PM R 7 (2015) S60-S65

www.pmrjournal.org

Regenerative Medicine

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Advanced Knee Osteoarthritis in an Active Male: Biologics or Total Knee Replacement

CASE SCENARIO

A healthy 54-year-old man presents to your office for your opinion regarding his progressively worsening right knee pain. At age 24, he underwent a primary anterior cruciate ligament reconstruction as a result of a skiing injury. He subsequently has had 2 arthroscopic surgeries, the first a partial resection undergone 15 years ago for a degenerative tear, followed 5 years later by a complete medial meniscus resection. His pain now interferes with his ability to complete a full round of golf, and he does not want to resort to using a cart. During the previous 2 years, he has tried a variety of treatments, including nonsteroidal anti-inflammatory medications, physical therapy with home exercises, unloader and patellar bracing, 2 corticosteroid injections, and 2 hyaluronic acid injections. He has experienced some temporary relief, but none of these treatments have allowed him to fully engage in golfing. Knee radiographs demonstrate Kellgren-Lawrence Grade 3 osteoarthritis, predominately affecting the medial compartment, but there is tricompartmental involvement. He consulted with an orthopedic surgeon, who recommended a total knee replacement (TKR). A second physician suggested he try stem cell therapy for osteoarthritis. He would like to re-engage in golfing and even skiing, and he seeks your advice regarding whether the total knee replacement (TKR) or stem cell treatment would provide the optimal treatment for his knee pain and function. Dr. Wayne Colizza will argue that a TKR will offer the best possible outcomes. Dr. Victor Ibrahim will argue that stem cell therapy is a viable treatment option for this patient.

Wayne A. Colizza, MD, FACS, Responds

This 54-year-old male patient presenting to my office is a member of a growing pool of younger, physically active patients with tricompartmental knee osteoarthritis. A common thread among these younger patients is the desire to return to a pain-free, active lifestyle. Given his history, presentation, and goals, I would provide the following information and advice.

He is not alone

The patient is among the estimated 20%-30% of U.S. adults living with osteoarthritis, according to the National Arthritis Data Workgroup, with hips, knees, and hands being the most commonly affected joints [1]. The increase in the prevalence of osteoarthritis is attributable to the increase in life expectancy, obesity, and sports-related joint trauma in our society.

It is accepted that trauma and surgical intervention to the knee joint increases the risk of osteoarthritis and the probability of undergoing a total knee replacement (TKR) in the future [2]. This finding is particularly true in patients who have undergone a complete meniscectomy, a procedure that removes one of the primary "shock-absorbers" and a secondary stabilizer of the knee. A complete meniscectomy rarely is performed today. In our patient's case, he has undergone anterior cruciate ligament reconstruction and other surgeries on his knee, including total medial meniscectomy.

He has not responded to any nonoperative management for his condition

This patient has tried nonsteroidal anti-inflammatory medications, physical therapy, bracing, intra-articular corticosteroid injections, and 2 series of viscosupplementation. Unfortunately, these treatments have failed to bring him to his goal of comfortably playing golf and skiing. It is my opinion that he now needs a TKR to reach this goal. If his circumstances were different and the osteoarthritis was confined to the medial compartment

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http://dx.doi.org/10.1016/j.pmrj.2015.02.009

of the knee, "less-invasive" procedures such as high tibial osteotomy or unicondylar knee replacement may have been options. In this patient's case, however, the disease has affected all 3 compartments of the knee and is classified as Kellgren-Lawrence Grade 3 osteoarthritis on radiographs, that is, osteophytes, joint space narrowing, sclerosis, and deformation. TKR best addresses this more severe degree of disease.

TKR is a successful treatment for his condition, but there are concerns given his younger age

Joint replacement is a well-established surgical treatment for osteoarthritis with documented results in improvements in function, pain reduction, correction of deformity, and return to activity. The outcomes of joint replacement have been evaluated extensively through the use of clinical scales, activity indices, pain scales, validated outcome instruments, and assessments of economic benefit [3-5]. Outcome studies pertaining to TKR are primarily retrospective in design. Nonetheless, these studies strongly indicate satisfaction rates exceeding 80% with notable improvements in quality of life measures [6-9].

In a younger patient, the greater worry is the survivorship of the prosthesis. Medical practitioners have expressed concern about early loosening and failure of the implant when TKR is performed in younger and more active patients. These risks would be discussed with the patient before proceeding with surgery.

