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AOA Critical Issues

The Role of Emotional Health in Functional Outcomes After Orthopaedic Surgery: Extending the Biopsychosocial Model to Orthopaedics

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Orthopaedic surgery successfully restores physical function and relieves pain in millions of Americans each year. In fact, orthopaedic surgery to treat arthritis of the knee and hip and lumbar spine conditions is among the top five surgical procedures by cost and volume in the United States. Despite the overwhelming success of orthopaedic procedures, functional improvement after surgery varies widely. Poor functional outcomes have been correlated with poor emotional health, such as anxiety, depression, poor coping skills, and poor social support^{1,2}. The variation in functional outcomes exists despite state-of-the-art surgical techniques and is independent of post-operative complications. Furthermore, suboptimal functional outcomes associated with poor emotional health have been reported in a variety of orthopaedic specialties, including spine surgery, trauma care and/or fracture repair, rotator cuff repair, sports-related surgery (e.g., anterior cruciate ligament [ACL] reconstruction), total hip replacement, total knee replacement, and hand and upper extremities surgery. It is well established

that the emotional health of the patient influences the outcome of many common orthopaedic surgeries.

Spine

There is a large body of literature on the influence of psychosocial factors on outcomes following lumbar spine surgery. In particular, many researchers have identified the need to isolate the specific factors and to assess interventions to address pain and depression in the perioperative period. Presurgical biopsychosocial variables can predict patient outcomes and provide a possible focus for targeted interventions³. Depression has been associated with poorer short-term outcomes after lumbar spinal stenosis surgery, and Sinikallio et al. suggested that routine pre-operative assessment of depression might be beneficial in practice⁴. Better emotional health (i.e., a higher mental component score on the Medical Outcomes Study 36-Item Short-Form Health Inventory Survey [SF-36]) before surgery predicted greater pain relief and functional outcomes up to two years after

Disclosure: One or more of the authors received payments or services, either directly or indirectly (i.e., via his or her institution), from a third party in support of an aspect of this work. In addition, one or more of the authors, or his or her institution, has had a financial relationship, in the thirty-six months prior to submission of this work, with an entity in the biomedical arena that could be perceived to influence or have the potential to influence what is written in this work. No author has had any other relationships, or has engaged in any other activities, that could be perceived to influence or have the potential to influence what is written in this work. The complete **Disclosures of Potential Conflicts of Interest** submitted by authors are always provided with the online version of the article.

spinal fusion⁵. Finally, low preoperative mental component scores have been linked to higher levels of postoperative dissatisfaction in patients who had spinal surgery⁶.

Trauma Care and/or Fracture Care

Ongoing disability after orthopaedic trauma has been related in part to persistent pain and posttraumatic stress disorder, which could be addressed in postoperative rehabilitation⁷. Other authors noted that psychological factors were associated with persistent pain after orthopaedic trauma⁸ and that postinjury psychological distress is often present after trauma⁹. In a study of 463 patients with severe injuries to the lower extremities, the presence of depression, poor physical function, and greater pain was associated with lower patient satisfaction, whereas patient demographics, type of treatment, or injury characteristics were not¹⁰.

Rotator Cuff Repair

Patients' preoperative expectations have been correlated to actual self-assessed functional outcome in patients with rotator cuff repairs¹¹. Greater preoperative function and higher general health status predict greater satisfaction¹². Compared with men, women reported a greater level of emotional difficulties on the emotions domain of the Western Ontario Rotator Cuff Index (WORC) questionnaire and had poorer functional outcomes after rotator cuff decompression or repair¹³.

Sports-Related Surgery (ACL Reconstruction)

The importance of having the psychological mindset of an athlete both before surgery and during the rehabilitation process was emphasized in a review of rehabilitation and subsequent participation in competitive sports following ACL reconstruction. The authors noted that fear of re-injury was an important psychological factor preventing the return to the previous level of physical activity¹⁴. The importance of emotional health was also illustrated in recent studies on the psychological aspects of returning to high-level competitive sports after ACL reconstruction surgery. In particular, higher feelings of self-efficacy before surgery positively influenced the recovery and satisfaction of the patient after surgery^{15,16}. When compared with an age and sex-matched normal population, patients with chronic ACL insufficiency had significantly lower scores on the SF-36, the results of which are considered to be a measure of health-related quality of life¹⁷.

