Original Article

The prevalence of depression and anxiety in patients with metastatic disease to the spine

ABSTRACT

Introduction: The prevalence of depression and anxiety in cancer patients is approximately 15% and 20%. Unfortunately, depression has been demonstrated to negatively impact patients after spinal fusion surgeries and is associated with worse overall survival in cancer patients. The rates of depression and anxiety have yet to be reported in patients with metastatic spine disease. The objective of this study was to determine the rate of depression and anxiety in patients with metastatic spine disease.

Materials and Methods: Patients >18 years of age at our institution who presented with metastatic spinal disease between 2017 and 2022 were identified through query search and verified by chart review of operative and biopsy notes. Patients who carried a depression and anxiety diagnosis were identified through a review of documentation in the electronic medical record. Demographic and surgical characteristics were recorded.

Results: One hundred and fifty patients were identified. The average age and Charlson Comorbidity Index were 63.5 ± 13.0 and 8.34 ± 2.76, respectively. There were 84 (56.0%) males, 28 (18.7%) patients carrying a diagnosis of diabetes, and 40 (26.7%) current smokers. There were 127 (84.7%) surgeries performed for spinal metastases. The most common operative location was the thoracic spine (42.5%), while the sacrum was the least common (2.36%). Overall, 20.00% of our cohort carried a diagnosis of depression, 17.3% carried a diagnosis of anxiety, and 28.7% carried a diagnosis of either depression or anxiety. The most common primary cancers were lung (20.67%), breast (17.33%), and prostate cancers (15.33%).

Conclusion: Our study demonstrates elevated rates of depression and anxiety in patients with spinal metastatic disease relative to the general population. When evaluating patients with spinal metastases, spine surgeons have an opportunity to screen for symptoms and place an early referral to a mental health professional.

Keywords: Anxiety, depression, mental health, metastatic disease, spine metastases

INTRODUCTION

Depression and anxiety are common in the United States, with studies reporting prevalence rates of major depressive disorder in 3%–10% of adults and feelings of anxiety or worry in 7%–11%.[1-4] Diagnoses of depression and anxiety have consistently been shown to negatively impact patient-reported outcomes after orthopedic surgery in general,[5-8] as well as spinal surgery in particular.[9,10] In fact, depression has been shown to be a significant predictor of failed back surgery syndrome.[11] In patients with a cancer diagnosis, the prevalence of depression and anxiety has been even higher, ranging from 12% to 38% and 19% to 41%,

Caleb Yeung, Jeremy Heard, Yunsoo Lee, Michael McCurdy, Rajkishen Narayanan, Samantha Kolowrat, Liam Gibbons, Tim Hagan, Jose A. Canseco, Alan S. Hilibrand, Alexander R. Vaccaro, Gregory D. Schroeder, Christopher K. Kepler

Department of Orthopaedic Surgery, Rothman Orthopaedic Institute at Thomas Jefferson University Hospital, Philadelphia, PA, USA

Address for correspondence: Dr. Rajkishen Narayanan, Rothman Orthopaedic Institute at Thomas Jefferson University, 925, Chestnut St, 5th Floor Philadelphia 19107, PA, USA.
E-mail: rajkishen.narayanan@gmail.com

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respectively.[4,12,13] Moreover, studies assessing patients with metastatic disease have reported rates of depression and anxiety as high as 20% and 44%, respectively.[14] Unfortunately, depression has been linked to worsened survival outcomes in cancer patients.[15,16]

Metastatic disease frequently affects the spine and may occur in up to 70% of cancer patients.[17] In addition, cancer may often initially present in the spine as axial back pain, with metastatic disease to the spine contributing to 10%–30% of new cancer diagnoses annually.[18] As such, spine surgeons may often be one of the first providers to whom a patient with a new or suspected cancer diagnosis is referred. During this initial diagnosis and workup, studies have demonstrated that cancer patients often undergo significant psychological distress, experiencing anxiety on initial diagnosis and progressing to depression within the first 2–4 weeks of treatment thereafter.[19]

Certainly, although treating psychiatric conditions is not within the scope of practice for spine surgeons, patient advocacy is a duty shared by every physician, regardless of specialty. As such, spine surgeons who interact with or consult on patients with newly diagnosed metastatic spinal disease have the unique opportunity and obligation to refer at-risk patients demonstrating signs or symptoms of depression or anxiety for further psychiatric evaluation and treatment. Furthermore, given that impaired mental health has been linked to worse outcomes, referring patients for psychiatric treatment of their depression and anxiety perioperatively may also improve surgical outcomes for the patients who require surgical intervention.

