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VA-Based Survey of Osteoporosis Management in Spinal Cord Injury

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Supplementary Data

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Abstract

Objective—Although osteoporosis is common following spinal cord injury (SCI), no guidelines exist for its treatment, diagnosis, or prevention. The authors hypothesized that wide variations in diagnosis and treatment practices result from the absence of guidelines. This study sought to characterize the diagnosis and management practices within the VA health care system for osteoporosis following SCI.

Design—Online survey regarding osteoporosis management in SCI composed of 27 questions designed to gather information on responder demographics, osteoporosis diagnostics, and treatment options.

Setting—VA health care system.

Participants—VHA National SCI Staff Physicians and VHA National SCI Nurses (total n = 450) were sent an email with an invitation to participate.

Intervention—Not applicable.

Main Outcome Measures—Practice patterns were assessed, including factors associated with ordering a clinical workup and prescribing osteoporosis treatment.

Results—The response rate was 28%. Ninety-two prescribing practitioners (physicians, nurse practitioners, and physician assistants) were included in the analysis. Of these respondents, 50 (54%) prescribe medications for SCI-induced bone loss; 39 (42%) prescribe bisphosphonates and 46 (50%) prescribe vitamin D. There were 54 (59%) respondents who routinely order diagnostic tests, including dual energy x-ray absorptiometry scans in 50 (54%). Variations in practice were not explained by age, gender, or years practicing SCI medicine. Many respondents (23%) reported barriers to osteoporosis testing including lack of scanning protocols, cost, wheelchair inaccessibility of scanning facilities, and lack of effective treatment guidelines once osteoporosis is diagnosed.

Conclusions—Despite an absence of screening and treatment guidelines, more than half of all respondents are actively diagnosing and treating osteoporosis with bisphosphonates within the VA health care setting. These data suggest that evidence-based practice guidelines are necessary to reduce practice variations and improve clinical care for this population.

Introduction

Osteoporosis is most commonly identified as a disease of postmenopausal women; however it is also a source of morbidity in individuals who experience immobility [1,2]. The magnitude of bone mass lost in the lower limbs following acute spinal cord injury (SCI) is substantial; this is a repeated finding in both cross-sectional and prospective studies [2-7]. Prospective studies suggest individuals with SCI can lose up to 40% of their bone mass at lower limb sites in the acute postinjury stages [6,8-11].

Bone loss after SCI predisposes these individuals to low-impact fractures (those occurring spontaneously or from a transfer from bed to chair). People with SCI tend to experience fragility fractures at younger ages than does the general population, and the most common fracture sites are those around the knee (ie, distal femur, proximal tibia) [12-15]. Fragility fractures in individuals with SCI have been reported to occur during events that would not normally cause fracture, such as a transfer from bed to chair [14-17]. The fracture prevalence in the SCI population has been reported to be as great as 70% [13,17]. The authors recently reported that

veterans with motor complete SCI are 3.7 times more likely to be hospitalized for low-impact fracture treatment than are those with incomplete injuries [14]. The median hospital length of stay was 7 times longer for fracture treatment than for all non-fracture-related SCI admissions within the VA system. Complications associated with these fractures are common and include delayed union, malunion or nonunion, pressure sores, gangrene, and osteomyelitis [14-16, 18]. Despite the clinical significance of these fractures post-SCI, there is no standard of care for the detection, prevention, or treatment of SCI-related osteoporosis and a lack of evidence supporting medication use to reduce fracture rates after SCI.

In the absence of treatment guidelines or a standard of care, wide treatment variations can occur. In this study, the authors used a Web-based questionnaire to survey current osteoporosis treatment practices, among physicians within the VA medical system, for individuals with SCI. They hypothesized that osteoporosis is commonly treated by SCI practitioners but that there would be wide variations in the imaging used to diagnose osteoporosis, the criteria for initiation of treatment, and the therapeutic agents prescribed.

Methods

Participants

VA providers involved in ordering tests to assess and treat osteoporosis and caring for persons with SCI were included in an online survey. All persons listed in the e-mail list for the VHA National SCI Staff Physicians and VHA National SCI Nurses (total N = 450) were included. The study was approved by the institutional review boards.

