

The Impacts of Anxiety and Depression on Outcomes in Foot and Ankle Surgery

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Daniel B. Shaw, BS¹, and Dominic S. Carreira, MD¹ 

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Introduction

There is a growing body of literature on the impacts of mental health disorders on musculoskeletal health. In particular, the effects of depression and anxiety are becoming better understood in relation to both musculoskeletal pain and surgical outcomes. An estimated 25% of general practice patients suffer from depression and/or anxiety,⁶⁵ and that proportion is estimated to be over 30% for patients with musculoskeletal pain.⁵² Because of the high proportion of patients with musculoskeletal pain who experience depression and anxiety, the impacts of these disorders on pain and surgical outcomes should be of concern to the practicing foot and ankle surgeon.

Depression and anxiety have been well-studied as factors that negatively predict the degree of surgical success in orthopaedics; however, investigations into the impacts of depression and anxiety in foot and ankle surgery are fewer and more recent than investigations focusing on other anatomical areas. Mental health disorders have been demonstrated to negatively affect surgical outcomes for a wide range of orthopaedic surgeries, including total hip and knee arthroplasties,^{2,26,27,30,35,38,40,51,66,74} hip arthroscopy,^{23,37,48,63,64} shoulder and elbow surgery,^{43,67,71} and spine surgery.^{10,47,62} The contributions of depression and anxiety to foot and ankle pain and the success of foot and ankle surgery have been more properly investigated in the past 5 years; however, they have not yet been summarized and critically analyzed in a review of the literature.

The purpose of this current concepts review is to analyze the literature related to the effects of depression and anxiety on foot and ankle surgeries. We will provide context into the pathology of depression and anxiety and how these conditions are related to musculoskeletal pain. We will also highlight the presentation of these psychiatric conditions and the screening methods that may be used in clinical practice to detect patients with depression and

anxiety. By focusing on preoperative pain and patient expectations, postoperative patient-reported outcomes, and other measures of surgical success such as complications and need for revision surgery, we hope to demonstrate the importance of considering depression and anxiety when managing foot and ankle pathologies and surgical expectations. Finally, we will present literature related to the treatment of preoperative mental health and its impacts on surgical outcomes. Summarizing these findings will have great clinical relevance to the practicing surgeon when deciding the best course of treatment for foot and ankle patients with anxiety or depression.

Pathophysiology and Musculoskeletal Pain

Depression and anxiety are chronic mental illnesses with wide-ranging psychological, social, and physiological characteristics and implications. Depression, also called Major Depression or Unipolar Depression, is a chronic illness characterized by lowered mood, lack of energy, difficulty experiencing pleasure and, in severe cases, thoughts of suicide.^{17,55} Insomnia and weight gain are also correlated with depressive symptoms,^{3,50} and obesity, in turn, is also associated with inferior surgical outcomes.⁹ The term *anxiety* is generally used when referring to Generalized Anxiety Disorder but can also refer to a cluster of disorders including Panic Disorder and Social Anxiety Disorder. Anxiety disorders are characterized by stress or fear that is experienced chronically and disproportionately to any present

¹Peachtree Orthopedics, Atlanta, GA, USA

Corresponding Author:

Dominic S. Carreira, MD, Peachtree Orthopedics, 2001 Peachtree Road NE #705, Atlanta, GA 30309, USA.
Email: Carreira.research@gmail.com

stressor or threat.¹⁶ Psychomotor agitation is common with anxiety disorders.⁵⁸ Although anxiety and depression have distinct symptoms and presentations, they often occur concomitantly. Up to 90 percent of depressed patients experience or have experienced severe anxiety, and 85 percent of patients with anxiety also exhibit depressive symptoms.⁶⁵ Depression and anxiety are often investigated simultaneously in orthopaedic clinical research.

The neurobiology of depression and anxiety is complex but highlights connections to the musculoskeletal system. Both disorders are characterized by altered neurotransmission that produces their affective and psychological symptoms, and they also have been shown to impact the hypothalamic-pituitary axis.^{20,70} Pathologic activation of the hypothalamic-pituitary axis leads to stress and systemic inflammation that can manifest in the musculoskeletal system, particularly through pain.²⁰ Multiple characterizations of depression and anxiety have listed physical pain as a symptom of both.^{1,28,68} There also appears to be a bidirectional relationship between depression and inflammatory pain where each pathology reinforces the other.^{4,6} Neurologic studies have provided further support for this relationship, demonstrating that both pain and depression affect the long-term neuroplasticity of the brain.²¹ The connection between anxiety and depression and pain should be considered by orthopaedic surgeons in their treatment plans.

