Which Nonsurgical Treatments Do Patients Believe Are Most Effective for Hip and Knee Arthritis?

Abstract

Background: The purpose of this study was to determine which nonsurgical treatments patients believe are most effective for managing pain secondary to hip and knee arthritis.

Methods: Five hundred sixty-five consecutive patients were administered an anonymous questionnaire developed in consultation with a center with expertise in survey design. Statistical analyses included Student t-test, Fisher Exact, Wilcoxon Rank-Sum test, and generalized cost-effectiveness analysis.

Results: Four hundred thirty-six patients completed the questionnaire (response rate 77.2%). Opioids (52 of 118; 44.1%), prescription nonsteroidal anti-inflammatory drugs (NSAIDs) (67 of 200; 33.5%), and corticosteroid injections (87 of 260; 33.5%) were reported as most effective. Stem cell and platelet-rich plasma injections were selected by three of 12 (25.0%) and three of 15 patients (19.5%), respectively, and physical therapy (PT) by 50 of 257 patients (19.5%). Twenty-five percent of respondents received opioids, commonly prescribed by primary care providers (48.2%) and orthopaedic surgeons (39.5%). Opioid use correlated with lower patient-reported effectiveness of PT, NSAIDs, and corticosteroid injections ($P < 0.05$). The highest cost-effectiveness ratios were NSAIDs, opioids, and acetaminophen (2.2, 3.7, 4.0, and 5.4, respectively). The lowest cost-effectiveness ratios were stem cell injections, platelet-rich plasma injections, and PT (1966.7, 520.8, and 138.6, respectively).

Conclusions: The nonsurgical treatments that are reported by patients to be most effective are oftentimes the least expensive.
to patients for the treatment of hip and knee osteoarthritis.\textsuperscript{2,5,6}

The American Academy of Orthopaedic Surgeons (AAOS) published the guidelines to assist in making evidence-based decisions in the conservative management of hip and knee osteoarthritis.\textsuperscript{7,8} Studies support the use of strengthening, low impact aerobic exercise, weight loss, nonsteroidal anti-inflammatory drugs (NSAIDs), and tramadol in the management of knee osteoarthritis.\textsuperscript{1,9-12} Physical therapy (PT), NSAIDs, and intraarticular corticosteroids are recommended for conservative treatment of hip osteoarthritis.\textsuperscript{13-15} Inconclusive evidence exists regarding the use of acetaminophen, opioids, and platelet-rich plasma (PRP) injections, and hyaluronic acid injections.\textsuperscript{7,8} In addition, the literature largely consists of studies comparing the effectiveness of one or two treatment options and lacks a study of patients’ attitudes toward which conservative treatments are most effective.

Despite AAOS recommendations, many patients undergo conservative treatment modalities that are either not endorsed or have inconclusive evidence.\textsuperscript{2,16,17} A recent study by Bedard et al.\textsuperscript{16} demonstrated that if only AAOS-recommended treatment modalities were used, the cost associated with treatment of osteoarthritis of the knee could be decreased by 45% in the year before arthroplasty. With the contemporary emphasis on minimizing healthcare costs, careful consideration should be given to the cost benefit ratio of conservative treatments for osteoarthritis of the hip and knee. The purpose of this study was to determine which nonsurgical treatments that patients reported are most effective for managing pain secondary to hip and knee arthritis and to determine the cost-effectiveness of each treatment modality.

