IMJ
Official Journal of the Irish Medical Organisation

Ir Med J; September 2024; Vol 117; No. 8; P1008
September 26th, 2024

The Stable Acute Vertebral (SAVe) compression fracture study

P. McCarroll[1], M. Alhazmi[1], M. Kostka[1], S. Mooya[1]. P. Coughlan[1], M. Curtin[1], L. Smith[1], C. Byrne[2], A. Ryan[2], F. Rowan[1], M. Cleary[1,3]

1. Department of Trauma & Orthopaedics, University Hospital Waterford, Dunmore road, Waterford, Ireland.
2. Department of Radiology, University Hospital Waterford, Dunmore road, Waterford, Ireland.
3. University College Cork, College Rd., Co. Cork, Ireland.

Aim

The primary objective of this study was to retrospectively analyse patient records during a 4-month period to identify the burden of care of vertebral compression fractures in the hospital.

Methods

This was a retrospective cohort study of patients referred for vertebral compression fractures from 1st of June, 2020 to 30th of September 2020 who were recorded and analysed in a model 4 hospital.

Results

Data from 63 patients were analysed for up to 120 days after referral. Patients were mostly elderly (mean age 75 years). 73% had visited the Emergency Department (ED) on a single occasion. 17.5% attended ED on 2 occasions. with10% attending more than twice over a 120-day period. 54% were admitted to hospital. The total number of bed days was 610, with an average length of stay (LOS) of 9.83 days. 16% of patients were readmitted to hospital due to a VCF related complaint within 120 days.

Discussion

Osteoporotic Vertebral Compression Fractures (VCF) in an aging population are increasingly common. Over a 14 year period, there has been an increase of 170% in hospitalisations for patients with VCF, with a corresponding increase of 364% inpatient bed days in acute care This study critically evaluated the management of VCF at a Model 4 hospital against the backdrop of an aging Irish population and a concomitant rise in VCF incidence. Our results illustrate the impact of current VCF management on healthcare burden and highlight the pressing need to proactively reshape our approach for managing VCF in the setting of an aging population.

IMJ
Official Journal of the Irish Medical Organisation

Ir Med J; September 2024; Vol 117; No. 8; P1018
September 26th, 2024

Introduction

Osteoporotic Vertebral Compression Fractures (VCF) are of increasing concern to our healthcare service, given the prevalence of the aging Irish population. In Ireland, we have seen some emerging trends in vertebral compression fractures and fragility fractures[1,2]. Over a 14 year period there was an increase of 170% in hospitalisations for all patients with VCF, which equated to a 364% increase in the number of patient bed days in acute care. It is estimated that by 2046, hospitalisation for all osteoporotic fractures will increase 150% with an additional increase in spending to over 300 million euro. Over 150 million euro of this spend is attributable to VCF.

The VCF cohort that require hospitalisation on average spend 10 days in acute care, have the highest hospital readmission rates of all fragility fractures; and have significantly increased rates of pneumonia, DVTs, and pressure ulcers; with a high mortality rate of 20-27%[3,4]. In University Hospital Waterford (UHW) over 300 patients presented with a diagnosis of VCF attend the hospital annually. The management of these patients varies, and a consensus has not yet been reached in the international literature regarding the optimal management of this condition Clinicians, have to date, relied on individual judgement and management decisions have been made on a case-by-case basis[5].

Our study hypothesizes that the current management practices of VCFs in UHW, leads to varied resource requirement at our institution. The primary objective of this study was to analyse patient records during a 4-month period to identify the burden of care for vertebral compression fractures in the hospital. Specific outcome metrics, such as emergency department visits, admission rates, length of stay outpatient follow-up and readmission rates were assessed**.** Given the ageing population and emerging trends that our health system is unprepared for the 'wave of silver trauma' that is forecast, this study may enable us to better plan future healthcare and optimise management strategies to improve patient outcomes and reduce costs.

Methods

This was a single-centre retrospective cohort study of all patients diagnosed with a stable VCF referred to the Orthopaedic Department University Hospital Waterford (UHW), Waterford, Ireland. UHW is a Model 4 tertiary referral hospital which serves a catchment area with a population of 500,000 . This study was carried out as part of a large quality improvement initiative.

