged 50 and above, from the emergency department, inpatient nursing hand overs, fracture clinics, and radiology.

At CMDHB, the FLS assesses a patient’s mechanism of fracture, their risk factors, and may request a bone density scan to evaluate osteoporosis risk. If treatment is recommended, bisphosphonates are the first option, and are available in either oral or intravenous formulations. Where feasible, CMDHB aims to administer zoledronate during the inpatient hospital admission. Teriparatide and denosumab can be applied for via special authority, with the
former for interval fracture despite bisphosphonate treatment, and latter reserved for those with severe renal impairment contraindicating zoledronate use. All funded osteoporosis treatments, including those that require special authority, can be prescribed by any vocationally registered medical practitioner. The FLS assessment and treatment recommendation letter is posted to the patient and a copy sent to the general practitioner (GP). The prescription of bone protection medication is left with the GP and CMDHB currently does not have the capacity to administer zoledronate in an outpatient setting. The patient is generally not reviewed by a physician face-to-face, although recommendations may include for him/her to be seen by a specialist clinic.

This retrospective study aims to assess if osteoporosis treatment recommendation is implemented in the community. We aim for 90% of patients who are recommended pharmacological treatment to have this initiated, which is the gold standard set by the International Osteoporosis Foundation.9

Method

All patients referred for FLS assessment at Middlemore Hospital in Auckland, between 1 January 2019 and 31 March 2019, were reviewed. Patients were excluded if they died within 6 months of fracture or if the type of fracture was a hip fracture. Hip fracture outcomes are well documented in the Australia and New Zealand Hip Fracture Registry (ANZHFR), with this group of patients having a distinct focus addressing osteoporosis treatment.11 Ethics approval was obtained from the Research Office at CMDHB.

Patient information collected included age, gender, ethnicity, and height and weight to calculate the body mass index (BMI). Clinical notes were reviewed regarding the patient’s medical history, particularly a history of rheumatoid arthritis and/or other conditions suggestive of secondary osteoporosis. Glucocorticoid use, a history of previous fracture, smoking status, alcohol consumption and parental history of hip fracture, were all noted. If a patient had dual X-ray absorptiometry scan (DXA) performed the bone mineral density (BMD) at the femoral neck was noted, and together with the above variables, was used to complete the Fracture Risk Assessment Tool (FRAX) calculation.12 Fracture prevention treatment is indicated if the 10-year risk of fracture at the hip is ≥3% or ≥20% risk of a major osteoporotic fracture.12 Other information collected included the type of fracture, if bone protection therapy had been previously dispensed, and renal function. Clinic letters and discharge summaries were assessed if bone protection therapy was recommended or alternatively administered during an inpatient stay. All electronic dispensing data available within six months of FLS communication was reviewed as a surrogate of commencing treatment. Six months following FLS written recommendation was used as the end date for first prescription, as 50% of re-fractures occur in the first 6–8 months following initial fracture.10

Existing practice is for all patients who had a DXA performed to have an individualised letter outlining management recommendations. Where a DXA was deemed unnecessary because a patient had clinical features of osteoporosis (e.g., minimal trauma fracture in an elderly patient) or if they had a recent DXA demonstrating osteoporosis, generic advice to commence bone protection therapy would be completed.

The FLS coordinator aims to telephone all patients within six months of initial fracture. The purpose of this includes answering patient queries regarding osteoporosis and its management, assess if bone protection therapy was recommended, when it was commenced, and encourage adherence. If treatment recommendations were not instituted by their primary care provider, an additional telephone call is made to their GP.

Statistical analysis was performed by calculating mean and standard deviation for normally distributed data, and median and interquartile ranges otherwise. Comparisons were made by two-sample T-tests, Chi-squared and Fisher’s exact tests to assess for significance, defined as p<0.05.

Results

Two hundred and thirty-eight patients were reviewed by the FLS during this three-month study. Of these, 38 patients with a hip fracture were excluded. Of the remaining 200 patients, 31 were excluded due to 18 deaths (eight died during their hospital admission for fracture), nine were non-contactable, three declined FLS review, and one patient had two National Health Index (NHI) numbers, so was only included once. The final study consisted of 169 patients.

The mean age was 73.9±11.3 years (range 50–99), with the majority being female (78.1%). Sixty-four point seven percent of patients identified as European (n=110), 15 identified as Pasifika, and 11 identified as Māori.