Survey

An e-mail invitation with a link to a brief online survey was sent to all individuals on the distribution list for the VHA in November 2007. Respondents were informed that responses were anonymous and would be used in the development of practice guidelines. A second email was sent 2 weeks later. The structured survey was developed via consensus between clinicians and researchers with expertise in osteoporosis and SCI and was pilot tested for readability and validity on a small sample of clinicians with a time to completion of approximately 5 minutes or less. The survey (available in the online version of the article at www.pmrjournal.org) was composed of 26 questions in total. Eighteen were multiple choice questions (11 with an open ended option), 7 were yes-no questions, and 1 was open-ended. Of these, 6 were related to respondent demographics, 6 were related to osteoporosis diagnosis, 11 were regarding treatment options, and 3 were related to the clinical impact of fractures.

Statistical Analysis

Descriptive statistics were used to describe the demographic characteristics, practice duration, and expertise of the respondents and are presented as mean (standard deviation [SD]) for continuous variables or count (percent) for categorical variables. Logistic regression (Proc Logistic; SAS, Cary, North Carolina) was used to examine factors associated with ordering a clinical workup and providing treatment for osteoporosis.

Results

Response Rate and Responder Characteristics

Respondent demographics are detailed in Table 1. There were 128 respondents (28%), and of these there were 52 who were physicians (MD/DO), 24 who were nurse practitioners (NP), and 16 who were physician assistants (PA). The others were registered nurses (RN) or other nursing department personnel (n = 34) and 2 respondents had doctorates. Among the 92 respondents included in the analyses, 42 were male (46%), 49 (53%) had been in practice for

longer than 20 years, and the vast majority (96%) said that a VA Medical Center best represented their practice environment. Forty respondents practice SCI medicine in the outpatient setting, 2 practice exclusively in the inpatient setting, and 41 practice in both the outpatient and inpatient setting. Age was available in 91 persons (50.9 ± 8.5 years), and the 1 person without a stated age was assigned the mean value in subsequent analyses.

Current Practices in Osteoporosis Screening in SCI

There were 54 practitioners (59%) who ordered a clinical workup to evaluate for SCI-induced bone loss; 39% ($n = 36$) reported ordering tests in the outpatient setting and 33% ($n = 30$) reported ordering tests after a fracture. Tests ordered included blood levels of parathyroid hormone, calcium, or vitamin D ($n = 27$, 29%); dual energy x-ray absorptiometry (DEXA) scanning ($n = 50$, 54%); testosterone levels ($n = 5$, 5%); and plain radiographs ($n = 6$, 7%). Among those who use DEXA to screen for osteoporosis, 41 practitioners reported scanning the hip and lumbar spine, 8 practitioners scanned the knee, 4 scanned the wrist, and 2 obtained either total body or regional long bone scans. Twenty-one persons (23%) described barriers to routine testing for osteoporosis in their practice. Barriers included lack of SCI-specific scanning protocols, cost, inaccessible DEXA scanning tables and rooms, inability of patients with flexion contractures to lie flat on the scanning table, time needed to schedule a DEXA scan, and lack of effective treatment guidelines once osteoporosis is diagnosed.

Current Practices in Osteoporosis Treatment in SCI

Routine prescription of medication for SCI-induced bone loss was reported by 50 practitioners (54%) and 72 (78%) reported routinely prescribing one or more rehabilitation therapies to prevent or treat bone loss (summarized in Table 2). For rehabilitation therapies, weight-bearing exercises and standing frames were the most commonly prescribed. The most commonly reported medication prescription was calcium followed by vitamin D and bisphosphonates. Alendronate was the most commonly prescribed bisphosphonate ($n = 39$) and 2 of these respondents also prescribed either etidronate or pamidronate. Of those prescribing medication, 80% ($n = 39$) do so in the outpatient phase of rehabilitation, with 6% ($n = 3$) prescribing during inpatient rehabilitation and 14% ($n = 7$) prescribing during either inpatient or outpatient rehabilitation.

The principal reason provided for not prescribing medication for osteoporosis in individuals with SCI was a lack of evidence-based guidelines, reported by 33 (36%) of respondents. Other reasons included concern about drug toxicity in 3 (3%) or thinking it was not important 1 (1%). In a free text field regarding medication use, comments included that a primary care provider handled this, they had not considered it, and there was no evidence of effectiveness for osteoporosis medication. Drug toxicity or intolerance was the leading reason stated for discontinuation of medication ($n = 45$, 49%). Other reasons included stabilization of bone density ($n = 5$, 5%), development of kidney stones, lack of effect, and poor patient adherence.