A recent report from the Swedish Knee Replacement Registry of more than 27,000 patients yielded an unadjusted 10-year implant survival rate of greater than 95% (all ages). Those patients aged 45-54 years had a 10-year survival of 93.6%, whereas the 75- to 84-year-old group had a survivorship of 98.2% [10].

In a recent review of the California Patient Discharge Database, it was determined that patients younger than 50 years of age had greater rates of loosening as the result of both aseptic (mechanical) and septic causes compared with the 65 years of age and older group. Hospitals in which more than 200 TKRs were performed per year had significantly lower rates of revision [11]. It appears that rates of TKR revision are approximately 1% per year on the whole, with slightly greater rates in the younger patient. As with surgery of any kind, success parallels the skill of the surgeon and the caseload of the hospital.

Assuming our patient lives to 80 years of age, he faces an approximate 30% risk of revision in his lifetime. Cell-based therapies for osteoarthritis of the knee cannot guarantee maintenance of knee function during a 30-year period with 70% certainty.

He will golf and ski again

Our patient wants to golf and ski. Fortunately, he does not want to run a marathon. There is a paucity of orthopedic literature addressing return to sport after TKR. In 2007, members of the American Association of Hip and Knee Surgeons were polled as to their preferences for the return to sporting activity after TKR. There was strong consensus toward allowing patients to return to skiing (if the patient had preoperative experience) and golfing [12]. Other studies support a return to golf but recognize the greater stress on the target-side knee, which will not be an issue if our patient is right-handed. Unfortunately, unlike his golf partners who have under gone a total hip replacement, he will notice a loss of 12 yards on his drive [13].

In a recent literature review using PubMed, Embase, and Sports Discus, authors showed that preoperative activity level, age, gender, and body mass index determined activity level after TKR. There was minimal evidence in the literature of an association between early failure of the implant and high post-TKR activity levels [14]. This observation bodes well for our young, active, and, hopefully, nonobese, man.

In 1997, Insall and Scott [15] reviewed their experience with patients who were 55 years old or younger with an average 8-year follow-up after their TKR. They found that 94% of patients had good or excellent Knee Society functional scores, and all but 2 patients had improvement in the activity score of Tegner and Lysholm. All patients were cautioned against impact activities. Nonetheless, 60% of patients returned to walking exercise, 53% returned to cycling, 24% returned to golf, 11% returned to construction or farm work, and 8% returned to skiing. Despite the increased activity the rate of survival of the implant was 90% at 18 years [15].

The TKR procedure is becoming easier and safer

Compared with 15 years ago, the TKR procedure is becoming easier and safer for the patient. The majority of knee replacements are now performed with the patient receiving spinal anesthesia as part of a multimodal pain protocol, including selective nerve blocks, preemptive oral medications, and limitations in the use of narcotics. A recent improvement to the protocol has been the addition of Exparel (Pacira Pharmaceuticals, Parsippany, NJ), a bupivacaine liposome injectable suspension that can be administered into the wound, facilitating pain control for up to 72 hours.

Tranexamic acid, a synthetic analog of the amino acid lysine, is an antifibrinolytic agent that can be given intravenously or placed into the knee wound perioperatively. It has been shown to decrease surgical bleeding in patients undergoing total hip and TKR without increasing the risk of deep venous thrombosis. Patients no longer have to donate autologous blood preoperatively, and perioperative heterologous transfusion rates have decreased, eliminating the risk of transfusion reactions and blood-borne infection.

Advanced rehabilitation protocols and early return to mobilization has led to shorter hospital stays and earlier return to function [16]. Several hospitals have become centers of excellence for joint replacement and consistently demonstrate fewer complications and better outcomes.

Knee replacement is the definitive treatment for osteoarthritis of the knee, but it is the last resort

In caring for any patient with knee arthritis, it is important to exhaust all therapeutic measures short of TKR before considering this operation. This is particularly true in the younger patient, in whom survivorship of the prosthesis is paramount.

TKR remains the most successful treatment for osteoarthritis of the knee in improving quality of life [17] and enabling patients like ours to return to golf and skiing, quite possibly for the remainder of his life. TKR remains the "gold standard" for the definitive treatment of osteoarthritis of the knee.