Currently, no literature describes the rates of depression and anxiety in surgical patients with spinal metastases nor assesses the influence of patient demographics, surgical intervention, primary cancer, or comorbidities on the prevalence of depression or anxiety in patients with metastatic spinal disease. Our current investigation aims to assess the rates of anxiety and depression in patients with spinal metastases treated either operatively or nonoperatively at our tertiary care institution.

MATERIALS AND METHODS

Patient selection

After the Institutional Review Board approval, a cohort of adult patients with metastatic spinal disease at a single, urban tertiary academic center for metastatic cancer was retrospectively retrieved using a Structured Query Language search from 2017 to 2021. ICD-9 (198.5, 198.3, 199.1, 174.9, 153.9, 162.9, 183.9, 157.9, 185, 170.2, and 192.2), and ICD-10 (C79.51, C79.31, C80.1, C50.919, C18.9, C34.90, C57.4, C25.9, C61, C41.2, C72.0, and C72.1) codes were used to identify patients with metastatic disease. Patient charts were then manually reviewed for evidence of spinal involvement as per imaging, biopsy documentation, and operative records.

A manual chart review was performed to obtain demographic characteristics, including age, sex, body mass index (BMI), Charlson Comorbidity Index (CCI), race, ethnicity, and smoking status (current, never, or former smoker). If the patient had surgery, operative records were used to record surgical data, including the surgical procedure performed, the number of levels involved in the surgery, and the spinal region involved. Patients diagnosed with depression or anxiety were obtained through a review of medical records, including notes from encounters with spine surgeons and past medical history on the electronic medical record. In addition, medications were screened for antianxiety or antidepressant medications. The primary cancer diagnosis was identified through patient records and pathology reports.

Statistical analysis

Standard descriptive statistics were reported for patient demographics, including proportions and averages with standard deviation. The Shapiro–Wilk test was used to analyze the normality of each continuous variable, and parametric data were compared with independent *t*-tests. In contrast, nonparametric data were compared with Mann–Whitney *U*-tests. Dichotomous variables were compared with Pearson's Chi-square tests. Bivariate analyses assessed differences in demographic and surgical characteristics based on a diagnosis of depression or anxiety. All statistical analyses used RStudio (Version 3.6.3, Vienna, Austria). Significance was set to $P < 0.05$.

RESULTS

Demographic characteristics

A total of 150 patients were identified, of which 30 (20.0%) carried a diagnosis of depression, 26 (17.3%) carried a diagnosis of anxiety, and 43 (28.7%) carried a diagnosis of depression or anxiety. The mean age, BMI, and CCI were 63.5 ± 13.0 years, 27.5 ± 7.65 kg/m^2, and 8.34 ± 2.76, respectively. A greater proportion of patients were male, nonsmoker, white, and non-Hispanic. Most patients (84.7%) received spine surgery after presentation to our team [Table 1].

Surgical characteristics

Of those who underwent surgery, the highest proportion of surgeries occurred in the thoracic region (42.5%), while the

lowest occurred in the sacral region (2.36%). More fusions were performed than decompressions (77.2% vs. 22.8%). The average number of vertebral levels decompressed was 1.97 ± 1.40 and fused was 3.76 ± 2.72 [Table 2]. The most common primary neoplasm was lung cancer (20.67%) [Table 3].

Bivariant analysis: Anxiety or depression versus no anxiety or depression

There were no significant differences in demographic or surgical characteristics between patients diagnosed with anxiety or depression and those without [Appendixes A and B].