Vertebral fracture was the most common fragility fracture occurring in 36.1% of patients. The
next most common fractures were of the forearm (22.5%), lower limb (19.5%), humerus (8.9%) and pelvis (5.2%). Three patients had multiple fractures. Ten patients had their fracture classified as “other”, including seven with a rib fracture, one with a clavicle fracture, and two patients with bisphosphonate related atypical femoral fractures.

One hundred and sixty-four of the patients referred had a height and weight recorded to calculate BMI, which ranged from 14.2–43.8 kg/m². Four of the five patients who were underweight (BMI <18.5 kg/m²) were recommended bisphosphonate therapy. Bone protection therapy was recommended in 75.9% of patients with a normal BMI (18.5–25 kg/m²), in 52.2% of those overweight (25.1–30 kg/m²), and in 44% of those with obesity (BMI >30 kg/m²).

Of the 127 patients who had DXA performed, average T score of the hip was -1.4 (±1.1SD) and at the spine was -0.97 (±1.6 SD). Fifty-two of the 127 patients referred for DXA were recommended osteoporosis prevention therapy. A 10-year FRAX score of the hip was reported in 51.2% (n=88) of patients, and 10.5% (n=18) also had their 10-year risk of major osteoporotic fracture reported.

Of the 169 patients, 21.9% (n=37) had a previous fragility fracture, with 13 not on any bone protection treatment following the sentinel fracture. Nine of these 13 patients who were not on therapy after a prior fracture had previously been reviewed by the CMDHB FLS. Of this, three had a previous neck of femur fracture (one patient received a single zoledronate infusion five years prior to their current fracture, without receiving further infusions as recommended), two patients had a previous wrist fracture, and four had a previous vertebral fracture. Of those already on treatment following a prior fracture, 13 were on oral bisphosphonates, nine had received zoledronate within 18 months of current fracture and two patients were on a drug holiday from bisphosphonate therapy.

Ninety-nine of the 169 patients were subsequently found to have osteoporosis (osteoporosis defined as a BMD score ≤2.5 standard deviations compared to a young adult mean of the same gender, or alternatively an elevated risk of fracture according to the FRAX algorithm), and all were recommended pharmacological bone protection therapy. Of this, 89 were recommended bisphosphonate therapy, eight were recommended Teriparatide and two were recommended denosumab. All 10 patients who were recommended either teriparatide or denosumab had previously been on bisphosphonate therapy (majority in the form of alendronate, three had zoledronate intravenously). Two of the patients recommended teriparatide had atypical femoral fractures thought to be bisphosphonate related.

Of the 89 patients recommended a bisphosphonate, 31 patients (34.8%) did not have this dispensed at six months. Thirty of the 31 patients had acceptable renal function for intravenous bisphosphonate therapy if this was preferred. One patient with an incidentally detected vertebral fracture and no prior fracture history, was recommended bisphosphonate therapy, but had declining renal function that prohibited its use. Two patients were known to the palliative care service at time of their index fracture but were still alive six months following.

Of the 31 patients who did not have their recommended bisphosphonate therapy prescribed, 13 had an earlier fragility fracture prior to the index fracture in this study, including three patients who were being assessed by the FLS service for the second time, and had been recommended treatment twice now. All patients who were recommended teriparatide or denosumab had this dispensed. Of the patients who received osteoporosis prevention medications, 55 of the 68 did so within a three-month period of FLS assessment.

A sub-analysis of the 99 patients recommended bone protection therapy was carried out comparing those who received this within six months of FLS communication to those who did not. Their baseline demographics showed no significant difference in age, gender, or ethnicity; nor was there a statistically significant difference between the two groups in terms of BMI, type of fracture, or previous fracture.

**Discussion**

The patients in this study were predominantly female and of NZ European ethnicity, which is the lead demographic population reviewed by other FLS centres nationally, as well as in the ANZHFR registry. In this study, 14% of patients identified as Māori or Pasifika; in the same year 4.4% of those in the ANZHFR 2020 registry identified as Māori/Pasifika in New Zealand. The increased prevalence of Pasifika patients in this cohort may reflect the demographics of the South Auckland population.