The bidirectional causal relationship between depression and musculoskeletal pain is well established in the pain literature^{4,6,49}; however, for many orthopaedic patients who present with both pain and mental illness, the physical limitations of pain may trigger depressive symptoms.^{31,32} It is likely that this depression is brought about by pain's interference with activities that bring happiness and are a core part of a patient's self-concept, such as sports. This direction of causation is further supported by studies that demonstrate depressive and anxious symptoms improve postoperatively for patients who experienced improvements in pain and physical function after surgery.^{22,45,54} Although this is certainly not true for every patient who presents with both depression and musculoskeletal pain, for many orthopaedic patients, it appears that preoperative depressive symptoms are a result of pain and functional limitations.

Focusing on surgical outcomes, a strong connection has been found between symptoms of depression and anxiety and inferior outcomes from a variety of orthopaedic surgeries. Beyond inferior patient-reported outcomes, patients with depression or anxiety who underwent orthopaedic surgeries also had higher rates of hospital readmissions and surgical complications.^{23,26,40} They were also more likely to require revision surgery.²³ Because of these readmissions, complications, and revisions, patients with depression and

anxiety exhibit increased health care utilization, resulting in greater costs.³⁷ Although these factors were not studied in foot and ankle patient populations, it is likely that these additional outcome measures should be factored into the surgical decision-making process for foot and ankle patients as well.

Presentation and Screening

The presentations of depression and anxiety are diverse and difficult to ascertain in a nonpsychiatric consult. Signs of these disorders are challenging to note because of the largely internal, psychological nature of their experiences⁶⁵; however, psychomotor agitation could be a sign of anxiety disorders.⁵³ Some patients visibly demonstrate severe anxiety, akin to claustrophobia, when being placed in a cast. Although this severe "cast anxiety" has been shown to negatively impact patient care, it is understood as a distinct disorder rather than a sign of generalized anxiety.⁵⁷ Certain demographic groups are more at risk of depression and anxiety, including elderly patients, women, patients with lower levels of educational attainment, and patients covered by Medicaid in the United States.^{24,29,45} Because orthopaedic practices see diverse patient populations, these demographic trends are important to consider. Orthopaedic surgeons should rely at a minimum on patient self-reporting for a diagnosis of anxiety or depression.⁶⁵

Various scales have been developed to measure depressive or anxious symptoms for research purposes and are more recently being introduced in foot and ankle practices. These scales include the Beck Inventory, which is often used for psychological or social research purposes.⁶⁹ The Patient-Reported Outcomes Measurement Information System (PROMIS) scales contain scales for both depression and anxiety.³³ Within the PROMIS inventory, a score of 60 on the depression or anxiety scales has been used to indicate a depression or anxiety diagnosis, with a score of 70 or higher indicating severe anxiety or depression.¹² For use in the clinic to screen patients for anxiety or depression, the best validated scales are the Patient Health Questionnaire-9 (PHQ-9) for depression and the Generalized Anxiety Disorder Screener-7 (GAD-7) for anxiety.^{36,44,46} For PHQ-9, a score of 5 to 9 indicates mild depression, 10 to 14 indicates moderate depression, 15 to 19 indicates moderately severe depression, and 20 or above indicates severe depression. A score of 10 or above is generally used as a cutoff for a depression diagnosis.^{42,46} For GAD-7, a score of 10 or above is generally used as a diagnosis of anxiety, with a score of 15 or above indicating severe anxiety.³⁶ It is highly advisable that orthopaedic practices use these scales not only as screening tools, but also as means to determine the severity of a patient's anxiety or depression for clinical decision making.

Preoperative Pain and Patient Expectations

Because of the connection between depression and anxiety and experiences of physical pain, it could be hypothesized that these disorders are correlated with preoperative pain in patients with foot or ankle pathologies; however, investigations into this correlation have provided mixed results. An investigation into the prevalence of mental health disorders in foot and ankle patients found that 30% of patients experienced anxiety and 27% experienced depression.⁵² These proportions are slightly higher than the reported proportion of 25% of patients who present to general practice settings with symptoms of depression or anxiety.⁶⁵ These proportions are also higher than those reported for orthopaedic patients who report pain in other locations including the hip, knee, and upper extremities^{5,30,73}; however, it is unclear whether these differences are significant as this investigation contained no comparison groups.