Total Hip Replacement

Depression, poor emotional health (low mental component score on the SF-36), and symptomatic osteoarthritis of another joint have been reported to predict dissatisfaction after one year after surgery in a study of 850 patients who underwent total hip replacement¹⁸. Data from the Swedish Hip Arthroplasty Register demonstrated that depression and anxiety scores were strong predictors of degree of pain relief and patient satisfaction. The authors noted that an "...appropriate assessment of emotional health may enable a modification in the way patients are managed."¹⁹ Preoperative quality-of-life

scores have been shown to impact quality-of-life scores after total hip arthroplasty in a cohort of patients three years after the procedure was performed²⁰. Lastly, a recent investigation reported an appreciable influence of depression and somatization scores on patient-perceived outcome after total hip replacement²¹.

Total Knee Replacement

Research on functional outcomes after total knee replacement surgery emphasizes the important influence of emotional health on pain and postoperative functional outcomes after total knee replacement surgery. In the 1990s, the Patient Outcomes Research Team (PORT) demonstrated that total knee replacement provides significant pain relief and, on the average, improves function six and twelve months after surgery²². The PORT investigators reported, "Those patients who had lower mental component scores before surgery were less likely to improve physically."²² More recently, our analysis of a second U.S. sample of patients having total knee replacement revealed two distributions after total knee replacement: one for high scores regarding emotional health (SF-36 mental component summary score ≥ 50), and one for low scores regarding emotional health (SF-36 mental component summary score < 50). The majority of patients had strong emotional health and reported significant improvement in function after total knee replacement, while the one-third of patients who had poor preoperative emotional health reported minimal functional gain after the operation²³. In addition, we believe that emotional health plays a role that is independent from pain tolerance in poor postoperative outcome. We previously reported that a subset of patients with depression and/or anxiety reported significant postoperative pain relief, demonstrating that perceived pain can improve despite emotional challenges^{1,23}. It is also likely that patients with low pain tolerance, whether they have strong emotional health or poor emotional health, will report poorer postoperative gains.

Hand and Upper-Extremity Conditions

A large volume of literature exists on the role of emotional health in disabling conditions of the upper extremities. Variability in the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire—the most widely used upper-extremity-specific outcome measure—has been linked to psychological factors such as depression²⁴. The authors point to the role of psychological factors in patient self-assessment of disability and to the impact that emotional health assessment could have on a physician's decision to perform surgery. The importance of psychological evaluation in patients who need hand or arm surgery has been recently highlighted²⁵. The presence of depression is likely to explain some of the variation in pain and disability experienced by patients after minor hand surgery²⁶. Depression also predicts satisfaction and perceived disability in patients with carpal tunnel syndrome²⁷. To address the emotional health needs in these patients, Ring et al. recommend collaboration between clinician and psychologist to improve patient outcomes²⁸. Beyond surgical outcome, psychosocial

factors have been identified as one predictor of taking sick leave after endoscopic carpal tunnel release²⁹. In addition, emotional stress predicted subsequent pain and poorer work status in patients who had a diagnosis of a disorder involving the upper extremity³⁰.

Across orthopaedic specialties and procedures, improved patient satisfaction correlates with greater functional gain after surgery. In addition, stronger emotional health is related to greater functional improvement. Of clinical importance, patients at risk of having suboptimal functional improvement as a result of having poor emotional health can be identified preoperatively. An important question is whether we can improve patient functional outcome after surgery for patients with poor emotional health by identifying high-risk patients preoperatively and placing them in a different post-operative pathway. The following discussion expands our knowledge of the relationship between emotional health and functional gain and presents a potential intervention to offer support to those who are at risk of having a suboptimal outcome.

Extending the Biopsychosocial Model to Orthopaedics

The biopsychosocial health model was introduced by George Engel to complement the traditional biological model of disease that views a disease solely as a consequence of biological malfunction³¹. The biopsychosocial model offers a multidimensional perspective by recognizing the impact of psychological and social factors (emotional states, beliefs, social factors, and behaviors) on the development and outcomes of illness and disease³¹. The biopsychosocial model has had a significant impact on research and on patient care. For instance, psychological factors can greatly affect chronic conditions, such as persistent pain, depression, or irritable bowel syndrome. Conversely, psychosocial factors can predispose patients to biological illnesses (e.g., lack of exercise and poor diet leading to obesity in the case of an individual with a predisposition to the development of type-2 diabetes).

