Chapter 34
Managing Cost and Quality in Musculoskeletal Care

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Introduction

The musculoskeletal system consists mainly of bone, muscle, tendon, ligament, and cartilage that together support and protect the body while also providing the foundation for movement [1]. Musculoskeletal disorders (MSD) affect one to multiple above mentioned musculoskeletal system components, occur in people of all ages, and result from both acute and chronic processes [2]. These disorders are extremely common and will only increase as our population continues to age.

In the 2015 National Health Interview Survey (NHIS), 124.1 million adults (persons age 18 and over) in the United States reported a MSD. This number is staggering, equating to roughly one in two adults [3]. Moreover, the rate of chronic MSD in adults is greater than the rates of both chronic circulatory and respiratory disorders, and the associated costs are substantial and have far-reaching implications on societal burden. Total MSD-related costs are divided into direct and indirect costs. Direct costs include those incurred in the diagnosis and treatment phases of care, such as hospital services (emergency, inpatient, and outpatient), physician and advanced practice provider outpatient services, prescription costs, and administrative costs. Indirect costs include those incurred through productivity loss as a result of disability or death [3, 4]. Between 2012 and 2014, the average total cost to treat MSD in the United States was $322 billion per year [3].

Through education and research, the quality of musculoskeletal care improves and associated cost decreases. Unfortunately, research funding for MSD is severely

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A. J. Schoenfeld et al. (eds.), *Principles of Orthopedic Practice for Primary Care Providers*, https://doi.org/10.1007/978-3-030-74625-4_34

lacking despite the clear healthcare impact. In terms of NIH funding, between 2012 and 2016, MSD research received $7.9 billion, while heart and circulatory disorders research received $23.1 billion [3]. For the long-term sustainability of our healthcare system, we must advocate for increased MSD research funding. In the short term, education, preventative strategies, and interdisciplinary collaborative efforts are key components to increasing quality while decreasing costs. In this chapter, we will highlight these key components as we discuss common MSD and the recommended diagnoses and treatment pathways. The information provided is intended to help streamline the care of patients suffering from MSD and improve the cost-effectiveness of care delivery.

Prevalence

According to the 2015 NHIS, roughly one in two adults living in the United States reported a MSD [3]. As the national death rate continues to decline, people will live longer, and the prevalence of MSD will only increase. In 2015, in the United States, life expectancy was 79.8 years, and by 2050 estimates project life expectancy to be as high as 85.9 and 93.3 years for men and women, respectively [3].

In 2012, arthritis, chronic joint pain, and low back pain were all listed in the top five of medical conditions reported. These MSD result in direct costs to the healthcare system but also in indirect costs due to the activity limitation and disability that commonly results [3]. Accordingly, of the 1.225 billion medical diagnoses made in 2013, 235.1 million, or 19.2 percent, were made for a MSD [3]. In addition, 10–20 percent of primary care visits occur for evaluation of musculoskeletal complaints [4]. In order to provide quality care and reduce unnecessary costs, it is important for primary care, emergency medicine, and hospitalist providers to be comfortable with appropriate diagnoses and treatment of MSD. In the remaining sections, we will outline appropriate steps in prevention, diagnosis, and treatment of three of the most common MSD: low back pain, osteoarthritis, and osteoporosis and fracture.

Low Back Pain

Back pain presents in many forms that can be differentiated based on location of pain, chronicity of symptoms, and cause. Low back pain is typically defined as back pain in the region distal to the 12th rib and proximal to the inferior gluteal folds [4, 5]. Back pain lasting less than 6 weeks is typically described as acute, between 6 and 12 weeks as subacute, and longer than 12 weeks as chronic [4]. On occasion, a specific pathoanatomic cause for pain is identified, but unfortunately, back pain is nonspecific in 90 percent of patients [4]. Patients with low back pain generally fit into one of three categories: nonspecific low back pain, back pain with radiculopathy, and specific back pain, including patients with associated neurologic deficits [6].