Predictors of Treatment Practices

Age, gender, duration of medical practice, clinical qualifications (MD/DO compared with NP/PA), and percentage of time caring for persons with SCI were examined as predictors of treatment practices for SCI-induced osteoporosis. No significant relationships were found between these variables and clinical practice. Specifically, whether a clinical workup was ordered was not related to age of the respondent ($P = .95$), gender ($P = .26$), duration of medical practice (>20 years versus ≤ 10 years, $P = .69$), MD/DO compared with NP/PA ($P = .29$), or percentage of time caring for persons with SCI ($>75\%$ compared with $<10\%$, $P = .43$), with similar results for whether a DEXA scan was ordered ($P = .25-.99$). Additionally, whether medication was prescribed for SCI-induced bone loss was also not related to age of the respondent ($P = .73$), gender ($P = .73$), duration of medical practice (>20 versus ≤ 10 years,

$P = .63$), MD/DO compared with NP/PA ($P = .59$), or percentage of time caring for persons with SCI ($>75\%$ compared with $<10\%$, $P = .43$). Age, gender, and duration of medical practice were not related to whether bisphosphonates ($P = .45-.98$), calcium ($P = .21-.85$), or vitamin D ($P = .27-.68$) was given.

Fracture Complications

Seventy-three practitioners (79%) indicated that they had treated SCI patients with osteoporotic fractures that occurred after initial SCI. The majority of respondents ($n = 72$) reported treating between 1 and 10 fractures in the prior 12 months. Fracture complications were common (Table 3), and the most frequently reported complications were pressure ulcer formation from casting or immobilization, nonunion of the fracture site after 1 year, and autonomic dysreflexia due to fracture.

Discussion

The current report is the first to describe the diversity of clinical practices pertaining to the diagnosis and treatment of SCI-induced osteoporosis among SCI providers in the VA medical system. Despite the fact that no treatment guidelines exist to dictate standard of care, more than half of the respondents in the current study routinely order tests to diagnose and medications and/or therapies to treat osteoporosis in patients with SCI. Clinical practice was not related to practitioner age, gender, duration of medical practice, clinical qualifications (MD/DO compared with NP/PA), and percentage of time caring for persons with SCI.

Results indicate that within the VA health care system, SCI-induced osteoporosis is managed predominantly in the outpatient setting. The majority of diagnostic tests that are ordered and medications prescribed are done so after discharge from acute rehabilitation. Half of all respondents reported ordering DEXA scans for bone mineral density (BMD) testing. While DEXA scanning is common among responding clinicians within the VA health care system, the majority of scans ordered do not include skeletal sites clinically relevant to SCI (distal femoral metaphysis or proximal tibial metaphysis) and there are no established clinical protocols for scanning these sites. A BMD at the knee of 0.6 g/cm^2 has been suggested by Garland et al [2] as the bone fracture threshold in SCI. However, fracture risk based on BMD has not been clearly defined in this population, and the extent of longitudinal bone loss over time following SCI is not known. Furthermore, outside of the research setting, DEXA scanning protocols for the knee are not widely available.

Half of all respondents routinely prescribe calcium and vitamin D. Nearly as many practitioners prescribe alendronate. In a recent study of chronic SCI, alendronate 70 mg weekly was shown to prevent total body and hip bone loss at 1-year postinjury [19]. Similarly, a 2-year course of daily alendronate (10 mg) prevented ongoing bone loss at the distal tibia following SCI [20]. However, there are no data on the effect of alendronate treatment on knee BMD or knee fracture rates in the long term in patients with SCI. There is an increased prevalence of vitamin D deficiency in SCI, and this may exacerbate bone loss [21]. Yet, treatment guidelines for vitamin D surveillance and replacement are also lacking.

A majority of respondents prescribe either weight-bearing exercises or standing frames. Based on the available literature, weight-bearing exercises, including standing frames, are not effective at restoring low BMD after SCI [22,23]. However, previous studies examining weight-bearing interventions were limited by few subjects and BMD assessment of skeletal sites not relevant to SCI. SCI-induced bone loss is rapid and severe, leading to 40% loss of sublesional BMD within the first 2 years following motor complete injury [24]. Multicenter prospective intervention trials are needed to evaluate the efficacy of weight bearing exercise in the prevention of SCI-induced osteoporosis.