References

1. Helmick CG, Felson DT, Lawrence RC, et al, National Arthritis Data Workgroup. Estimates of the prevalence of arthritis and other rheumatic conditions in the United States. Part 1. Arthritis Rheum 2008;58:15-25.
2. Brophy RH, Gray BL, Nunley YM, Barrack RL, Clohisy JC. Total knee arthroplasty after previous knee surgery. J Bone Joint Surg Am 2014;96:801-805.
3. Losina E, Walensky RP, Kessler CL, et al. Cost-effectiveness of total knee arthroplasty in the United States: Patient risk and hospital volume. Arch Intern Med 2009;169:1113-1121.
4. Jenkins PJ, Clement ND, Hamilton DF, Gaston P, Patton JT, Howie CR. Predicting the cost-effectiveness of total hip and knee replacement: A health economic analysis. Bone Joint J 2013;95-B:115-121.
5. Bedair H, Cha TD, Hansen VJ. Economic benefit to society at large of total knee arthroplasty in younger patients: A Markov analysis. J Bone Joint Surg Am 2014;96:119-126.
6. Kim YK, Kim JS, Choe JW, Kim HJ. Long-term comparison of fixed-bearing and mobile-bearing total knee replacements in patients younger than fifty-one years of age with osteoarthritis. J Bone Joint Surg Am 2012;94:866-873.
7. Long WJ, Bryce CD, Hollenbeak CS, Benner RW, Scott WN. Total knee replacement in young, active patients: Long-term follow-up and functional outcome: A concise follow-up of a previous report. J Bone Joint Surg Am 2014;96:e159.
8. Colizza WA, Insall JN, Scuderi GR. The posterior stabilized total knee prosthesis. Assessment of polyethylene damage and osteolysis after a ten-year-minimum follow-up. J Bone Joint Surg Am 1995;77:1713-1720.
9. Bourne RB, Chesworth BM, Davis AM, Mahomed NN, Charron KD. Patient satisfaction after total knee arthroplasty: Who is satisfied and who is not? Clin Orthop Rel Res 2010;468:57-63.
10. Gudnason A, Hailer NP, W-Dahl A, Sundberg M, Robertsson O. All-polyethylene versus metal-backed tibial components—an analysis of 27,733 cruciate-retaining total knee replacements from the Swedish knee arthroplasty registry. J Bone Joint Surg Am 2014;96:994-999.
11. Meehan JP, Danielsen B, Kim SH, Jamali AA, White RH. Younger age is associated with a higher risk of early periprosthetic joint infection and aseptic mechanical failure after total knee arthroplasty. J Bone and Joint Surg Am 2014;96:529-535.
12. Klein GR, Levine BR, Hozack WJ, Strauss EJ, D'Antonio JA, Macaulay W, Di Cesare PE. Return to athletic activity after total hip arthroplasty. Consensus guidelines based on a survey of the Hip Society and American Association of Hip and Knee Surgeons. J Arthroplasty 2007;22:171-175.
13. Mallon WJ, Callaghan JJ. Total knee arthroplasty in active golfers. J Arthroplasty 1993;8:299-306.
14. Jassim SS, Douglas SL, Haddad FS. Athletic activity after lower limb arthroplasty: A systematic review of current evidence. Bone Joint J 2014;96-B:923-927.
15. Diduch DR, Insall JN, Scott WN, Scuderi GR, Font-Rodriguez D. Total knee replacement in young, active patients. Long-term follow-up and functional outcome. J Bone Joint Surg Am 1997;79:575-582.
16. Jones CA, Beaupre LA, Johnston DW, Suarez-Almazor ME. Total joint arthroplasties: Current concepts of patient outcomes after surgery. Clin Geriatr Med 2005;21:527-541.
17. Ethegen O, Bruyere O, Richy F, Dardennes C, Reginster JY. Health-related quality of life in total hip and total knee arthroplasty. A qualitative and systematic review of the literature. J Bone Joint Surg Am 2004;86-A:963-974.

Victor Ibrahim, MD, Responds

Osteoarthritis is a common pathology seen in both surgical and nonsurgical clinics. The advent of modern-day stem cell science and its clinical applications poses a potential paradigm shift in how clinicians evaluate and treat such pathologies. The current method of "watch and wait" has been supplanted by cellular based therapies that may offer patients improved function with minimal risk. Because of these new treatment options, it is first important to outline the limitation of modern-day joint replacement and compare it with these novel cell-based interventions. When one compares safety, efficacy, and cost, stem cell therapy appears to be a reasonable and potentially superior option.

Basis for Autologous Cell Treatment

Autologous cell-based therapy is based on harnessing the body's physiologic self-regulation of cartilage repair. This well-described physiology relates progenitor cells, chrondrocytes, and growth factors in an orchestrated synergy that culminates in slow, but effective, cartilage regeneration [1]. Accessing this physiologic pathway to facilitate healing has been a primary goal of using cell-based therapies, including stem cell therapy and platelet-rich plasma (PRP).