\section*{Methods}

\subsection*{Study Population and Questionnaire Administration}

A consecutive series of 565 new patients presenting to one of three arthroplasty surgeons at a single

\begin{table}[ht]
\centering
\caption{Respondent Demographics}
\begin{tabular}{ll}
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Demographic & Number (percent) \\
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Age at survey (years) & 61.6 ± 10.92 \\
Sex, male & 191 (45.2) \\
Insurance type & \\
Employer & 163 (43.1) \\
Spouse’s employer & 76 (20.8) \\
Veteran’s association & 5 (1.4) \\
Purchased directly & 45 (12.4) \\
Medicaid and/or Medicare & 171 (44.8) \\
Other & 46 (13) \\
Racial identity & \\
White & 329 (75.5) \\
Hispanic or Latino & 39 (8.9) \\
Black or African American & 48 (11) \\
Asian & 10 (2.3) \\
Other & 3 (0.7) \\
American Indian or Alaskan Native & 2 (0.5) \\
Native Hawaiian or Pacific Islander & 1 (0.2) \\
Highest education level & \\
Some high school & 16 (3.9) \\
High school diploma & 59 (14.5) \\
Trade school & 15 (3.7) \\
Some college & 74 (18.2) \\
Associate’s degree & 28 (6.9) \\
Bachelor’s degree & 106 (26.1) \\
Master’s degree & 74 (18.2) \\
Advanced degree & 34 (8.4) \\
\hline
\end{tabular}
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\textsuperscript{2} Journal of the American Academy of Orthopaedic Surgeons

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Dr. Hannon or an immediate family member serves as a paid consultant to ExplORer Surgical, Inc. Dr. Gerlinger or an immediate family member is a member of a speakers’ bureau or has made paid presentations on behalf of Smith and Nephew, serves as a paid consultant to Smith and Nephew, and has received research or institutional support from Smith and Nephew. Dr. Nam or an immediate family member serves as a paid consultant to KCI and Stryker and has received research or institutional support from KCI and Zimmer Biomet. Dr. Della Valle or an immediate family member has received royalties from Smith & Nephew, Zimmer Biomet; serves as a paid consultant to DePuy, A Johnson & Johnson Company, Smith & Nephew, Zimmer Biomet; has stock or stock options held in Orthophor and Surgiphor, Parvizi Surgical Innovations; has received research or institutional support from Smith & Nephew, Stryker, Zimmer Biomet; and serves as a board member, owner, officer, or committee member of American Association of Hip and Knee Surgeons, Arthritis Foundation, Hip Society. Neither of the following authors nor any immediate family member has received anything of value from or has stock or stock options held in a commercial company or institution related directly or indirectly to the subject of this article Dr. Nahhas and Dr. Fuller.
academic medical center were invited to participate in this study. All patients were undergoing their initial visit for arthroplasty evaluation. All patients must have been diagnosed with arthritis by a physician before being eligible to schedule an appointment with any of the three surgeons. An anonymous questionnaire was given to patients at the start of their first clinical appointment. The survey was administered only once to patients presenting to clinic over a 5-month period from November 1, 2018, to April 1, 2019. The 32-question survey was distributed by a single mode (paper) and was self-administered (Appendix 1, http://links.lww.com/JG9/A75). The voluntary and anonymous nature of the questionnaire was outlined to patients in a cover letter attached to the survey. Patients were given sufficient time to complete the questionnaire in addition to the standard new patient registration forms. The institutional review board granted exemption of this study.

**Questionnaire Design**

A survey of 32 questions was created in collaboration with the University of Wisconsin Survey Center.\(^\text{18,19}\) Before commencement of this study, a small sample of patients were asked to partake in cognitive interviewing, a process in which a participant reads the questionnaire aloud and explains their reasoning as they answer questions.\(^\text{20}\) This methodology helped to identify any words or sentences that might have been misunderstood by patients. The survey was revised accordingly to address the concerns raised by cognitive interviewing. The administered questionnaire is available in Appendix 1, http://links.lww.com/JG9/A75.

**Questionnaire Content**

The questionnaire asked the respondents to think only about the hip or knee that was causing the most pain at the time they took the survey. The question items inquired about whether a patient had tried a particular treatment and their perceived effectiveness.