In orthopaedics, the biopsychosocial health model has impacted the management of musculoskeletal conditions, such as spine disorders³². However, outcomes after treatment have been primarily limited to measures of biological functions, and return-to-health is viewed as a symptom-free state. For a patient having a chronic disease, such as osteoarthritis, return-to-health may be defined broadly to include pain-free walking, improved emotional well-being, and improved feelings of self-efficacy with regard to physical activity. In the introduction to their paper on the interactive biopsychosocial model, Lindau et al. described the view on health as “an emphasis on positive themes of happiness, social and emotional well-being, and quality of life.”³³ The authors suggest that the interactive biopsychosocial model is a good model for research on health outcomes in chronic diseases, as it takes into account the impact of changes in biological, psychological, and social factors as well as their dynamic interaction throughout the course of the disease. The shift from the biomedical view of arthritis to one that incorporates psychological factors has been the subject

of a recent review pointing to the importance of emotional, cognitive, behavioral and social factors in arthritis pain and disability. This same review also emphasizes the need for more research and for the dissemination of current knowledge to the clinical practice³⁴. Thus, the interactive biopsychosocial model of knee osteoarthritis can be readily extrapolated to the care of the patient who is undergoing knee replacement.

Emotional Health Is Important to Total Knee Replacement Care

Osteoarthritis is the number-one cause of disability and limited mobility in the United States. The disease affects more than 21 million adults, 50% of whom are older than sixty-five years and predominantly women. There is no cure for advanced osteoarthritis. Total knee replacement is routinely and successfully used to relieve pain and improve function in patients with severe, symptomatic osteoarthritis of the knee. Total knee replacement is the most common and costly procedure in the Medicare budget. Utilization of total knee replacement is projected to increase 670% by 2030³⁵. Patients with osteoarthritis who choose total knee replacement have significant functional limitation, with a mean preoperative physical function score (physical component summary of the SF-36) of more than two standard deviations below that of healthy adults²³. The fastest growing subgroups of users of total knee replacement—working adults and people younger than sixty-five years of age—currently represent 40% of patients who undergo total knee replacement³⁶. Working adults with osteoarthritis report limited activities 23% of the time (versus 9% for working adults who do not have osteoarthritis) and lose eight more annual workdays compared with adults without osteoarthritis. Adjusted for age, sex, job characteristics, and comorbidities, the total per-employee cost is \$1800 in benefits and \$7454 in loss of productivity, for a total of more than \$9000 per person per year³⁷. In addition, total knee replacement is cost-effective and increases quality-adjusted life years for Medicare patients from 6.8 to 7.96, with an incremental cost-effectiveness ratio of \$18,300 per quality-adjusted life year³⁸. Thus, successful total knee replacement that returns patients to optimal function contributes significant individual and societal benefits.

With an aging population and a rising number of total knee replacement procedures among working adults, the need to focus on optimizing functional outcome after total knee replacement has become critical. Of interest, a recent study found that the physical demands of a patient's job had a moderate influence on the patient's ability to return to work following a primary total knee arthroplasty. However, the authors noted that certain characteristics of the patient, such as a higher preoperative mental composite summary score on the Medical Outcomes Study 12-Item Short-Form Health Inventory Survey (SF-12) and a higher level of motivation (sense of urgency to return), increased the likelihood of return to work³⁹. Traditionally, orthopaedists focus on optimal implant material, surgical technique, and postoperative rehabilitation to ensure optimal surgical outcome after total knee replacement. However, it is

likely that optimal postoperative rehabilitation after total knee replacement will need to address psychological factors⁴⁰. A better understanding of the relationship between psychological factors, osteoarthritis, and outcome after total knee replacement will be instrumental in optimizing the preoperative and postoperative care of osteoarthritis patients.

Emotional Health and Functional Gain After Total Knee Replacement

Total knee replacement is a consistently successful surgical procedure to relieve pain associated with advanced osteoarthritis of the knee⁴¹. In addition, research has demonstrated a significant improvement in the SF-36 physical component score (mean change of 11 points) at two years after the performance of total knee replacement²³. Another study reported improvements in the WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) knee-specific function and pain scores, from 24 to 51 and from 38 to 64, respectively⁴². While the majority of the improvements are documented by six months after surgery, the function scores peak at twelve months^{43,44}.