Most people will experience back pain at some point in life. In 2015, 72.3 million adults in the United States reported chronic back pain [3]. In addition, a 2002 survey revealed roughly 2 percent of all physician visits occurred due to low back pain [7]. It is important for frontline providers to identify patients at risk for back pain, to categorize patients appropriately, specifically looking out for red flag presentations and symptoms, and to subsequently initiate the appropriate diagnoses and treatment pathways.

Prevention

As with most disease processes, prevention typically results in reduced costs in comparison to disease treatment. Preventative measures focus on lifestyle modifications, which reduce comorbid conditions that frequently complicate and exacerbate MSD. Low back pain has been associated with excessive weight/obesity and smoking history [8, 9]. Shiri et al. conducted meta-analyses to evaluate the association between obesity and low back pain, and also smoking and low back pain. Analyses revealed that overweight/obesity increased the risk of low back pain while also having the strongest association with seeking care. In addition, analysis revealed a higher incidence and prevalence of low back pain in current and former smokers [8, 9]. Interestingly, in the meta-analysis conducted by Steffens et al., education and exercise were found to be effective in preventing low back pain. As a society, it is important that we focus on preventative measures, such as education, lifestyle modifications, ergonomics, and exercise, as a means to reduce both the incidence and prevalence of MSD [10]. Furthermore, the connection between comorbid disease processes is not always overly apparent to patients, and must be emphasized.

Diagnosis

Patients with low back pain generally fit into one of the three categories: nonspecific low back pain, back pain with radiculopathy, and specific back pain. Specific back pain is rare, identified in roughly 5 percent of patients with low back pain [6]. However, frontline providers must be aware of red flag presentations and/or symptoms that warrant expedited, advanced work-up to rule out conditions such as fracture, tumor, infection, or cauda equina syndrome. Red flag presentations and symptoms include major trauma (or minor trauma in the elderly), night pain associated with unexplained weight loss, unrelenting pain associated with recent fevers or chills, bacterial infection, intravenous drug use, saddle numbness, urinary retention or incontinence, and severe, progressive lower extremity neurologic deficit [11].

In patients with nonspecific low back pain without red flag presentations and/or symptoms, the conservative approach to diagnosis and treatment is preferred [6]. The natural history suggests improvement over time; however, recurrence is

common, with a lifetime recurrence rate of roughly 85 percent, with 5–10 percent of patients developing chronic symptoms [4, 11]. A thorough history and physical exam is essential in order to properly categorize patients and determine appropriate treatment. X-rays are typically obtained as part of the initial work-up; however, there is a lack of evidence to prove that obtaining X-rays improves patient outcomes [6, 12]. Deyo et al. conducted a prospective study to assess the effects of omitting spine X-rays in patients presenting with low back pain. 101 patients were randomized into one of the two groups: initial spine X-rays or education with subsequent spine X-rays with failure to improve. Analysis revealed no serious diagnoses missed and similar symptom resolution and functional improvement between groups. Furthermore, radiology costs were substantially decreased in the education group [12].

Treatment

For patients with nonspecific low back pain, conservative treatment is preferred. Conservative treatment options are vast and include education, activity modification, exercise therapy, manipulation, bracing, medications, and injections [11]. However, little is known in regard to the efficacy of these treatment options. Lin et al. conducted a systematic review assessing the cost-effectiveness of treatments for low back pain. For subacute and chronic low back pain, interdisciplinary rehabilitation, exercise, acupuncture, spinal manipulation, and cognitive behavioral therapy were found to be cost-effective, while massage alone was unlikely to be cost-effective [13].

When treating back pain, the primary objective of the frontline provider must be to determine if the patient has red flag presentations and/or symptoms based on history and physical exam. If so, expedited, advanced work-up must occur, with involvement of the subspecialist if surgical intervention is warranted. If nonspecific back pain, or back pain with radiculopathy, is identified, conservative treatment can be pursued. Patients must first be educated on the natural history of low back pain. Additionally, X-rays are likely not needed initially, as forgoing initial imaging does not lead to serious missed diagnoses or delayed functional improvement.