Referrals are received from three surrounding model 3 hospitals St. Luke's General Hospital , South Tipperary General Hospital, Wexford General Hospital, UHW Emergency Department, inpatient services, and general practitioners in the South East catchment area.
The Hospital In-Patient Enquiry System (HIPE) is a computer-based medical administrative system designed to collect demographic, clinical, and administrative data on hospital discharge and death from acute hospitals in the Republic of Ireland. This provided data on the OPD follow-up for these patients. Data was collected using HIPE conjunction with electronic referral records in the orthopaedic department. Dates included were from June 1st, 2020 to September 30th, 2020. This included patient demographics, attendance and reattendance to the emergency department, and length of stay. Orthogeriatric blood workup for osteoporosis was assessed through manual data extraction from patient notes.

Patients were eligible and included in the study if they presented with a VCF of the cervical, thoracic, or lumbar spine. A fracture caused by a fall from a standing height or excessive loading on the spine like lifting or with no trauma is considered a VCF which has been described previously, and the fracture was noted by visual inspection of the images by the orthopaedic team on-call, clinical assessment, and confirmed radiology reports from spinal X-rays, Computed Tomography (CTs), and/or Magnetic Resonance Imaging (MRIs)[3]. Stable as defined by Denis classification / TLICS score[6,7].

Patients were excluded if they were aged <50 years, polytraumatized, had acute neurological deficits, features on clinical examination suggestive of myelopathy, or an oncological process that could account for pathological fractures, fractures in patients with diffuse idiopathic skeletal hyperostosis, and fractures in ankylosed segments and adjacent to them.

The chronicity of the fracture was determined at the time of referral based on previous imaging and clinical findings from the referring centre. Affected levels were determined both clinically and radiologically at the time of referral.

The length of stay was defined as the date of admission to the date of discharge. The date of admission was admission to an orthopaedic ward form the emergency department. A bed day was defined as an inpatient bed in which the patient stayed overnight. The total number of bed days was the sum of all recorded bed days throughout the study period. Descriptive statistics were performed using the GraphPad software (PRISM). Between-group analysis was conducted using the independent t-test ($p < 0.05$, 95% CI) and chi-square test ($p < 0.05$).

Results

A total of 63 patients were included in the study over 4 months (*Table 1*). Two cohorts of patients were identified presenting with VCF : those admitted to the hospital (Group 1) and those managed without admission (Group 2).

ED Attendances and Reattendances

A total of 87 ED visits were recorded over a 4 month period. 73% (n=46) of the patients visited the ED only once. In total, 17.5% (n=11) of the patients had visited the ED twice. 10% (n=6) of the patients presented more than twice over a 120-day period. The average number of ED attendances was similar between the groups, with both groups having a mean of 1.38 (group 1 (SD ± 0.70), group 2 (SD ± 0.78)). The comparison of the mean number of ED reattendances due to VCF showed no significant difference (p=0.820).

Hospital Admissions and Readmissions

34 patients (54%) required hospital admission following their ED visit, whereas 29 patients (46%) were managed without inpatient care. Readmission rates were low, with the majority of the cohort (84.1%, n=53) not experiencing any readmissions. Eight patients (12.7%) had one readmission, and two patients (3.2%) were readmitted twice.

Length of Stay and Total Bed Days

The length of hospital stay varied significantly among the admitted patients, with a mean LOS of 9.84 days and a wide range from 0 to 76 days. The total number of bed days accumulated by the cohort was 610, reflecting the substantial impact of osteoporotic VCFs on health care resources. Follow-up OPD are presented in (*Table 2*). 62% (n=39) did not have any orthopaedic OPD follow-up.

Age and Gender Distribution

Patients were elderly with a mean age 75 years, and the majority being female (81%, n=52). Group 1 consisted of 34 patients, with a mean age of 78 years (SD ± 8.10). Group 2 included 29 patients, with a mean age of 73 years (SD ± 12.93). There was no statistically significant difference in the mean age between the groups (p=0.065). The gender distribution across both cohorts was similar, and a chi-square test confirmed no significant difference in distribution (p=0.988).

Chronicity of fracture

57% of our cohort (n=36) was diagnosed with acute VCF. Our study found a higher number of acute VCF cases in group 1, with 21 acute and 13 chronic cases. Group 2 displayed a more balanced distribution between acute[15] and chronic[14] cases. However, the Chi-square test revealed no significant difference in the distribution of acute versus chronic conditions between groups (p=0.584).

33% (n=21) had fractures at multiple spinal levels. Analysis of the number of vertebral levels affected revealed a mean of approximately 1.44 levels for group 1 (SD = 0.93) and a slightly higher mean of 1.55 levels (SD +/-1.02) for group 2. No statistically significant difference was found in the number of levels affected between groups (p=0.654).

Orthogeriatric blood workup

30% (n=19) of the patients had appropriate orthogeriatric blood performed at the time of referral, and 60% (n=38) did not have any orthogeriatric blood. This indicates that a low number of patients are being treated for their underlying conditions.