However, despite excellent surgical outcomes and uniform pain relief after total knee replacement, there is still significant variation in functional improvement after total knee replacement. For example, a multisite study reported that, at twelve months after total knee replacement, function actually declined in 19% of participants while other patients reported functional gains more than three times the average⁴⁵. Variation in outcome may be due in part to inconsistent access to emotional and physical self-care support. Self-care support is required to address fragile emotional and physical health, both of which are known to negatively affect outcomes after total knee replacement. Patients who had poorer preoperative emotional health (mental component score <50) had less improvement in terms of pain and physical function twelve months after total knee replacement in comparison with patients with high preoperative emotional health (mental component score ≥50). However, large numbers of patients with poor emotional health reported no improvement in the physical component score at twelve months²³. We also reported that a poor mental component score was associated with significantly greater trait anxiety (i.e., a predisposition to react with anxiety in stressful situations) and depression, and poorer social support and coping skills¹.

International studies of patient cohorts concur that emotional health predicts function after total knee replacement, but those studies report varying levels of significance. Poorer mental well-being (higher mental component scores) has been reported to predict worse WOMAC outcome twenty-four months after total knee replacement⁴⁶ and more dissatisfaction after surgery⁴⁷. The presence of social support, a low level of pain, and better mental component scores before surgery has been associated with better outcomes (pain and function) and improved health-related quality of life after surgery⁴⁸. In one study, patients who experienced psychological distress before total knee replacement had a slightly worse

outcome twenty-four months after surgery in terms of pain, although their function score was not different from that of the group of patients without distress; the changes in pain and function scores were not significantly different between the two groups⁴⁹. In another study of patients having total knee replacement, patients who had preoperative depression and anxiety reported more pain at one year after surgery than did patients who did not have preoperative depression and anxiety⁵⁰. A recent review of 551 consecutive patients from a Canadian registry revealed that a poorer mental health state at the time of surgery was associated with worse long-term (three to four years) outcomes (WOMAC and SF-36) after total knee replacement⁵¹. Across studies, 13% to 32% of patients report emotional health issues at the time of total knee replacement. It is important to note that, while the relationship between emotional health and functional gain after total knee replacement appears to be important, the mechanism of action is not understood.

Addressing the Emotional Health of the Patient in the Perioperative Period

At the University of Massachusetts Medical School, we are currently leading Joint Action, a prospective randomized trial funded by the National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS 5R01AR054479-04), in which patients who undergo total knee replacement are supported both physically and emotionally during the perioperative period for the purpose of assessing how this supportive intervention affects functional gain after total knee replacement. While this trial focuses on patients who are undergoing primary total knee replacement, the concepts can be extrapolated to other orthopaedic patients. The results of this randomized controlled trial will have important implications to inform patient care before total knee replacement and rehabilitation after total knee replacement.

Self-Efficacy and Patient Function

A focus on patient self-efficacy in arthritic knee care and physical activity illustrates the shift from a “disease model” to a “biopsychosocial model.” Self-efficacy is a person’s belief in his or her ability to succeed in a particular situation⁵². A person can develop self-efficacy through mastery of experiences (i.e., performing a task successfully), social modeling (i.e., seeing a similar person succeed at a task), and/or social persuasion (i.e., receiving positive encouragement to achieve a goal). Psychological responses, such as moods, emotional states, physical reactions, and stress levels, can impact how a person feels about his or her abilities, and therefore self-efficacy, in a particular situation. According to Bandura, “many chronic health problems are partly the cumulative products of unhealthy behaviors and harmful environmental conditions.”⁵³ Accordingly, the updated American College of Rheumatology (ACR) guidelines for the care of patients with osteoarthritis state that patient self-care education should be a part of the treatment plan⁵⁴. ACR recommendations are based on studies reporting reduction in knee pain and improved function, a decrease in the number of

physician visits, an increase in physical activity, and an improvement in the overall quality of life of patients who followed self-management programs such as the Arthritis Self-Management Program (ASMP) developed by Lorig et al.⁵⁵⁻⁵⁹. Of importance, ASMP benefits were reported to remain after one year⁵⁵⁻⁵⁹. The ACR also recommends the use of personalized social support either directly or through telephone calls. Such interventions have proven successful in relieving pain and improving function⁶⁰ as well as in improving the perception of self-efficacy and in decreasing depression⁶¹. In addition to the health benefits conferred by self-management programs, these programs are also successful in reducing health service utilization, thus lowering the cost per patient⁶⁰. Multiple-component support programs train patients in pain-coping skills and teach them how to reduce anxiety; in addition, through the use of psychological interventions or lifestyle behavioral weight-loss interventions, these programs are instrumental in reducing the pain and disability associated with rheumatoid arthritis and osteoarthritis⁶².