FLS assessment involves reviewing a patient’s risk of future fracture, and in some patients a DXA is required to stratify risk. In this study, 127 patients were referred for updated DXA assessment, with 52 recommended osteoporosis prevention therapy. While low weight is a known risk
Table 1: Baseline patient characteristics in those recommended bone protection therapy according to medication dispensing status.

<table>
<thead>
<tr>
<th></th>
<th>Yes (n=68)</th>
<th>No (n=31)</th>
<th>Total (n=99)</th>
<th>P-value</th>
</tr>
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<tr>
<td>Age; mean (SD)</td>
<td>77.7 (9.2)</td>
<td>78.6 (10.0)</td>
<td>78.0 (9.4)</td>
<td>0.66</td>
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<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
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<tr>
<td>Female</td>
<td>57 (67.1%)</td>
<td>28 (32.9%)</td>
<td>85 (85.9%)</td>
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<tr>
<td>Male</td>
<td>11 (78.6%)</td>
<td>3 (21.4%)</td>
<td>14 (14.1%)</td>
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<tr>
<td><strong>Ethnicity</strong></td>
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</tr>
<tr>
<td>European/NZE</td>
<td>48 (70.6%)</td>
<td>20 (30.3%)</td>
<td>68 (68.7%)</td>
<td>0.46*</td>
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<tr>
<td>Māori</td>
<td>4 (100%)</td>
<td>0 (0%)</td>
<td>4 (4.1%)</td>
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<tr>
<td>Pacific</td>
<td>5 (71.4%)</td>
<td>2 (28.6%)</td>
<td>7 (7.2%)</td>
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<tr>
<td>Asian</td>
<td>10 (55.6%)</td>
<td>8 (44.4%)</td>
<td>18 (18.6%)</td>
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</tr>
<tr>
<td>Other</td>
<td>1 (50%)</td>
<td>1 (50%)</td>
<td>2 (2.1%)</td>
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<tr>
<td>BMI; mean (SD)</td>
<td>25.5 (4.6)</td>
<td>25.4 (5.5)</td>
<td>25.5 (4.9)</td>
<td>0.93</td>
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<td><strong>Type of fracture</strong></td>
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<td>Vertebral</td>
<td>30 (68.2%)</td>
<td>14 (31.8%)</td>
<td>44 (44.4%)</td>
<td>0.21*</td>
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<td>Lower limb</td>
<td>15 (83.3%)</td>
<td>3 (16.7%)</td>
<td>18 (18.2%)</td>
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<tr>
<td>Forearm</td>
<td>8 (44.4%)</td>
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<td>18 (18.2%)</td>
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<tr>
<td>Humerus</td>
<td>6 (75%)</td>
<td>2 (25%)</td>
<td>8 (8.1%)</td>
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<td>Pelvis</td>
<td>5 (100%)</td>
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<tr>
<td>Other</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
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</table>

Chi-squared test or fisher exact test used (*), two sample t-test used for means.
factor for osteoporosis, a significant proportion of the overweight and obese patients had osteoporosis, at 52.5% and 44%, respectively, highlighting one cannot assume weight to be a protective factor in patients with a non-hip fracture.  

FRAX scores are used to characterise osteoporosis risk. This study found under-reporting of FRAX scores in the written correspondence (10-year FRAX score of the hip reported in only 51.2% of patients). This has been highlighted within the department and reporting of risk scores are encouraged to improve visibility of future fracture risk.  

This study found one in five patients with a current fracture, had already experienced a previous fracture (n=37; 21.9%). Thirteen of these patients were not on bone protection treatment, despite nine of them having been reviewed and recommended bisphoshonate therapy from the CMDHB FLS following a prior fracture. This highlights a chasm between FLS recommendation and implementation in the community, with the current fragility fracture being a potentially preventable one. The cost of this is not insignificant when considering the patient's physical pain, disability/impairment to their activities of daily living, additional time off work, reduced quality of life, and the strain placed on dependent family members. A repeat fracture also comes at a financial cost to the DHB in terms of further hospital admission, treatment for the current fracture, and ongoing follow-up. Unfortunately, this whole process has been repeated twice now for three patients in this study, whom after two virtual reviews by the CMDHB FLS, for two different fractures, still did not have their bone protection therapy dispensed at six months following their most recent FLS written recommendations.  

