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“Pathologic” Fractures: Should These Be Included in Epidemiologic Studies of Osteoporotic Fractures?

Jeffrey R. Curtis, MD MPH¹, Allison J. Taylor, MPH², Robert S. Matthews, BS², Midge Ray, MSN CCS³, David J. Becker, PhD⁴, Lisa C. Gary, PhD⁴, Meredith L. Kilgore, PhD⁴, Michael A. Morrissey, PhD⁴, Kenneth G Saag, MD MSc^{1,2}, Amy Warriner, MD⁵, and Elizabeth Delzell, ScD⁴

¹Division of Clinical Immunology and Rheumatology, University of Alabama at Birmingham; Birmingham, AL

²Department of Epidemiology, University of Alabama at Birmingham; Birmingham, AL

³Department of Health Services Administration, University of Alabama at Birmingham, Birmingham, AL

⁴Department of Health Care Organization and Policy, University of Alabama at Birmingham, AL

⁵Division of Endocrinology, University of Alabama at Birmingham; Birmingham, AL

Abstract

Introduction—Analyses of osteoporosis-related fractures that use administrative data often exclude pathologic fractures (ICD-9 733.1x) due to concern that these are caused by cancer. We examined “pathologic” fractures of the vertebrae and hip to evaluate their contribution to fracture incidence and assessed the evidence for a malignancy.

Methods—We studied U.S. Medicare beneficiaries age ≥ 65 with new fractures identified using ICD-9 diagnosis codes 733.13 (pathologic vert), 805.0, 805.2, 805.4, 805.8 (non-pathologic vert); and 733.14 (pathologic hip), 820.0, 820.2 820.8 (non-pathologic hip). We further examined the proportion of cases with a diagnosis of a malignancy proximate to the fracture.

Results—We identified 44,120 individuals with a vertebral fracture and 60,354 with a hip fracture. Approximately 50% of vertebral fractures and 3% of hip fractures were coded as pathologic. For only approximately 25% of persons with a “pathologic” vertebral fracture ICD-9 code, but 66% of persons with a “pathologic” hip fracture, there was evidence of a possible cancer diagnosis.

Corresponding Author: Jeffrey Curtis, MD 510 20th Street South FOT 840 Birmingham AL 35294 jcurtis@uab.edu 205-934-7727.

Mini-abstract Pathologic fractures are often excluded in epidemiologic studies of osteoporosis. Using Medicare administrative data, we identified persons with vertebral and hip fractures. Among these, 50% (vertebral) and 3% (hip) of the fractures were coded as pathologic. Only 25% and 66% of persons with these pathologic fractures had evidence for malignancy.

Disclosures

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Conclusion—Among U.S. Medicare beneficiaries, one-fourth of pathologic vertebral fracture and two-thirds of pathologic hip fracture cases had evidence for a malignancy. Particularly for vertebral fractures, excluding persons with pathologic fractures in epidemiologic analyses that utilize administrative claims data substantially underestimates the burden of fractures due to osteoporosis.

Keywords

hip fracture; vertebral fracture; pathologic fracture; epidemiology

Introduction

Many studies of the epidemiology and outcomes associated with osteoporotic fracture exclude pathologic fractures (1,2). Although the rationale for this exclusion is often not explicitly given, nor the criteria for what constitutes a pathologic fracture identified, the implication is that a pathologic fracture is due to a localized process such as a malignancy or infection and is not related to osteoporosis. Accordingly, these fractures should be excluded in studies of osteoporotic fractures.

However, a dictionary definition of a pathologic fracture is “a fracture of a bone weakened by disease” (3). This definition is nearly identical to the definition in the U.S. used by physicians who are submitting claims for reimbursement for fracture management, where a pathologic fracture is defined by the American Hospital Association coding manual as a “break in a diseased bone due to weakening of bone structure by pathologic processes without identifiable trauma”, although may sometimes follow minor or slight trauma (4). Thus, the administrative data that results from these reimbursement claims yields a definition of a pathologic fracture does not require the presence of a malignancy, infection or other local process. In fact, based on these definitions, the “disease” or underlying cause of a fracture may be osteoporosis. For that reason, epidemiologic studies, particularly those using administrative databases, that exclude pathologic fractures without explicitly confirming that a cancer metastatic to bone or a localized disorder of bone is present, may substantially underestimate the burden of osteoporotic fractures.