Research in total joint replacement has also revealed a correlation between six-week postoperative scores regarding self-efficacy and long-term improvement in physical function⁶³. In patients having total knee replacement, greater anxiety and depression have been associated with a poorer perception of self-efficacy¹. In summary, we hypothesize that focused support to enhance feelings of self-efficacy with regard to knee exercise and physical activity may improve physical function after total knee replacement.

Self-Efficacy for Physical Activity

Physical activity and exercise benefit general health and well-being and are recommended in the rehabilitation of knees after total knee replacement or of knees with osteoarthritis. Moderate-intensity physical activity can benefit patients with osteoarthritis by reducing pain, improving function, reducing the risk of disability, improving mental health, and supporting weight maintenance^{64,65}. A combination of diet and aerobic exercise can result in significant improvements in self-reported physical function, six-minute walk distance, stair-climb time, and knee pain^{66,67}. In addition, regular physical activity can improve one's quality of life, function, and maintenance of independence⁶⁸. Physical activity and exercise during the rehabilitation period after total knee arthroplasty can also improve global function, benefit other joints with osteoarthritis, and help maintain global health⁶⁹. However, several factors may limit activity after surgery, including comorbid conditions such as obesity or depression. These conditions may limit activity during the postoperative rehabilitation period, a time that is critical to the restoration of function. Therefore, our proposed intervention supports self-efficacy with regard to exercise and physical activity in the perioperative period for the purpose of improving functional gains after total knee replacement.

Joint Action—An Intervention Trial

We recently concluded enrollment in this NIAMS-funded randomized controlled trial to support the patient's periop-

erative perception of self-efficacy and optimize daily exercise, physical activity, and function after total knee replacement. This research involves (1) the implementation of real-time assessments of patient-reported pain and function in the Arthritis and Joint Replacement Center of UMass Memorial Medical Center to guide patient and surgeon decisions and (2) a telephone-guided support program to reinforce exercise, physical activity, and self-efficacy in the postoperative period. The telephone intervention includes twelve sessions (four preoperative calls and eight postoperative phone calls) and uses patient-centered counseling to identify individual goals on the basis of patient motivations and needs. The intervention is delivered in English or Spanish, according to the preference of the patient. To date, more than 80% of patients undergoing total knee replacement have been willing to participate in the trial and 100% of participants completed the intervention and the study.

Data analysis from the Joint Action randomized controlled trial will determine if patients with telephone support have greater feelings of self-efficacy and more uniform functional gain at six and twelve months after surgery. In particular, we will evaluate the effectiveness of supportive intervention among patients who have depression, anxiety, and other emotional health conditions as they undergo total knee replacement. If we are successful, we hope to translate the trial program to orthopaedic practice through standardized patient support software. In the future, total knee replacement rehabilitation may be tailored to a patient's physical and emotional health and facilitated through enhanced perceptions of self-efficacy with regard to daily exercise and activity.

Conclusions

Orthopaedic surgeons provide some of health care's most effective interventions to improve quality of life and physical activity. However, both the orthopaedic literature and the broader chronic disease literature underscore the importance of addressing emotional health conditions prior to the performance of orthopaedic procedures. Surgeons must be aware that the emotional health of the patient influences the patient's physical recovery after surgery. Patients who, because of emotional health challenges (such as depression or grieving), are at risk of having less functional improvement after orthopaedic surgery can be identified preoperatively. More research is needed to define perioperative strategies that will simultaneously support the physical and emotional health of our patients to ensure optimal functional gain after technically successful surgery. Successful postoperative care may require different care pathways with different levels of support, depending on the patient's preoperative emotional health. Such pathways may involve teams of clinicians, including physical therapists, behavioral psychologists, and other support professionals. Finding practical financial and operational models to follow tailored pathways of care will be challenging. Our future research will evaluate cost-effective strategies to accomplish this goal. ■

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