The subgroup of patients recommended bone protection therapy was reviewed to better understand the care gap observed between treatment recommendation and initiation. With the exclusion of the two palliative patients who might have a reasonable explanation for lack of medication uptake and the single patient with deteriorating renal function limiting bisphosphonate treatment, only 71.6% of patients recommended pharmacological prevention therapy received this at the six-month follow-up. This is below the 90% target of those recommended treatment receiving this. There was no statistically significant difference between those who did and did not have treatment dispensed based on gender, age, ethnicity, type of fracture, or previous fracture (Table 1). A key difference however was only those recommended bisphosphonate therapy had poor uptake. The current special-authority restrictions on denosumab prescription limits available options for those with first presentation fracture and reduced renal function, as affected 1 patient in this study. On closer review, the patients who were prescribed teriparatide (n=8) or denosumab (n=2) had been on bisphosphonate therapy for a previous fracture. This signified a higher risk group and may explain the increased treatment uptake, as patients and clinicians may be more motivated (i.e., a form of treatment bias).  

The lack of a specific patient-related factor for poor treatment uptake suggests the intervention implemented needs to be a global one. Ganda et al. proposed four ways of classifying FLS programs. The CMDHB program is classified as Type B, where assessment and advice are provided by FLS, but the prescribing and treatment implementation is carried out by the primary care provider. A Type A program would perform the whole process including prescription, but this would require additional costs for the DHB such as physician time to discuss recommendations with the patient, administrative support staff, and a physical clinic space.  

The CMDHB FLS program was compared with its two neighbouring DHBs in the Auckland Region. At Auckland DHB, the FLS nurse reviews inpatients with fractures and compiles a list of patients with vertebral fracture from an electronic search of computerised tomography (CT) reports. If a specialist review is required, the patient has a DXA scan, endocrinologist assessment, and can have zoledronate administered on the same day, as a “one stop shop”. At Waitematā DHB (WDHB), DXA is outsourced, and the virtual FLS assessment and treatment recommendation is sent via written communication to both patient and GP. If zoledronate is indicated, WDHB recommends this be administered in the GP setting, but does have the capacity to administer it at their outpatient day stay. On reviewing the FLS programs delivered within the greater Auckland Region compared to the funding received for the CMDHB FLS program, aiming for a Type A program is currently too costly to implement. The DHBs in New Zealand are also in the process of national restructuring and this may lead to further changes in FLS delivery. The most realistic intervention at present relies on one that assimilates into the current Type B program.  

As a result of this study, a review of the FLS process at Middlemore was undertaken amongst all
members of the service. The agreed intervention was to bring forward the current follow-up phone call from the FLS coordinator to patients, from within six months to within a 16-week period, following fracture. This time frame was agreed based on most patients who filled in prescriptions, did so within the first three months of fracture (80.1%). This may improve motivation and uptake of preventive therapy as the effect of fracture are more recent and potentially more memorable. Earlier contact with the patient would allow queries regarding osteoporosis and its treatment to be answered, alongside the reminder phone call to the patient's GP to occur. The CMDHB FLS team have since recruited a second FLS coordinator to help manage the anticipated increased workload from implementing this intervention.

Limitations of this study include reliance on electronic medication dispensing records as a surrogate for prescription. In reality, other factors could play a role, including the patient not wanting to take medication (e.g., not understanding the secondary prevention role, concern of side effects, etc.) or simply not filling in a script that was provided. Reviewing the patient's socio-economic status and/or highest education attainment may help in understanding these factors; however, we did not have this level of detail available for all patients. Another limitation of this study was that hip fractures were excluded. We specifically wanted to assess non-hip fractures as this is the “second tier” in the Osteoporosis New Zealand Strategic Plan, but by doing so we have excluded a major osteoporotic fracture type\(^1\). The final limitation is that referral to a falls prevention clinic, a key part of FLS recommendations, was not audited.

In conclusion, pharmacological therapy to prevent further fracture was below the international gold standard guidelines for non-hip fracture patients at CMDHB. An early follow-up call from the FLS coordinator to the patient within 16 weeks of FLS written recommendation has been implemented. Within the department, reporting FRAX scores in all written communication sent to patients and their primary care providers has been recommended, which may lead to improved understanding of the concept of “fracture begets fracture”, in this high-risk cohort. A repeat audit performed at a later stage to assess the success of the intervention is recommended.
COMPETING INTERESTS
Nil.

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