Both stem cell therapy and PRP involve procuring progenitor cells from the patient. PRP is performed simply via a blood draw, whereas stem cell therapy is usually via a bone marrow aspiration. These cells are then concentrated and injected into the affected issues. Although harvesting stem cells is more invasive than PRP, the acquisition of bone marrow cells through needle aspiration is a well-described and safe method for establishing an autologous osteogenic progenitor cell solution [2]. Methods and safety have been established and documented in the literature for injecting such cells into a knee with primary osteoarthritis [3].

Stem cells and autologous blood products have become used more widely in recent years because of their low risk and effective impact. Basic science studies have shown that bone marrow cells have both anti-inflammatory and chrondroprotective effects [4]. Of increasing clinical interest, these cells have been shown to facilitate cartilage repair in osteoarthritis [5]. In addition to these studies, Centeno et al [3] have published outcomes data from 681 patients during a 2.5-year period demonstrating significant functional improvement with bone marrow concentrate injections, with mild pain as the predominant adverse event. Interestingly, the mean age for treatment in this study was 54 years, which is the same as the patient in this scenario. Additional studies in PRP as an alternative form of biologic treatment also have shown that PRP is superior to hyaluronic acid injections [6], suggesting that physiologic impact on cartilage regrowth is possible. Such interventions have thus far been studied on mild to moderate arthritis. With more advanced disease, it may be that the greater degree of cell loss creates a greater need for these cells to promote regeneration.

Addressing Barriers to Treatment

Common barriers to recommending cellular-based therapies include safety concerns, efficacy, and cost. Concerns for safety are of course most paramount when considering new treatments. To date, there have been no reportable incidents of significant adverse reaction to stem cell intra-articular injection reported in the literature. As has been noted, and in the author's experience, mild pain from the procedure is the most common adverse reaction. The concern over malignant conversion of cells has largely arisen out of animal studies in which cells were induced and expanded [7]. These studies rightly highlight the caution of tissue cell expansion. It should be noted that for the purposes of this argument, the cellular therapy recommended for this patient would be one that complies with current U.S. Food and Drug Administration (FDA) regulations. That is, the patient would undergo an autologous bone marrow cell injection with only minimal manipulation of cells, which would not involve any tissue culturing. There is currently no FDA-approved method for tissue culturing for this purpose in humans; however, a number of veterinary sports orthopedic surgeons routinely culture cells and transplant cultured tissue for treatment of chondral defects and other orthopedics conditions [8,9]. To date, there has been no malignant cell conversion reported in these clinics.

Given its good safety profile thus far, the effectiveness of the treatment must then be considered. The outcome most often sought by patients and physicians alike for the treatment of osteoarthritis is decreased pain and improved function. According to Centeno et al, the majority of patients undergoing stem cell injection for knee arthritis reported significant improvement in both pain and function [3]. The degree of functional gain, as is the case in joint replacement, remains less clear. The standard research end point for most studies has been return to sedentary like work. In the author's experience in sports medicine, several hundred patients have returned to high-impact sports activities after receiving cell-based treatments.

Finally, the issue of cost has been of increasing concern. With only a few centers in the country providing this therapy, and insurance providers along with Medicare denying coverage for such treatments, the cost of such interventions may prove the limiting factor in its use. As determined by a simple internet search, the average cost of a stem cell treatment appears to range from $2000 to $5000, and may be less for a simpler treatment such as PRP. The variation in cost has much to do with the lack of access by region, combined with the high level of overhead most clinics acquire when performing these high-level cellular therapies. This of course is a very real barrier for any therapy. The average cost of a total joint replacement, however, is reportedly $50,000 [10]. With most new insurance policies, a patient may be obligated to pay up to 20% of this bill. The cost to a patient of a stem cell treatment, therefore, becomes more comparable.

Recommendation to Patients

When providing a clinical treatment plan for a patient, it is prudent that the practitioner adequately explain alternative treatment options. It is certainly reasonable that a health care provider may feel uncomfortable describing stem cell treatment based on the lack of robust clinical outcomes research; however, a real discussion should be had with the patient regarding the potential complications and the lack of longevity associated with a TKR. In a healthy 54-year-old man, the likelihood of a revision surgery is very high. This surgery would be performed at a later age, in which risk of complications would undoubtedly be greater and whose risks are truly unknown. Considering the low risk of autologous cellular therapy, it is reasonable and prudent to raise such a possibility to patients. In contrast, stem cell therapy has a low reported rate of immediate complications. As with any new drug or medical implant, however, patients should be aware that long-term implications of autologous cell therapy currently are unknown. Given that these are autologous cells, a long-term adverse event rate may comparable with skin graft surgery.