Discussion

Over a 4 month period, this study demonstrated varied resource requirements within the hospital for patients with VCFs, as evident in the significant range in LOS and the differences in the management of acute care and follow-up. This is consistent with the hypothesis that current management practices for VCFs at UHW lead to varied resource requirements. 610 bed days were recorded in the cohort, 54% required hospital admission, reflecting a significant impact on healthcare resources. Given the emerging trends, with a 170% increase in hospitalisations with VCFs, a resultant 364% increase in the number of patient bed days in acute care over a 14 year period and further estimated increase in admission rates for all osteoporotic fractures of 150% over the next 20 years; VCF will account for >50% of this, with a significant increase in projected costs[1,8]. The importance of appropriate healthcare planning for this increased burden of care in this patient cohort is self-evident.

Our cohort is similar to those described in the literature, the hospitalised cohort spend on average 10 days in hospital, are multi morbid with a 26.9% one year mortality rate[9]. These patients had the highest rate of readmission of all osteoporotic fractures; on average, they consulted their doctor 14 times more than matched controls[9,10]. 15% of our cohort required readmission, with 35% having repeat emergency department visits and vertebral compression fracture-related complaints. This provides a substantial burden of care for both emergency and inpatient services. The majority of literature states that readmission rates are generally due to poor mobility and pain control, but these patients, even when admitted, generally leave the hospital with poorly controlled pain[3]. This would question the benefit of these patients being admitted, and it has been shown that this elderly cohort will rehab better in a community environment[11]. The shift to community care in this patient cohort may benefit both patients and reduce the burden of acute-care services.

Our cohort had a mix of acute (57%) and chronic fractures with no significant difference in the distribution of these conditions between the groups. 33% had fractures at multiple spinal levels. Based on this data, we hypothesised that chronic fractures and patients with multiple levels of fractures have a potential missed opportunity for secondary prevention at the presentation of the first fracture. Up to 2/3 of patients with VCF have fallen twice or more in the previous year[3]. Hirstch et al, have described a significant lag time to diagnosis of VCF of 4 to 6 weeks with 2/3 of these fractures being missed at initial presentation[12]. Only 30% of patients in our study were being adequately worked up for osteoporosis. This is echoed

throughout the international literature, with only approximately 1/3 of patients being appropriately treated with bone protection post-VCF[10,13]. This missed secondary prevention may contribute to the high burden of care and presentation of patients with chronic VCF.

This study has highlighted various management principles and resource requirements locally, which is also prevalent in the literature[5]. We acknowledge the limitations of this study, including the small sample size, short duration of follow-up, and retrospective observational design. Our results, in combination with the concerning trends and possible waves of silver trauma expected to hit Ireland over the next 20 years, have raised the need for prompt action to be taken to optimise services and care for this complex patient cohort. Hip fracture care has significantly improved in recent times, and improvements have been made using a clinical care pathway. By utilising the model of care observed in hip fracture patients, the aim of our future research is to develop a pathway for VCF that shifts the treatment of this complex patient cohort to community-based multidisciplinary care. This pathway would be developed to attempt to decrease admission and readmission rates, length of stay, the need for outpatient follow-up, optimise fall prevention, bone health, and minimise future fracture risk.

This study critically evaluated the management of VCF at UHW against the backdrop of a rapidly aging Irish population and concomitant rise in VCF incidence and resultant healthcare burden. Our research confirms the hypothesis that current management practices for VCF at UHW lead to varied resource requirements, with implications for patient outcomes and health care costs. Specifically, 54% of the patients in our study required inpatient care, with a marked range in hospital stay length, underscoring the need for optimised management strategies that could potentially streamline resource allocation.

Our results resonate with the pressing need to proactively reshape our approach for managing VCF. With the anticipated "wave of silver trauma", our healthcare system must pivot towards more proactive, preventive, and patient-centred care. Drawing inspiration from improved clinical pathways in hip fracture management, our next objective is to pioneer a clinical care pathway for VCF that emphasizes community-based multidisciplinary care. It is through such endeavours that we can hope to meet the complex needs of our aging population, improve the quality of life for our patients, and create a more sustainable healthcare model in the face of a looming surge in VCF.

Declarations of Conflicts of Interest:
None declared.