Osteoarthritis

Osteoarthritis (OA) is the most common joint disorder, primarily affecting the hips, knees, and hands, and is a leading cause of disability in the United States [14–19]. OA is a progressive degenerative joint disease affecting the joint cartilage, synovium, and subchondral bone [15, 20]. Although the primary etiology remains unclear, there is a common endpoint of joint pain and stiffness, leading to functional limitations and disability [19, 20]. A recent systematic review reported the overall

prevalence of OA in hand at 43%, knee at 23.9%, and hip at 10.9% [21]. The prevalence of clinically symptomatic OA, when both joint pain symptoms and radiographic OA are present, increases with age and is predicted to rise from 40 million by 2030 to 78 million by 2040, as the US population continues to age [22, 23]. OA also varies by sex, as females comprise 78% of adults with OA [3, 24]. The high prevalence of OA results in a significant economic burden through both direct and indirect costs.

In 2013, OA was diagnosed in 2.4% of ambulatory visits and 10% of all hospitalizations for any cause [3]. Direct medical costs totaled 65.5 billion dollars annually in 2013, while indirect earning costs have been estimated at 71.3 billion dollars in the same year [3]. The increasing prevalence and concomitant high cost of OA treatment and resulting disability underscore the importance for frontline providers to identify at-risk patients and to have a sound treatment framework that emphasizes prevention and early intervention.

Prevention

The etiology of OA is multifactorial, with non-modifiable risk factors of age and sex being the strongest predictors of disease development. The propensity for older women to have increased incidence of OA after the age of 65 is thought to be related to hormonal changes affecting the volume of cartilage [18, 24]. Previous joint injury is also a strong non-modifiable risk factor, with some studies reporting a fourfold increase in post-traumatic arthritis [25].

The most established modifiable risk factor for onset and progression of OA in the hip and knee is obesity [26–29]. Obesity has been shown to increase the risk for knee OA by threefold [30]. In addition to the increased mechanical load transferred through the joint, there is evidence that an inflammatory process mediated by adipokines may also play a role in OA onset and progression [31]. Furthermore, the risk of OA development has been shown to be proportional to the number of years spent at high BMI, highlighting the importance of disease prevention through weight loss [32].

Diagnosis

OA should be suspected in older patients with pain related to specific joint usage. The pain is typically worse with weight-bearing and can present as stiffness after a period of immobility that resolves within minutes [32]. The radiographic features of osteoarthritis include joint space narrowing, osteophyte formation, and subchondral sclerosis and cysts [15]. It is important to rule out other potentially red flag causes of perceived joint pain, such as septic arthritis, septic bursitis, crystalline arthropathy, inflammatory arthropathy, or bone pathology [33]. Additional diagnostic

imaging with ultrasound, computed tomography, and magnetic resonance imaging are not necessary in the initial work-up of a patient with osteoarthritis; however, these imaging techniques can help rule out red flag causes of joint pain if they are suspected [32].

Treatment

Three treatment modalities exist for osteoarthritis: non-pharmacologic, pharmacologic, and surgical. Regardless of treatment modality, all recommendations should be patient-centered through shared decision-making. Non-pharmacologic treatment recommendations by both the American Academy of Orthopaedic Surgeons (AAOS) and the American College of Rheumatology/Arthritis (ACR) in 2019 strongly recommend exercise for all patients with hand, hip, and knee arthritis [34, 35]. Self-management programs for OA treatment have been found to be the most effective interventions for managing OA over the long term. These programs combine risk factor optimization, wellness, pain coping, and exercise options, which aid in arthritis care [36].

As previously mentioned, obesity is a risk factor for the development and progression of OA. Further studies have shown a dose response for weight loss and functional improvement in OA symptoms with weight loss of 11% improving OA symptoms by 50% [37]. The use of assistive devices, such as a cane for hip and knee OA, tibiofemoral knee braces for knee OA, and hand orthoses for hand OA, is generally cost-effective and allows for improved daily function and limitation of disability [34, 35].