DISCUSSION

In comparison to the prevalence of depression and anxiety in the general population, which have been reported to be 3%–10% and 7%–11%,[1-4] respectively, patients with a cancer diagnosis have exhibited higher rates, closer to 40%.[4,12,13] In our study, we observed elevated rates of depression and anxiety in patients with metastatic spinal disease, at 20.0% and 17.3%, respectively. We demonstrate that these higher rates are not significantly different in patients who undergo surgical treatment or those who are managed nonoperatively. These findings carry sobering implications when taken in the context of the literature regarding poor mental health negatively affecting cancer patient survival and quality of life. They also underscore the fundamental physician duty of patient advocacy and referral for care even if treatment of depression and anxiety is outside of the scope of practice of the particular provider. Patients with metastases to the spine may be referred to spine surgeons either during or after their initial cancer diagnosis given the proclivity for metastatic disease to manifest in the spine, and for spine surgeons, this represents an opportunity to advocate for patient-centric care, including their mental health.[20] It is worthwhile to note that up to 40% of patients with anxiety and depression do not seek treatment on their own, which further highlights the opportunity for meaningful referrals by providers who participate in the treatment of this population.[21]

Prior studies have suggested that certain primary malignancies with higher mortality rates are more likely to be associated with depression.[22] However, we did not find any particular type of cancer associated with higher rates of depression or anxiety. In addition, we did not observe any significant differences between depression or anxiety rates based on patient demographics, such as age, sex, and race, which have been shown to have varying associations with invasiveness and variants of the disease.[22] This indicates that regardless of the patient's demographics or cancer type when patients present with spinal metastases, there is substantial value and opportunity for spine surgeons to improve the mental health

Table 1: Demographic characteristics

	***n*=150, *n* (%)**
Age (years)	63.5 (13.0)
Sex	
Female	66 (44.0)
Male	84 (56.0)
BMI (kg/m^2)	27.5 (7.65)
CCI	8.34 (2.76)
Diabetes	
No	122 (81.3)
Yes	28 (18.7)
Smoker	
No	93 (62.0)
Current	40 (26.7)
Former	17 (11.3)
Race	
White	92 (61.3)
Black	36 (24.0)
Asian	5 (3.33)
Hispanic	6 (4.00)
Not reported	11 (7.33)
Ethnicity	
Hispanic	6 (4.00)
Not Hispanic, Latino/a, or Spanish origin	137 (91.3)
Not reported	7 (4.67)
Diagnosis of anxiety	
No	124 (82.7)
Yes	26 (17.3)
Diagnosis of depression	
No	120 (80.0)
Yes	30 (20.0)
Either depression or anxiety	
No	107 (71.3)
Yes	43 (28.7)
Spine surgery	
No	23 (15.3)
Yes	127 (84.7)

BMI - Body mass index; CCI - Charlson Comorbidity Index

Table 2: Surgical characteristics

	***n*=127, *n* (%)**
Surgery location	
Cervical	16 (12.6)
Cervicothoracic	21 (16.5)
Thoracic	54 (42.5)
Thoracolumbar	15 (11.8)
Lumbar	18 (14.2)
Sacral	3 (2.36)
Surgery	
Decompression	29 (22.8)
Fusion	98 (77.2)
Number of levels decompressed	1.97 (1.40)
Number of levels fused	3.76 (2.72)
Total number of tumor operations	
>1	26 (20.4)
One	101 (79.6)

Table 3: Primary neoplasm type

Primary neoplasm	Percentage of total
Lung	20.67
Breast	17.33
Prostate	15.33
Multiple myeloma	12
Unknown origin	6.67
Lymphoma	4.67
Renal cell	4
Hepatocellular carcinoma	3.33
Upper GI cancer	3.33
Melanoma	3.33
Bladder	2
Uterine	1.33
Pheochromocytoma	1.33
Pharyngeal	0.67
Ovarian	0.67
Esophageal	0.67
Cervical	0.67
Pancreatic	0.67
Langerhans cell histiocytosis	0.67
Colon	0.67

GI - Gastrointestinal

of their patients by maintaining a high index of suspicion for depression and anxiety during the initial workup of their patients and a low threshold for psychiatric referral if any signs or symptoms are noted. Although a mental health professional should only initiate treatment, awareness of the substantially elevated rates of depression and anxiety in patients with metastatic spinal disease can make spine surgeons better overall advocates for their patients.