Corresponding author:
Paul McCarroll,

Official Journal of the Irish Medical Organisation

Ir Med J; September 2024; Vol 117; No. 8; P1018
September 26th, 2024

Department of Trauma & Orthopaedics,
University Hospital Waterford,
Dunmore Rd.,
Co. Waterford,
Ireland.
E-Mail: paulmccarroll@rcsi.ie

References:

1. Kelly M, McGowan B, McKenna M, Bennett K, Carey J, Whelan B, et al. Emerging trends in hospitalisation for fragility fractures in Ireland. Irish Journal of Medical Science (1971-). 2018:1-8.
2. Svedbom A, Hernlund E, Ivergard M, Compston J, Cooper C, Stenmark J, et al. Osteoporosis in the European Union: a compendium of country-specific reports. Archives of osteoporosis. 2013;8:137.
3. Ong T, Sahota O, Gladman J. The Nottingham Spinal Health (NoSH) Study: a cohort study of patients hospitalised with vertebral fragility fractures. Osteoporosis International. 2019:1-8.
4. Ong T, Kantachuvesiri P, Sahota O, Gladman JR. Characteristics and outcomes of hospitalised patients with vertebral fragility fractures: a systematic review. Age and ageing. 2018;47(1):17-25.
5. Parreira PC, Maher CG, Megale RZ, March L, Ferreira ML. An overview of clinical guidelines for the management of vertebral compression fracture: a systematic review. The Spine Journal. 2017;17(12):1932-8.
6. Wood KB, Khanna G, Vaccaro AR, Arnold PM, Harris MB, Mehbod AA. Assessment of two thoracolumbar fracture classification systems as used by multiple surgeons. JBJS. 2005;87(7):1423-9.
7. Joaquim AF, de Almeida Bastos DC, Jorge Torres HH, Patel AA. Thoracolumbar injury classification and injury severity score system: a literature review of its safety. Global spine journal. 2016;6(1):80-5.
8. McGowan B, Casey M, Silke C, Whelan B, Bennett K. Hospitalisations for fracture and associated costs between 2000 and 2009 in Ireland: a trend analysis. Osteoporosis international. 2013;24(3):849-57.
9. Ong T, Kantachuvesiri P, Sahota O, Gladman JRF. Characteristics and outcomes of hospitalised patients with vertebral fragility fractures: a systematic review. Age and ageing. 2017;47(1):17-25.
10. Megale RZ, Pollack A, Britt H, Latimer J, Naganathan V, McLachlan AJ, et al. Management of vertebral compression fracture in general practice: BEACH program. PloS one. 2017;12(5).

11. Schroeder HS, Israeli A, Liebergall M, Or O, Abu Ahmed W, Paltiel O, et al. Home Versus Hospital Rehabilitation of Older Adults Following Hip Fracture Yields Similar Patient-Reported Outcome Measures. INQUIRY: The Journal of Health Care Organization, Provision, and Financing. 2024;61:00469580241230293.
12. Hirsch JA, Beall DP, Chambers MR, Andreshak TG, Brook AL, Bruel BM, et al. Management of vertebral fragility fractures: a clinical care pathway developed by a multispecialty panel using the RAND/UCLA Appropriateness Method. The Spine Journal. 2018;18(11):2152-61.
13. Ferreira ML, March L. Vertebral fragility fractures–How to treat them? Best Practice & Research Clinical Rheumatology. 2019.

List of Tables

Table 1: Demographics, hospital admissions and Orthogeriatric workup

	Participants (n = 63)
Category	**n (%) <average>**
Sex	
Female	51 (81%)
Male	12 (19%)
Age (years)	
Mean	75
≥ 80 years old	26 (41.2%)
65–79 year old	28 (44.4%)
< 65 years old	9 (14.2%)
Number of ED visits	
Total, (average)	87 <1.38>
One visit	46 (73%)
Two visits	11 (17.5%)
Three visits	5 (7.93%)
Four visits	1 (1.58%)
Admissions	
Yes	34 (54%)
No	29 (46%)
Number of admissions	
One admission	24 (38%)
Two admissions	8 (12.7%)
Three admissions	2 (3.17%)
Total	24 + (8*2) + (2*3) = 46
Readmission due to VCF related complaint	
Yes	10 (16%)
No	53 (84%)
Length of Stay (LOS) in days	
Total	610 <9.84>
Ortho-geriatrics work-up	
Done	19 (30%)
Not done	38 (60%)

Table 2: Outpatients department (OPD) follow up during the 4 months period.

	Participants (n = 63)
Category	**n (%)**
Follow-up visits	
Yes	24 (38%)
One OPD visits	7 (11%)
Two OPD visits	12 (19%)
Three OPD visits	2 (3%)
Four OPD visits	3 (5%)
No	39 (62%)