A majority of practitioners have treated osteoporotic fractures associated with secondary medical complications ranging from pain to amputation secondary to nonhealing pressure ulcers. The high rate of ordered diagnostic tests and prescribed medications/therapies may reflect this experience and the perceived clinical importance of SCI-induced osteoporosis since it is associated with a high lifetime fracture risk and secondary complications without proven efficacy of treatment.

While the mechanism of SCI-induced bone loss is poorly understood, it is widely believed to be distinct from postmenopausal osteoporosis. There are reports of increased expression of substance P in sublesional bone [25] as well as decreased circulating osteoprotegerin in complete tetraplegia [26]. Therefore, to be effective, treatment strategies may need to be tailored to the specific mechanism of bone loss. Since the mechanisms responsible for bone loss appear to be different, medications and exercise interventions shown effective in postmenopausal osteoporosis cannot be transferred to the SCI population without establishing efficacy in preventing or slowing bone loss and reducing fractures.

There are several limitations to the current study that must be considered. First, this is a relatively small sample within a restricted population of SCI providers with a low response rate. It is not known if these management practices are similar to those of other SCI providers in different health care settings or unique to the VA health care environment. Also, there may be a bias in our data in that responders to the survey may be inherently more interested in or more likely to treat SCI-induced osteoporosis. Despite these limitations, these findings provide important insight into current prescribing practices for SCI-induced osteoporosis.

Conclusions

Within the VA health care system, roughly half of all responders routinely order diagnostic testing and medication for the treatment of SCI-induced osteoporosis. These measures are done in the absence of an established standard of care and suggest that evidence-based practice guidelines are necessary to reduce practice variations and improve clinical care. To establish evidence-based guidelines, future research should be directed at determination of treatment efficacy, improvement of diagnostic protocols tailored to the SCI population, and assessment of therapeutic agents to prevent bone loss and decrease fracture rates.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1
Respondent characteristics

Variable	MD/DO (n = 52)	NP/PA (n = 40)	Total (n = 92)
Age, y (mean $\pm$ SD)	51.1 $\pm$ 8.7	50.6 $\pm$ 8.2	50.9 $\pm$ 8.4
Male	30 (57.7)	12 (30.0)	42 (45.7)
Duration of medical practice			
>20 y	27 (51.9)	22 (55.0)	49 (53.3)
11-20 y	14 (26.9)	10 (25.0)	24 (26.1)
$\leq$ 10 y	11 (21.2)	8 (20.0)	19 (20.7)
Time caring for persons with SCI			
>75%	26 (50.0)	23 (57.5)	49 (53.3)
11%-75%	15 (28.9)	12 (30.0)	27 (29.4)
<10%	11 (21.2)	5 (12.5)	16 (17.4)
Clinical workup ordered	33 (63.5)	21 (52.5)	54 (58.7)
DEXA scan	31 (59.6)	19 (47.5)	50 (54.4)
Medications prescribed	27 (51.9)	23 (57.5)	50 (54.4)
Bisphosphonates	22 (42.3)	17 (42.5)	39 (42.4)
Calcium	25 (48.1)	22 (55.0)	47 (51.1)
Vitamin D	25 (48.1)	21 (52.5)	46 (50.0)

Values given as n (%) unless otherwise indicated.

DEXA indicates dual energy x-ray absorptiometry.

Table 2
Reported osteoporosis management

Treatment Prescribed	No. of Practitioners (%)
Pharmacologic	50 (54.4)
Calcium	47 (51.1)
Vitamin D	46 (50.0)
Bisphosphonates	39 (42.4)
Rehabilitation therapy	72 (78.3)
Weight-bearing exercises	60 (65.2)
Standing frames	53 (57.6)
Body weight-supported treadmill training	18 (19.6)
Electrical stimulation	17 (18.5)
Other ^a	13 (14.1)

^aIncludes general exercise programs, weight training, and vibration platform.

Table 3
Reported fracture complications

Complication	No. of Practitioners (%)
Pressure ulcer from immobilization or casting	33 (35.9)
Nonunion of the fracture site after 1 y	28 (30.4)
Autonomic dysreflexia due to fracture	21 (22.8)
Deep venous thrombosis or pulmonary embolism	17 (18.5)
Cellulitis requiring antibiotic treatment	10 (10.9)
Osteomyelitis at the fracture site	8 (8.7)
Other ^a	5 (5.4)

^aIncludes pain, amputation, and heterotopic ossification.