Referral of patients for mental health care also represents an opportunity to improve the outcomes of patients who undergo surgical intervention for their metastatic disease. Indeed, depression and anxiety have already been established as important prognostic predictors of patient outcomes following spine surgery. In a retrospective cohort analysis of patients who underwent anterior cervical discectomy and fusion, Cha *et al*. demonstrated that patients with more severe preoperative depression were more likely to experience blunted improvements in patient-reported outcome measures, including the Visual Analog Scale (VAS) for arm pain, Neck Disability Index (NDI), the mental health component of the Short Form-12 Survey Mental Component Score (SF-12 MCS), and Patient-Reported Outcomes Measurement Information System physical function (PROMIS PF) after multilevel cervical fusion.[23] In a separate analysis, after anterior cervical discectomy and fusion, Divi *et al*. demonstrated significantly less improvement in the VAS arm ($P < 0.001$), NDI ($P = 0.010$), and the physical health component of the SF-12 PCS ($P = 0.026$) in patients with preoperative depression, defined as SF-12 MCS scores <45.6.[24] In a retrospective cohort study of 172 patients, Yoo *et al*. showed that worsened preoperative mental health (SF-12 MCS <50) was associated with worsened patient-reported outcomes (PROMIS PF, $P < 0.001$) after transforaminal lumbar interbody fusion (TLIF).[25] Patel *et al*. also found that patients undergoing TLIF were less likely to experience clinical improvement, as per the Oswestry Disability Index, VAS back and leg pain, and the Veterans RAND-12 mental and physical component score (each $P < 0.001$). This study also demonstrated that people with depression were at higher risk for increased narcotic use ($P = 0.005$).[26] An additional study by Tetreault *et al*. also observed that patient-reported outcomes were hindered by preexisting depression before surgery for degenerative cervical myelopathy.[27]

In sum, these studies suggest that spine surgeons must consider the mental health of their patients as an important contributing factor to outcomes after spinal surgery. As our study demonstrates that patients undergoing spine surgery for metastatic disease are likely to experience higher rates of depression or anxiety, surgeons should try to assess their patients for the presence of these diseases to maximize the clinical benefits of surgery. Therefore, to improve patient outcomes, consistent, simple mental health screening metrics such as the PHQ-9, which can be conducted during patient intake even before meeting with the spine surgeon,[28] may serve as a high-value, low-time demand screen for these patients. At the very least, basic awareness and a lower threshold by spine surgeons to take the simple step to refer patients with spinal metastatic disease for psychiatric care who demonstrate overt signs of depression or anxiety may still translate to substantial and meaningful improvements in patient mental health.

Limitations of our study are those inherent to a retrospective analysis. In addition, our criteria for identifying patients with depression or anxiety were based on a chart review instead of an evidence-based survey. The accuracy of self-reported diagnoses in a single-item survey fashion is not as accurate as validated questionnaires. However, this does not invalidate our results. A recent study assessed the accuracy of self-reporting in a two-item (yes/no) survey similar to the patient intake survey used at our institution compared to the PHQ for the identification of people with depression, demonstrating that rates were slightly higher in the two-item survey (7.7% vs. 5.9%).[29] Other studies have demonstrated acceptable agreement between single-item versus algorithm-based diagnostic criteria for anxiety and depression disorders.[30] This indicates that while our study may not follow a protocol that employs the diagnostic

criteria for major depressive disorder or generalized anxiety disorder, our proportions are likely near the true value of such disease categories in our population. Finally, we may be underpowered to detect differences between patients who have depression and anxiety and those who do not. As there is a significant lack of literature on depression and anxiety in this patient population, no effect size can be used for power analysis to determine the appropriate cohort size. For this reason, we encourage additional large-scale retrospective investigations assessing the prevalence of depression and anxiety in spine surgery patients with metastatic disease to the spine.

CONCLUSION

The rates of depression and anxiety have yet to be reported in patients with metastatic disease to the spine. We demonstrate rates of 20.0% and 17.3%, respectively, which are higher than the known rates of the general population. As such, spine surgeons have an opportunity to help advocate for the mental health of their patients through proper awareness and timely referrals. Additional studies corroborating our results are encouraged, given that the sample size was limited due to the nature of our patient population.