In addition to a discussion of risks, the success rate and costs of the proposed treatment must be discussed. Outcomes after a TKR may be improved if the patient lives a sedentary lifestyle, but high-impact activities

and a limited shelf life of 15 years remain concerning limitations. Also, given the greater costs to patients, insurance companies, and society associated with a TKR, stem cell therapy is a more attractive option.

The weight of the clinical decision ultimately lies in the informed consent of a patient. Stem cell therapy is a novel approach to osteoarthritis but should not be overlooked for the false sense of security in the current standard of care. In fact, an honest review of the statistics and studies would suggest that a joint replacement at a young age increases and compounds the lifetime risk of an adverse event. If an alternative treatment is reasonable, it should be at least discussed with patients. Given this patient's age and level of function, stem cell therapy provides a relatively safe, effective, and relatively low-cost method in treating osteoarthritis in a 54-year-old active individual. Given the known risks associated with a TKR, stem cell treatment for this patient is very reasonable and may be in the best interest of the patient.

References

1. Milner PI, Wilkins RJ, Gibson JS. Cellular physiology of articular cartilage in health and disease. In: Rothschild BM, ed. Principles of Osteoarthritis—Its Definition, Character, Derivation and Modality-Related Recognition. Rijecka: InTech; 2012; 567-590.
2. Sakai S, Mishima H, Ishii T, Akaogi H, Yoshioka T, Uemura T, Ochiai N. Concentration of bone marrow aspirate for osteogenic repair using simple centrifugal methods. Acta Orthop 2008;79:445-448.
3. Centeno C, Pitts J, Al-Sayegh H, Freeman M. Efficacy of autologous bone marrow concentrate for knee osteoarthritis with and without adipose graft. BioMed Res Int 2014;2014:e370621.
4. Kehoe O, Cartwright A, Askari A, El Haj AJ, Middleton J. Intra-articular injection of mesenchymal stem cells leads to reduced inflammation and cartilage damage in murine antigen-induced arthritis. J Transl Med 2014;12:157.
5. Wakitani S, Imoto K, Yamamoto T, Saito M, Murata N, Yoneda M. Human autologous culture expanded bone marrow mesenchymal cell transplantation for repair of cartilage defects in osteoarthritic knees. Osteoarthritis Cartilage 2002;10:199-206.
6. Say F, Gürler D, Yener K, Bülbül M, Malkoc M. Platelet-rich plasma injection is more effective than hyaluronic acid in the treatment of knee osteoarthritis. Acta Chir Orthop Traumatol Cech 2013;80:278-283.
7. Mahmoudifar N, Doran PM. Chondrogenic differentiation of human adipose-derived stem cells in polyglycolic acid mesh scaffolds under dynamic culture conditions. Biomaterials 2010;31:3858-3867.
8. Tsai SY, Huang YC, Chueh LL, Yeh LS, Lin CS. Intra-articular transplantation of porcine adipose-derived stem cells for the treatment of canine osteoarthritis: A pilot study. World J Transplant 2014;4:196-205.
9. Lopez MJ, Jarazo J. State of the art: Stem cells in equine regenerative medicine. Equine Vet J 2015;47(2):145-154.
10. Nwachukwu BU, McCormick F, Provencher MT, Roche M, Rubash HE. A Comprehensive analysis of Medicare trends in utilization and hospital economics for total knee and hip arthroplasty from 2005 to 2011. J. Arthroplasty 2015;30:15-18.

Wayne A. Colizza, MD, Rebuts

There is no question that stem cells provide great promise in the treatment of a multitude of both orthopedic and nonorthopedic conditions. Many questions remain, however, with respect to the procurement, development, characterization, biology, immunogenicity, and safety of stem cells. There is substantial heterogeneity in the methods of use of these cells. Furthermore, there is simply a paucity of solid clinical data establishing that mesenchymal stem cells (MSCs) are effective.