Pharmacologic treatments of OA are used in combination with non-pharmacologic treatments. As a first-line treatment, the AAOS and ACR both recommend the use of oral nonsteroidal anti-inflammatory drugs (NSAIDs) [34, 35]. If the use of oral NSAIDs is not recommended due to concerns over gatrointestinal toxicity or concurrent coritcosteroid or anticogulant use, then the AAOS recommends acetominophen, topical NSAIDs with the addition of a gastroprotective agent, or a COX-2 specific agent [15, 35]. The use of glucocorticoid intra-articular injections is widely used for knee OA. However, a recent Cochrane review outlines the short-term efficacy of such treatment, revealing only slight benefit for 1–6 weeks [38]. The ACR recommends intra-articular glucocorticoids for hip OA and knee OA, while the AAOS only recommends intra-articular glucocorticoids for hip OA [34, 35, 39]. Alternative intra-articular injections with hyaluronic acid have also been studied with a recent meta-analysis of data from only double-blinded placebo-controlled trials showing no clinically important difference [40]. These treatments are often costly to the patients and lack clinical benefit. Finally, opioids are often used by the frontline provider given the chronic pain that accompanies OA [41]. However, the current evidence-based guidelines from the AAOS and ACR do not recommend opioids for treatment of symptomatic OA of the hip, knee, or hand [34, 35]. Lastly, referral to an orthopedic surgeon to consider surgical intervention for end-stage OA

with a total joint arthroplasty should be reserved for patients who have exhausted the abovementioned conservative treatment modalities and who have optimized their health status by improving modifiable risk factors that impact arthritis progression and total joint replacement success (i.e., obesity, diabetes, smoking) [42].

Osteoporosis and Fracture

Osteoporosis is a skeletal disorder characterized by microarchitectural degradation leading to decreased bone strength predisposing to increased fracture risk [43, 44]. The National Osteoporosis Foundation (NOF) estimates that nearly 10 million US adults have osteoporosis and 43 million have low bone density [45]. While 50 percent of women are likely to experience a fracture related to osteoporosis in their lifetime, fragility fractures also occur in 20 percent of men [46]. Osteoporotic fracture in long bones most commonly occurs in the spine, proximal femur, and distal forearm and portends future fragility fractures. In contrast, fracture of fingers, toes, skull, and face is not associated with underlying bone strength [43, 47]. The impact of these fractures on patient quality of life ranges from full recovery to disability and death [47]. Moreover, a single fragility fracture of the hip or spine increases the risk of a future fragility fracture by 2.5-fold and 2-fold, respectively [47, 48]. Hip fracture has been shown to increase all-cause mortality in both sexes, with an almost twofold increase in mortality persisting greater than 8 years after the injury, even when controlling for comorbidities and lifestyle factors [49].

The public health burden of osteoporotic fractures becomes more clear in the context of a recent review of hospitalizations for osteoporotic fractures in postmenopausal women. The review found that these admissions are more common than stroke, myocardial infarction, and breast cancer [50]. Osteoporotic fractures primarily occur in older populations who often rely on Medicare for their insurance coverage. An analysis of the financial burden of osteoporosis in the United States found that Medicare pays for approximately 80 percent of the annual 432,000 hospitalizations, 2.5 million office visits, and 180,000 nursing home admissions [46, 47]. Furthermore, the estimated cost of osteoporotic fracture care is expected to reach $25 billion in 2025 [51]. Given both the medical and economic burden of osteoporotic fractures, it is important for frontline providers to have an understanding of risk factors, diagnostic variables, and treatment strategies for this common disease.