Similar investigations with control groups have reached conflicting conclusions about the prevalence of anxiety and depression in foot and ankle patients. A matched case study of 90 patients found that patients who experienced chronic foot and ankle pain for more than 6 months were more likely to have higher scores on the Hospital Anxiety Depression scale.⁶¹ Foot and ankle patients were also more likely to have high neurotic personality scores, which could act as a potential confounding factor. This study also did not categorize patients by the location or cause of pain. A similar matched case study of 90 patients focused specifically on patients with plantar heel pain found that these patients were likely to report higher depression, anxiety, and stress scores.¹⁵ Because this study only focused on a specific location of foot pain, the generalizability of the results to all foot and ankle patients is limited.

Providing a more detailed analysis, a large investigation of 4455 patients categorized patients according to the location of their pain and found that only patients with widespread, bilateral foot pain were more likely to have depression or anxiety. Patients who had foot or ankle pain localized in a specific area showed no statistically significant differences in anxiety or depression than patients without foot or ankle pain.¹¹ Only 20% of foot and ankle patients fell into the widespread, bilateral foot pain category so the association between pain and depression or anxiety did not apply for a large majority of patients. These results call into question whether depression and anxiety are associated with foot and ankle pain or if the association only holds in specific contexts.

There is ample evidence that higher levels of preoperative pain are reported in patients with higher depression and anxiety scores. An investigation of 250 foot and ankle patients found that higher depression and anxiety measured via the Hospital Anxiety Depression Scales were associated with higher preoperative VAS and lower scores on the

Self-Administered Foot Evaluation Questionnaire (SAFE-Q), a measure of foot-related quality of life.⁵² A similar investigation of 271 foot and ankle patients found the same association using the Foot and Ankle Outcome Score to measure preoperative quality of life.³⁴ These associations also hold when depression and anxiety are isolated as variables of analysis. Greater preoperative anxiety measured via the PROMIS scale was associated with greater preoperative pain and worse quality of life in 205 foot and ankle patients.⁵³ Similarly, hallux valgus patients with depression reported higher preoperative VAS than patients without depression.⁶⁰ These investigations cohesively show that greater preoperative anxiety or depression is associated with greater preoperative pain and worse quality of life.

Interestingly, evidence suggests that foot and ankle patients with greater depression or anxiety report higher surgical expectations than patients who exhibit less depressive or anxious symptoms. Surgical expectations are what a patient believes they will achieve in terms of postoperative outcomes. Not having expectations met does not necessarily mean that a patient has not improved or is not satisfied with the results of surgery. A study of 554 patients with a wide variety of foot and ankle pathologies found that patients who reported more depressive or anxious symptoms on a Patient Health Questionnaire and Generalized Anxiety Disorder scale were more likely to expect greater improvement after their surgery.¹⁴ A similar investigation using the same measurement scales used multivariate analysis that isolated depression and anxiety as independent predictors of higher patient expectations.¹³ By isolating preoperative anxiety and depression from their associations with preoperative pain and functional limitations, this investigation provides evidence that depression and anxiety alone are associated with higher patient expectations.

Postoperative Patient-Reported Outcomes

Investigations into the postoperative patient-reported outcome measures (PROMs) of patients who underwent foot and ankle surgery have provided strong evidence to support the association between preoperative anxiety and depression and poorer surgical outcomes. The outcomes of total ankle arthroplasty (TAA) in particular have been well-studied. A small study of 40 TAA patients found that patients with greater preoperative depression reported higher postoperative VAS (3.1 ± 2.4 for patients with depression and 1.4 ± 2.3 for patients without depression) and worse postoperative American Orthopaedic Foot & Ankle Society ankle-hindfoot scores (89.3 ± 13.4 for patients with depression and 95.0 ± 8.1 for patients without depression) at a 2-year follow-up.³⁹ A much larger study of 668 TAA patients surveyed patients at 1-2 years and 5 years postoperatively and found that patients with

preoperative depression reported higher postoperative VAS and worse 36-item Short Form (SF-36) and Short Musculoskeletal Function Assessment (SMFA) than patients without preoperative depression. Interestingly, this difference was much smaller at the 1-2-year follow-up.¹⁹ Because their range of follow-up for the 1-2-year outcomes included time points relatively close to the date of surgery—some as early as 10 months postoperation—these results could provide evidence that the impacts of depression on foot and ankle surgical outcomes do not manifest until later time points in surgical recovery.

