Importance of Routine Bone Mineral Density Screening Prior to Elective Total Joint Replacement

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Low bone mineral density (BMD) appears to be common in patients undergoing total joint replacement (TJR), with up to two thirds and one third meeting criteria for osteopenia and osteoporosis, respectively.1-9 Emerging data raise concerns that low BMD may increase the risk of intraoperative and postoperative complications in patients undergoing TJR. In a study of total ankle arthroplasty, low tibial BMD, as measured by Hounsfield units, from preoperative ankle computed tomography scan was associated with a higher risk for periarticular fracture ($P=0.018$), with all intraoperative fractures occurring in patients with tibial Hounsfield units less than 200.10 A study investigating the stability of uncemented acetabular cups in 34 female patients undergoing total hip arthroplasty (THA) found that women with normal BMD did not show statistically significant cup migration after the settling period of 3 months, whereas those with low BMD had continuous proximal migration between 3 and 12 months ($P=0.03$), with these differences in cup migration persisting at 24 months.11 A prospective case-control study comparing patients with (n=44) and without (n=56) osteoporosis undergoing computer-assisted navigation total knee arthroplasty (TKA) found that osteoporosis was associated with greater valgus position of the coronal tibial component.12

Although findings of these studies should be replicated, results suggest that knowing a patient’s BMD status prior to surgery could help inform surgical decisions that may reduce the risks of BMD-related complications. For example, to reduce the risk of intraoperative fractures in patients with low BMD undergoing total ankle arthroplasty, surgeons may wish to consider prophylactic internal fixation of the medial malleolus in patients with tibial Hounsfield units less than 200.10 When performing THA, physicians may use hydroxyapatite coating to help incorporate implants in osteopenic bones or decide not to use uncemented cups in patients with impaired bone quality to reduce the risk of acetabular cup migration in patients with low BMD.11 Surgeons should be aware of the possibility of gross and undetectable tracker pin movement during computer-navigated TKA in osteoporotic knees, which may require intraoperative conversion from navigation to conventional TKA.12

Another reason for surgeons to evaluate BMD prior to TJR is mounting evidence that bisphosphonate treatment before and after TJA may have protective effects. Meta-analyses of randomized controlled trials of oral bisphosphonates found that treatment preserves periprosthetic BMD for more than 5 years after THA.13,14 In addition, 1 year of bisphosphonate treatment prevents early reduction of hip BMD after THA regardless of osteoporosis diagnosis.15 In 20,784 primary TKA patients 65 years and older, patients who did not use bisphosphonates had a more than 3 times greater risk of revision than patients who used bisphosphonates and bisphosphonates had a protective effect even for patients with normal BMD postoperatively.16 Further, several studies suggest that treatment of osteoporosis with bisphosphonates for patients with osteoarthritis may reduce the need for TJR, potentially through...
antiresorptive effects that minimize periprosthetic bone loss and osteolysis.\textsuperscript{17,18}

Despite the potential benefits of knowing patients’ BMD status prior to and following TJR, there is a significant gap between national screening guidelines for BMD and clinical practice, with significant underutilization of dual-energy x-ray absorptiometry screening in primary care settings.\textsuperscript{19,20} The US Preventive Services Task Force recommends screening for osteoporosis with BMD testing to prevent osteoporotic fractures in women 65 years and older and in postmenopausal women younger than 65 years who are at increased risk of osteoporosis.\textsuperscript{21} An analysis of administrative claims data from 2008 to 2014 for approximately 1.6 million American women with no prior history of osteoporosis diagnosis, osteoporosis drug use, or hip fracture found BMD testing rates of 21.1%, 26.5%, and 12.8%, respectively, among women 50 to 64 years old, 65 to 79 years old, and 80 years or older.\textsuperscript{20} Although screening rates had increased in some age groups over time, this study revealed large, persistent deficiencies in real-world implementation of evidence-based guidelines for osteoporosis screening.