Using administrative claims data from older Americans enrolled in Medicare, we evaluated pathologic and non-pathologic fractures of the vertebrae and hip to determine the proportion of persons with evidence of a malignancy. We hypothesized that persons with a diagnosis of a pathologic fracture of the spine or hip would be more likely to have evidence of a malignancy than those without diagnoses of pathologic fractures. We further hypothesized that persons with more than one type of fracture might have a greater likelihood of having a malignancy than those with only a single fracture.

Methods

After local institutional review board approval and Data Use Agreements (DUA) put in place with the Center for Medicare and Medicaid Services (CMS), we obtained Medicare claims data from the Chronic Condition Warehouse (CCW) data for the years 1999-2005. We identified Medicare beneficiaries who were ≥ 65 years of age, had Medicare A+B coverage, were not HMO enrollees, lived in the U.S., and were included in a 5% random sample. We identified individuals with a new fracture of the spine or hip following a 12-month “clean” period during which there were no fracture diagnoses of these types. The ICD-9 diagnosis codes used for vertebral fracture were 733.13 (pathologic) and 805.0, 805.2, 805.4 and 805.8 (non-pathologic); ICD-9 codes for hip fractures were 733.14 (pathologic) and 820.0, 820.2 and 820.8 (non-pathologic). Using an observation window of 3 months starting from the date of the first

spine or hip fracture, we classified persons as having only pathologic fracture diagnosis codes, only non-pathologic fracture diagnosis codes, or both.

We examined the proportion of persons with fractures who had at least one inpatient or outpatient physician ICD9 diagnosis code associated with a malignant neoplasm (excluding non-melanoma skin cancer) or a benign tumor of bone in the 12 months before or in the 4 months following the date of the fracture. ICD9 codes included: 140-172, 174-208, 213, and V10 (excluding V10.83, other skin neoplasm). We further evaluated the proportion of persons with evidence for a malignancy that had diagnosis codes only for a history of cancer (ICD-9 V10). Results were stratified by whether persons experienced other types of incident fractures (e.g. distal forearm, humerus) during the same observation period. Finally, we stratified results by gender and by age (65-72, ≥ 73).

Results

We identified 44,120 individuals with a first vertebral fracture diagnosis. Their mean $\pm$ standard deviation age was 78 $\pm$ 7 years; 74% were women, and 95% were white. We identified 60,354 individuals with a hip fracture diagnosis. Their mean age was 80 $\pm$ 7 years; 75% were women, and 93% were white. The proportion of persons with pathologic vertebral fracture diagnos(es) only, non-pathologic fracture diagnos(es) only, and both diagnoses is shown (Table). The proportion of persons with vertebral fracture with evidence for a malignancy was approximately 20-25% and minimally different regardless of whether the vertebral fractures were coded as pathologic or not. The proportion of persons with a hip fracture with evidence for a malignancy differed considerably, ranging from 19-67% depending on whether the hip fracture was coded as pathologic or non-pathologic. The proportion of persons with spine fractures that had evidence for a malignancy did not substantially differ regardless of whether or not there were other fractures. However, for persons with a hip fracture, the prevalence of malignancy was somewhat higher for those with additional fractures. Women and younger persons with vertebral fractures were 8% and 3% more likely to have a pathologic fracture diagnosis, $p < 0.0001$ for both; this trend was not observed for pathologic fractures of the hip.

Among the cases of pathologic vertebral fractures who also had evidence for a malignancy, the four most common cancer diagnoses accounted for 71% of all cancers and were of the breast (27.9%), prostate (21.7%), colon (13.1%) and lung (9.1%). Of the people with pathologic vertebral fractures and evidence for malignancy, 21.9% had diagnosis codes for only a history of malignancy (V10). In contrast, only 12.6% of persons with a pathologic hip fracture and evidence for a malignancy had diagnosis codes for only a history of malignancy (V10).