Analysis into the effects of anxiety have reported similar results. A study of 205 patients who underwent a variety of foot and ankle surgeries, excluding trauma, infection, and hardware removal, reported that patients with worse preoperative anxiety were more likely to have residual pain and functional disability at early follow-up.⁵³ These outcomes were measured via the PROMIS anxiety, pain interference, and physical function scales. This investigation provides a rare analysis into the impact of anxiety apart from comorbid depression. A factor that has not been analyzed in the foot and ankle literature is pain catastrophizing, which is often linked to anxiety.³⁰ In orthopaedic literature, catastrophizing has been reported to be a mediator for lower pain tolerance and higher pain perception in patients with anxiety.⁴⁹ Further research is needed to analyze the impacts of pain catastrophizing and anxiety independently in foot and ankle patients.

Focusing specifically on hallux valgus surgical outcomes, a study of 239 patients found that patients with depression reported significantly worse outcomes on the Short Form-12 (SF-12), Foot and Ankle Ability Measure (FAAM), and FAAM Activities of Daily Living score. Interestingly, patients with preoperative depression reported lower postoperative VAS than patients without depression.⁶⁰ This finding has not been reproduced in any other investigation.

Aside from PROMs, other studies have used patient satisfaction surveys as surgical outcome measures. The previously mentioned investigation into hallux valgus surgeries found no significant differences in patient satisfaction after surgery between the depression group and the non-depression group; however, patients with depression reported less satisfaction related specifically to their level of postoperative pain.⁶⁰ This finding is particularly interesting because patients with depression reported significantly lower levels of pain on postoperative VAS than patients without depression (3.0 vs 4.1).⁶⁰ It could be hypothesized that patients with depression had greater expectations related to surgical success that influenced their satisfaction with postoperative pain; however, more research into that hypothesis would be necessary.

Another investigation into patient satisfaction of a variety of foot and ankle surgeries found that patients with depression and anxiety were less satisfied with their surgery and less likely to recommend their surgery to others with

the same problem.³⁴ They also reported lower scores of the Foot and Ankle Outcome Score (FAOS). Patients with anxiety and depression in this study did report higher preoperative expectations for surgery than the control group, providing further evidence that poorer satisfaction with surgery could be related to higher surgical expectations.

It is important to note that several investigations uniformly report significant improvement postoperatively regardless of preoperative mental health status.^{19,34,39,53,60} These findings highlight that even though outcomes of patients with depression and anxiety are inferior when compared with those patients without comorbid anxiety or depression, patients with comorbid mental illness do improve. Surgical intervention will likely provide substantial relief for patients with anxiety and depression; however, the surgical expectations and likelihood of success should be adjusted for these patients. These results also lead to the question of whether the statistically significant differences in outcomes are clinically relevant, as the 2 cohorts usually only report small differences. It is possible that these differences in PROMs may not manifest in clinically relevant differences in pain and quality of life.

Surgical Complications

It has been hypothesized that preoperative depression and anxiety may lead to a higher risk of surgical complications. Particularly related to infections, the link between mental health status and surgical risk is clear. Reviews of general surgical literature have shown that preoperative depression increases risk of postoperative infections.^{25,26} The disruption of serotonin signaling in the brain that is characteristic of depression has been shown to produce immune system dysregulation.^{6,56} This dysregulation may be responsible for the link between preoperative depression and postoperative infection. For other outcomes, such as hospital readmissions or the need for revision surgery, the association with mental health status is unclear.

Studies of the impacts of mental health on postoperative complications from foot and ankle surgery are limited to total ankle arthroplasty and have produced mixed results. A large study of 8047 patients found that patients with depression who underwent TAA had significantly higher rates of nonhome discharge, extended length of stay, prosthetic complication, wound complication, prosthetic and superficial infections, and medical complications following TAA than patients without comorbid depression.⁷² On the contrary, a broader analysis of TAA complications analyzed a wide range of comorbidities, including depression and found that depression was not associated with a greater risk of postoperative complications.¹⁸ Although this study's sample size was smaller, it was still sizable ($n = 1024$), and the proportion of depressed patients was a predictable 22%. Although this investigation was not as focused on

depression, further research is needed into this association to provide more clear evidence.

The greatest evidence for a link between mental health diagnoses and postoperative complications is found in other orthopaedic subspecialty surgeries. A large investigation of 412 777 patients who underwent elective upper extremity or spine surgery found that patients with depression or anxiety experienced higher rates of complications, with 30.2% of patients with psychiatric diagnoses experiencing a complication vs 25.1% of patients without psychiatric diagnoses.⁸ All psychiatric diagnoses were included in the experimental cohort; however, depression and anxiety were the most commonly reported of these diagnoses.

An important consideration for the practicing surgeon is whether their patients are taking antidepressant medications prior to surgery. In particular, selective reuptake inhibitors for serotonin and norepinephrine (SSRIs and SNRIs) have been found to increase bleeding risk for surgical patients, especially when coupled with nonsteroidal anti-inflammatory drugs (NSAIDs).⁷ Patients with anxiety or depression who are treated with SRIs may be more likely to experience bleeding-related surgical complications; however, this has not been studied in the literature.