A recent PubMed search (from 1990 to 2013) revealed only 9 animal and 7 human studies addressing the use of MSCs in the treatment of osteoarthritis [1]. This review highlighted several of the questions that currently remain unanswered. Are MSCs palliative or disease-modifying? What is the optimal method of MSC administration? What is the optimal dosing, frequency, timing, and number of injections? What is the optimal source of MSCs? What is the optimal clinical imaging to determine the effect of MSCs? Finally, what role can MSCs play in the treatment of the joint deformity commonly seen in osteoarthritis.

The use of stem cell therapy is growing despite the lack of strong clinical evidence and, in some instances, violation of FDA guidelines regarding manipulation of cells. In contrast, knee replacement enjoys strong clinical research support as to its efficacy, is approved by the FDA, is relatively safe and cost-effective, and addresses joint deformity. Furthermore, TKR is a durable procedure. Current knee replacements do NOT have a "shelf-life" of 15 years. Failure rates average 1% per year. The long-term benefit of stem cell therapy in osteoarthritis simply has not been determined.

The goal of treatment for osteoarthritis is relief of pain and improvement in function. Fortunately, many patients with osteoarthritis are able to achieve these goals through nonoperative measures, including activity modification, weight loss, rehabilitation, and the use of nonsteroidal anti-inflammatory drugs and viscosupplementation. The latter 2 modalities enjoy both FDA approval and documented clinical success. Stem cell use does not. I agree with Dr. Ibrahim when he states that, "if an alternative treatment (other than TKR for osteoarthritis) is reasonable, it should be discussed with the patient," MSC therapy, however, has not been proven to be an alternative to TKR, nor has this therapy been documented to be any more efficacious than other proven nonoperative measures.

There is no question that the emerging use of stem cell therapy faces a burdensome regulatory process

that impedes clinical investigation. As this hurdle is overcome, many of the questions surrounding stem cell therapy will be answered. I believe this will lead to better-defined clinical applications that will, one day, allow many of our patients with osteoarthritis to avoid surgical intervention. Unfortunately, that day is not yet here. For our active 54-year-old patient with advanced osteoarthritis, TKR remains the "standard of care."

Reference

1. Wolfstadt JI, Cole BJ, Ogilvie-Harris DJ, Viswanathan S, Chahal J. Current concepts: The role of mesenchymal stem cells in the management of knee osteoarthritis. Sports Health 2015;7:38-44.

Victor Ibrahim, MD, Rebuts

The ultimate goal in treating this patient is to improve his *function*, and this is the critical starting point for treatment in this case. There is no convincing study that suggests that patients are able to maintain high-impact activity after a TKR. A consensus that higher-level activity is "reasonable" is not a fair argument to make to patients who are truly seeking a higher level of function. There is simply no data that convincingly point to any improvement in function beyond activities of daily living. Arguing that a patient can maintain high-impact activity after a TKR is purely anecdotal. Although many may argue that a stem cell approach is also anecdotal, it is certainly not any less reasonable than a TKR in this light.

The secondary, and perhaps more pressing matter, is that of long-term outcome of any proposed treatment. The longevity studies cited in the counter argument do not extend beyond a decade. This 54-year-old active individual will likely live beyond 64 years. What options will he have then? Again, there are concerning data regarding the success rates for revision surgeries. Patients undergoing stem cell treatments have demonstrated no long-term restrictions or complications at 5 year follow-up [1].

Finally, what does this patient have to lose if he seeks out a stem cell treatment? Perhaps the financial implication is consideration for pause, but a TKR can cost up to $52,000 [2]. In the setting of a relatively younger patient in whom there is a high likelihood for revision, the life-time costs of a TKR may be even greater. If the patient does not respond to stem cell treatment, knee replacement remains a viable option. Sadly, the reverse is not true.

When presenting clinical options for a patient in this scenario, it is vital to be fair, honest, and thorough. Any clinical decision should be evidence based and catered to the patient's individual goals. If there is a safe, reasonable, and less-invasive alternative to surgery, it should be offered to patients. It is important that we do not withhold care options for patients when reasonable alternatives are available. In fact one may question the validity of a physician's recommendations in this patient if he or she does not discuss the currently available literature regarding the available regenerative treatment options.

References

1. Skowroński J, Rutka M. Osteochondral lesions of the knee reconstructed with mesenchymal stem cells—results. Ortop Traumatol Rehabil 2013;15:195-204.
2. Nwachukwu BU, McCormick F, Provencher MT, Roche M, Rubash HE. A comprehensive analysis of Medicare trends in utilization and hospital economics for total knee and hip arthroplasty from 2005 to 2011. J Arthroplasty 2015;30:15-18.

Disclosure

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Disclosure: nothing to disclose