Conflicts of interest

JC – Accelus, CSRS, PathKeeper Surgical, Wolters Kluwer Health – Lippincott Williams and Wilkins; AH – Biomet, CTL Amedica, Paradigm spine; AV – Accelus, Advanced Spinal Intellectual Properties, AO Spine, ATEC, Atlas Spine, Avaz Surgical, AVKN Patient Driven Care, Cytonics, Deep Health, Dimension Orthotics LLC, Electrocore, Elsevier, Flagship Surgical, FlowPharma, Globus Medical, Harvard MedTech, Innovative Surgical Design, Jaypee, Jushi, Medtronics, National Spine Health Foundation, Nuvasive, Orthobullets, Parvizi Surgical Innovation, Progressive Spinal Technologies, Sentryx, Spinal Elements, SpineWave, Stout Medical, Stryker, Taylor Francis/Hodder and Stoughton, Thieme, ViewFi Health; GS – Advance Medical, AO Spine, Bioventus, Cerapedics, CSRS, DePuy, Medtronic Sofamor Danek, Surgalign, Wolter Kluwer Health – Lippincott Williams and Wilkins; CK – Clinical Spine Surgery, Curetiva, Regeneration Technologies Inc.

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Appendix A: Demographic characteristics of people with spine metastases and depression and anxiety

	No depression or anxiety (*n*=107), *n* (%)	Depression or anxiety (*n*=43), *n* (%)	*P*
Age (years)	62.9 (14.0)	64.0 (12.5)	0.992
Sex			
Female	44 (41.1)	22 (51.2)	0.348
Male	63 (58.9)	21 (48.8)	
BMI (kg/m^2)	27.6 (7.87)	26.7 (7.61)	0.219
CCI	8.30 (2.70)	8.50 (3.15)	0.451
Diabetes	20 (18.7)	8 (18.6)	1.000
Smoker			
No	69 (64.5)	24 (55.8)	0.407
Current	28 (26.2)	12 (27.9)	
Former	10 (9.35)	7 (16.3)	
Race			
Asian	5 (4.67)	0	0.116
Black	28 (26.2)	8 (18.6)	
Hispanic	6 (5.61)	0	
Not reported	9 (8.41)	2 (4.65)	
White	59 (55.1)	33 (76.7)	
Ethnicity			
Hispanic	6 (5.61)	0	0.299
Not Hispanic, Latino/a, or Spanish origin	95 (88.8)	42 (97.7)	
Unknown	6 (5.61)	1 (2.33)	
Spine surgery			
No	17 (15.9)	6 (14.0)	0.963
Yes	90 (84.1)	37 (86.0)	

BMI - Body mass index; CCI - Charlson Comorbidity Index

Appendix B: Surgical characteristics and primary cancer comparison for people with spine metastases and depression and anxiety

	No depression or anxiety (*n*=107), *n* (%)	Depression or anxiety (*n*=43), *n* (%)	*P*
Surgery location			
Cervical	10 (11.1)	6 (16.2)	0.556
Cervicothoracic	17 (18.9)	4 (10.8)	0.395
Thoracic	39 (43.3)	15 (40.5)	0.927
Thoracolumbar	11 (12.2)	4 (10.8)	1.000
Lumbar	12 (13.3)	6 (16.2)	0.886
Sacral	1 (1.11)	2 (5.41)	0.203
Surgery			0.625
Decompression	19 (21.1)	10 (27.0)	
Fusion	71 (78.9)	27 (73.0)	
Number of levels decompressed	2.01 (1.39)	1.86 (1.43)	0.211
Number of levels fused	3.98 (2.68)	3.21 (2.78)	0.107
Total number of tumor operations			
>1	19 (21.1)	7 (18.9)	0.971
One	71 (78.9)	30 (81.1)	
Primary cancer			
Breast	18 (16.8)	8 (18.6)	0.595
Lung	19 (17.8)	12 (27.9)	
Multiple myeloma	14 (13.1)	4 (9.30)	
Prostate	16 (15.0)	7 (16.3)	
Other[a]	40 (37.4)	12 (27.9)	
Primary cancer: Lung versus other			
Lung	19 (17.8)	12 (27.9)	0.244
Other[b]	88 (82.2)	31 (72.1)	

[a]Unknown origin, lymphoma, melanoma, renal cell, hepatocellular carcinoma, gastric/pancreatic, pheochromocytoma, uterine, Langerhans cell histiocytosis, cervical, bladder, esophageal, colon, pharyngeal, [b]Breast, prostate, multiple myeloma, unknown origin, lymphoma, melanoma, renal cell, hepatocellular carcinoma, gastric/pancreatic, pheochromocytoma, uterine, Langerhans cell histiocytosis, cervical, bladder, esophageal, colon, and pharyngeal