Risk Factors and Diagnosis

Patients are commonly asymptomatic prior to the index fracture event, which makes proper screening a critical step in the diagnosis and prevention of osteoporotic fracture. The NOF recommends that all postmenopausal women and men aged over

50 years should be screened for osteoporosis [47]. Screening at a younger age is recommended for patients with risk factors such as low body weight, early menopause (age less than 45 years old), and family history; comorbidities such as rheumatoid arthritis, inflammatory bowel disease, and chronic obstructive pulmonary disease; as well as long-term use of medications such as glucocorticoids, proton pump inhibitors, and selective serotonin reuptake inhibitors [43, 46, 47]. Patients with previous osteoporotic fragility fractures are also at high risk for future fragility fracture, with some studies reporting 31 percent of patients will have an additional fragility fracture within 5 years [48, 52].

The screening process involves calculating a T-score, which is the standard deviation of one's bone density compared with the average bone density of a 30-year-old healthy adult. The diagnosis of osteoporosis can be made with a T-score of less than or equal to −2.5 based on radiographs of the lumbar spine, femoral neck, hip, or distal radius [53]. The Fracture Risk Assessment Tool (FRAX®) is a 12-question risk calculator combining variables such as age, sex, T-score, and other risk factors to predict an individual patient's risk of osteoporotic fracture within the following 10 years [54]. The FRAX® is important as it helps the frontline provider determine the indicated treatment based on an individual's overall risk.

Treatment

The primary purpose of treating osteoporosis is to avoid fracture through maintenance of bone integrity. Non-pharmacologic treatments include weight-bearing exercise for at least 30–40 min three times per week, in addition to calcium and vitamin D supplementation to maintain serum 25-hydroxyvitamin D greater than 30 ng/mL [43, 53]. The NOF and the American College of Endocrinology (ACE) recommend initiation of pharmacologic therapy for all individuals with osteoporosis based on their T-score or presence of fragility fracture. The NOF and ACE also recommend pharmacologic treatment in patients with a T-score of −1.0 to −2.5 in combination with a risk for hip fracture and major osteoporotic event greater than or equal to 3 and 20 percent, respectively, in the next 10 years based on the FRAX® calculation [43, 53]. The FDA has approved two classes of medications for the treatment of osteoporosis, bisphosphonates, and denosumab, which have been shown to reduce osteoporotic fractures of the spine, hip, and nonvertebral fractures [43, 53]. The dose and frequency of these medications vary based on their route of entry, but all require continued monitoring of potential side effects with regular blood work, and specifically drug holidays for patients being treated with bisphosphonates [55]. While these treatments have been shown to greatly reduce the risk of future fracture, many patients remain untreated in the year after their index fragility fracture, which emphasizes the importance of patient education and shared decision-making [56].

The consequences of osteoporotic fracture on overall patient health in both the short and long term can be devastating. As the population ages, fractures attributed to osteoporosis will increase, as will the economic impact. The frontline provider

should be aware of the risk factors, diagnostic criteria, and treatment options for osteoporosis in order to mitigate the burden of disease on the individual and healthcare system.

Summary

Musculoskeletal disorders (MSD) are the norm, not the exception. The incidence and prevalence of MSD will continue to increase as our population ages, with life expectancy projections reaching as high as 80–90 plus years by 2050. Additionally, risk factors such as obesity and smoking, if not modified, will further increase the number of patients affected.

As a society, the sheer number of people with MSD should be alarming, as the associated direct and indirect costs, in terms of diagnosis, treatment, and resultant disability, could overwhelm the healthcare system. Healthcare providers must take control and start preemptively thinking about MSD in a proactive manner, as has been achieved in other common medical conditions such as heart disease and diabetes.

Prevention of the development of MSD through education and counseling is key, as patients are often unaware of the associations between MSD and comorbid conditions. Additionally, initial conservative management of common MSD is almost always the correct option once red flag diagnoses are ruled out. Conservative treatment pathways have been shown to reduce costs while maintaining quality of care. Information included in this chapter provides the data and clinical principles necessary to prevent, diagnose, and treat common MSD successfully.

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