Conclusion

Using data that are nationally representative of the Medicare fee for service population of older Americans, we found that approximately 50% of vertebral fractures and 3% of hip fractures were coded as pathologic fractures. For only approximately 25% of persons with vertebral fractures identified using a "pathologic fracture" ICD-9 code, but 66% of persons with pathologic hip fractures, there was evidence of a possible cancer diagnosis.

The underlying explanations for why a fracture that is solely due to osteoporosis would be coded as a pathologic fracture are unclear but could relate to the amount of trauma associated with the fracture, administrative coding ambiguities or even to reimbursement advantages. A vertebral fracture may occur spontaneously and thus be more easily identified as occurring due to a disease (e.g. osteoporosis) and, therefore, coded as a pathologic fracture (ICD9 733.13). In contrast, a hip fracture usually occurs in association with a fall, even though the fracture

may have caused the fall. Perhaps for this reason, hip fractures may be more likely to be coded as traumatic fractures (ICD9 800-829), and we found that a code for a pathologic hip fracture is considerably more likely to suggest underlying malignancy than for a vertebral fracture. Consistent with this explanation, women and younger persons were significantly more likely to have a pathologic fracture diagnosis of the spine but not the hip. This suggests the possibility that osteoporosis (rather than cancer) was more easily recognized as being responsible for the vertebral fracture. Additionally, for a hospitalized vertebral fracture in the U.S., a pathologic fracture diagnosis (ICD9 733.13) generates a higher-weighted Diagnosis Related Group (DRG) and thus higher reimbursement to the facility than a non-pathologic fracture diagnosis (ICD9 805.X). This circumstance does not extend to other fractures that require surgical management since reimbursement for the procedure will generally be equivalent regardless of the fracture diagnosis code used.

The results of our study must be interpreted in light of its methodologic design. We used administrative claims data and did not have access to medical records, so we could not confirm incident fractures or cancer diagnoses. However, we used claims-based fracture identification algorithms that have been shown to perform well in prior validation studies that did have access to medical records (5-7). Administrative claims data have also been shown to identify malignancies with high validity (8-10). The definition of malignancy that we used intentionally maximized sensitivity over specificity; we did not, for example, require treatment with radiation or chemotherapy as might be expected for many incident cancers that had skeletal complications. Therefore, our estimates of the prevalence of cancer are likely too high. Moreover, even among persons with both a pathologic fracture and cancer, one cannot assume that the fracture was due to the cancer. Finally, we acknowledge that patterns of fracture care and administrative coding in the U.S. may be different than in other countries with different reimbursement structures and administrative data coding, and thus our results may not be generalizable to these settings.

In conclusion, we found that a large proportion of vertebral fracture cases is coded as pathologic, yet only in a minority of these is there evidence of a malignancy. In contrast, the majority of hip fractures coded as pathologic seem to be associated with cancer diagnoses. Future studies of the epidemiology and outcomes associated with fractures should be explicit about how they handle pathologic fractures, since excluding them may substantially underestimate the burden of fractures due to osteoporosis.

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Table

Proportion of Persons with Spine or Hip Fractures with Pathologic Fracture Diagnoses, and the Proportion of Fractures Cases and Controls with Evidence for Cancer

	Pathologic Fracture Diagnoses Only	Non-pathologic Fracture Diagnoses Only	Both Diagnoses
Spine fractures (% of total spine fractures)	13,076 (29.6)	22,988 (52.1)	8,056 (18.3)
Proportion of these persons with evidence for a malignancy			
Overall, %	24.6	20.2	23.8
Without other types of fractures, %	24.2	20.3	23.7
With other types of fractures, %	25.5	19.9	23.9
Hip fractures (% of total hip fractures)	921 (1.5)	58,786 (97.4)	647 (1.1)
Proportion of these persons with evidence for a malignancy			
Overall, %	66.6	19.2	42.5
Without other types of fractures, %	61.8 ^a	18.6 ^b	42.3
With other types of fractures, %	69.1 ^a	19.6 ^b	42.6

^a p = 0.03 comparing the prevalence of cancer among persons with pathologic hip fractures that do or do not have additional fractures

^b p = 0.01 comparing the prevalence of cancer among persons with non-pathologic hip fractures that do or do not have additional fractures