Future research is necessary into the association between preoperative anxiety and postoperative complications, as the available foot and ankle literature has only investigated depression. Additionally, the relevant foot and ankle research on surgical complications has focused on total ankle arthroplasty. Further research is warranted into the association between mental health status and complications of foot and ankle surgeries more broadly, to ensure that this association extends beyond total joint replacements.

Treatment

The modifiability of the negative impacts of depression and anxiety on postoperative outcomes has not been investigated for foot and ankle patients. Therefore, there is insufficient evidence to support the claim that preoperative treatment of depression and anxiety improves outcomes for foot and ankle patients. Despite this lack of evidence in the foot and ankle literature, investigations into this research question have been performed in other orthopaedic subspecialties. In the area of lumbar spine surgery, it was found that patients who experienced positive improvements in depression and anxiety postoperatively were more likely to meet the minimal clinically important difference than patients who did not demonstrate positive improvements in depressive or anxious symptoms.⁵⁴ A similar investigation focusing on lower extremity arthroplasty, not including TAA, also found that positive changes in depressive scores postoperatively were associated with better functional outcomes.²² Although these studies did not investigate any treatment variable, it did demonstrate that positive improvements in depression and

anxiety are associated with better outcomes; however, the direction of causation in this association is unclear.

Investigating the effect of treating preoperative depression, a study of total hip arthroplasty patients found that patients with preoperative depression who were treated with psychotherapy had less postoperative narcotic usage, less health care utilization and a lower likelihood of needing 1-year revision surgery than patients with depression who received no preoperative treatment.⁵⁹ Another investigation into the treatment of preoperative depression found that patients with treated and untreated depression reported similar postoperative physical function scores; however, patients with untreated depression reported a smaller magnitude of improvement.⁴¹ These results of investigations into the potential modifiability of preoperative depression indicate a need for further research into this question. In addition, these investigations have focused solely on depression and future research should also investigate the modifiability of preoperative anxiety.

Because there is limited evidence that preoperative treatment of anxiety and depression impacts surgical outcomes and because there is ample evidence that outcomes of patients with depression and/or anxiety undergoing orthopaedic procedures demonstrate inferior surgical outcomes, we do generally recommend that all patients be considered for psychological or psychiatric evaluation before surgery. Screening tools such as PROMIS, PHQ-9, and GAD-7 could be used to identify patients with depression and/or anxiety. This consideration, and not universal recommendation, for evaluation is based on the fact that for many patients who experience both musculoskeletal pain and depression and/or anxiety, surgical treatment alone may improve their mental health, as supported by multiple studies that demonstrate improvement in depression and anxiety scores postoperatively.^{22,45,54}

It could be hypothesized, although it is unproven in the literature, that patients with more severe depression or anxiety may have a lower likelihood of success than patients with mild or moderate depressive or anxious symptoms. We suggest screening patients with PROMIS scoring, the PHQ-9, or GAD-7 to identify mental illness and to consider referral for psychiatric evaluation. Patients with severe or moderately severe symptoms may be approached with greater concern regarding their likelihood of success. Future research should be performed to compare the surgical outcomes of patients with varying severities of preoperative depression and anxiety to gain a more complete understanding of how severity of mental illness impacts outcomes.

Conclusion

Depression and anxiety are common clinical diagnoses, and a large proportion of patients with musculoskeletal pain report heightened depressive or anxious symptoms.

The link between depression and anxiety and inferior outcomes of orthopaedic surgeries has been well-established in most subspecialties, including more recently in the foot and ankle literature. There appears to be a higher prevalence of depression and anxiety in patients with foot and ankle pain; however, this may only be true for patients with widespread, nonlocalized pain. For patients undergoing foot or ankle surgery, a clear link has been established between preoperative depression and anxiety and both greater preoperative pain and inferior postoperative pain-related and functional outcomes. The links between these diagnoses and other outcomes such as infection, readmission, and revision are less clear related to foot and ankle surgery but have been described in other orthopaedic specialties. Future research is needed to understand how the severity of depression and anxiety impacts surgical outcomes so that surgical screening tools may be used to identify good surgical candidates.

Ethical Approval

Ethical approval was not sought for the present study because it is a review article involving no interaction with human participants.

Declaration of Conflicting Interests

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ORCID iD

Dominic S. Carreira, MD,  <https://orcid.org/0000-0003-0887-7424>

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