There are scant real-world data regarding the frequency of BMD screening prior to TJR. Therefore, the current authors conducted a retrospective chart review of 513 patients who underwent primary TKA between March 2009 and December 2017 at a university-based tertiary care hospital to estimate the prevalence of patients who had received BMD testing prior to surgery. Data analyses were descriptive. The Wald 95% confidence interval, which is based on the normal approximation to the binomial distribution, was estimated for all values. Patients were predominantly female (66.9%; n=343) and had a mean age of 66.2 years (range, 22-95 years) and body mass index of 31.7 kg/m\textsuperscript{2} (range, 17.7-51.9 kg/m\textsuperscript{2}). Among patients with race data (n=452), 57.1% were white, 38.7% were black, and 4.2% were other race. The overall prevalence of dual x-ray absorptiometry scans was 13.1% (95% confidence interval, 10.1% to 16.0%). Almost all scans were performed for female patients (94.0%; n=63). Among patients who met US Preventive Services Task Force criteria for BMD screening (n=204), 20.6% (95% confidence interval, 16.0% to 26.1%) had been screened. Patients who met the US Preventive Services Task Force criteria for BMD screening within the authors’ patient population had a mean age of 72.4 years (range, 65-95 years) and body mass index of 31.2 kg/m\textsuperscript{2} (range, 17.7-46.3 kg/m\textsuperscript{2}). The racial composition of this subgroup was 58.6% white, 36.4% black, and 5.0% other race. The low rate of BMD screening found in the authors’ patient population is consistent with national trends for BMD screening in primary care settings and available data suggesting that BMD screening is rarely performed prior to TJR.\textsuperscript{20,22}

One reason for low BMD screening rates prior to TJR is that orthopedic surgeons may not view this information as important to their clinical decision making or relevant to TJR outcomes. In a survey completed by 433 members of national and international orthopedic associations, only 4% stated that they routinely test BMD prior to performing THA.\textsuperscript{22} Interestingly, among the surgeons who responded that they do not routinely order BMD screening, 65% acknowledged that low BMD would be a reason to reconsider their choice of implant. In another survey of orthopedic surgeons, only 14% agreed that it is their responsibility to initiate osteoporosis follow-up after a patient sustains a minimal trauma fracture despite more than 80% acknowledging that discussing osteoporosis with a patient following a minimal trauma fracture may improve patient compliance with management.\textsuperscript{23} These findings suggest that a significant proportion of orthopedic surgeons may be unaware of the clinical relevance of BMD screening and that most orthopedic surgeons do not view BMD screening as their responsibility, generally perceiving nonsurgical management of osteopenia/osteoporosis to be outside of their purview.\textsuperscript{24-25}

Orthopedic guidelines largely do not address the importance of conducting BMD screening prior to performing TJR and the potential for bisphosphonates to improve outcomes in TJR patients. The American Academy of Orthopaedic Surgeons guidelines for the surgical management of knee osteoarthritis and the American Academy of Orthopaedic Surgeons guidelines for the management of hip osteoarthritis offer no recommendations regarding BMD screening for patients who may be candidates for TJR.\textsuperscript{26,27} The American Orthopaedic Association’s Own the Bone program, which was launched in 2009 to raise awareness of the emerging epidemic of osteoporosis-related fragility fractures, publicly recognizes hospitals and practices that achieve 75% compliance with at least 5 of the 10 Own the Bone prevention measures, one of which is BMD screening. Despite these efforts, there is still significant room for improvement in screening practices in both primary care and orthopedic settings.

If orthopedic surgeons regularly requested BMD testing, patients could be at lower risk for significant complications during and after TJR (eg, intraoperative and postoperative fractures, revision surgery). Orthopedic surgeons require clearance of TJR candidates from primary care physicians prior to TJR. Including BMD screening as part of this mandatory preoperative workup would be a simple way of ensuring that TJR candidates have been screened for osteoporosis. Previous studies have shown that an integrated model using primary care physicians and orthopedic surgeons improves evaluation rates for osteoporosis in patients with hip fracture. Implementation of a Hospitalist-Orthopaedic Surgeon Integrated Model of Care, in which hospitalists evaluated orthopedic patients admitted with fragility hip fractures not only for medical clearance but also for secondary causes of osteoporosis, resulted in improvement of the rate of screening for secondary causes of osteoporosis (BMD was not performed...
because a fragility hip fracture was considered diagnostic for osteoporosis (24% to 89%). Large prospective studies are needed to clearly establish the relationship between preoperative and postoperative BMD and TJR outcomes to convince orthopedic surgeons of the importance of BMD screening. In addition, studies are needed to clearly establish the benefits of prophylactic bisphosphonate treatment for long-term TJR outcomes. Lack of high-quality research on these topics may be one reason why orthopedic guidelines have not taken a clear stance on the value of preoperative BMD screening. Future studies should rigorously evaluate the effects of routine BMD screening and treatment of osteopenia/osteoporosis on surgical outcomes, patient-reported outcomes, and fragility fractures in TJR patients to definitively prove the value of this intervention prior to TJR.

REFERENCES