### Table 2: Proportion of Respondents Who Tried Each Treatment and Corresponding Rated Effectiveness\(^a\)

| Treatment                             | Number (percent) (n = 435) | Mean Reported Effectiveness |
|---------------------------------------|----------------------------|------------------------------|
| Over-the-counter NSAIDs               | 330 (75.9%)                | 2.56 ± 0.91                 |
| Acetaminophen                         | 302 (69.4%)                | 2.14 ± 0.90                 |
| Corticosteroid injection              | 260 (59.8%)                | 2.64 ± 1.20                 |
| Physical therapy                      | 257 (59.0%)                | 2.25 ± 0.98                 |
| Prescription NSAIDs                   | 200 (46.0%)                | 2.61 ± 1.00                 |
| Gel injection                         | 156 (35.9%)                | 2.33 ± 1.19                 |
| Assistive walking device              | 147 (33.8%)                | 2.49 ± 0.91                 |
| Opioids                               | 118 (27.1%)                | 3.11 ± 1.11                 |
| Platelet-rich plasma injection        | 15 (3.4%)                  | 1.52 ± 1.04                 |
| Stem cell injection                   | 12 (2.8%)                  | 1.50 ± 1.00                 |

\(^a\) NSAID = nonsteroidal anti-inflammatory drug; PT = physical therapy; PRP = platelet-rich plasma; Rx = prescription

### Figure 1: Non-Op Treatments Tried

The proportion of survey participants who tried each nonsurgical treatment is represented concurrently with the mean rated effectiveness of that treatment, as rated on a five-point Likert scale. NSAID = nonsteroidal anti-inflammatory drug; OTC = over the counter; PT = physical therapy; PRP = platelet-rich plasma; Rx = prescription.
nonsurgical treatment as a way to reduce pain in their hip or knee. If they indicated that they had tried a particular treatment, they were then asked how effective it was in reducing their pain on a scale (five point Likert scale: one not at all, two a little, three somewhat, four very, and five extremely). Some items had additional follow-up questions, including which type of physician prescribed a particular treatment. The nonsurgical treatments survey included PT, acetaminophen, over-the-counter (OTC) NSAIDs, prescription NSAIDs, opioids, corticosteroid injections, hyaluronic acid injections, PRP injections, stem cell injections, and assistive walking devices. Each pharmaceutical treatment type listed examples of generic and brand names to assist respondents in recognizing the pharmaceutical in question.

After step-wise questioning of each treatment type, respondents were then asked to choose the single most effective treatment in reducing the pain in their hip or knee. The final portion of the questionnaire inquired about demographic information including age, joint (hip or knee), sex, race and ethnicity, education level, and insurance type.

### Statistical Analyses

Descriptive statistics were used to provide the raw survey results. Statistical analyses included the Student $t$-test and Fisher exact test for categorical variables and the Wilcoxon Rank-Sum test for continuous variables. A generalized cost-effectiveness analysis was performed using each recipient’s individual rating of effectiveness on the Likert scale, and dollar amounts were derived from the previously published data on cost and institutional data on the mean cost for treatment event at the site this study was performed. All analyses were performed with Stata 14.2 (Stata Corp, College Station, TX) using alpha = 0.05.

### Results

Four hundred thirty-six patients completed the questionnaire (response rate 77.2%). Respondents were a mean age of 61.6 ± 10.9 years (range, 24 to 90 years old). Respondents were 45.2% men, 75.5% white, and 77.8% had at least some college education. The questionnaire enabled respondents to identify more than one insurance type with Medicare or Medicaid being most common, followed by insurance through an employer (Table 1).

Before presenting for arthroplasty evaluation, respondents tried a mean of 4.1 ± 1.9 (range, 0 to 9) nonsurgical treatments for their pain. The most commonly used treatments were OTC NSAIDs (75.9%), acetaminophen (69.4%), intra-articular corticosteroid injections (59.8%), and PT (59.0%) (Table 2 and Figure 1). When asked to pick the most effective of treatments of the ones they have tried and adjusting for only the treatments each patient had tried, patients preferred opioids (44.1%), corticosteroid injections (33.5%), and prescription NSAIDs (33.5%). PRP was preferred by three of the 15 patients who received it. Stem cell injections were also preferred by three of 12 patients (25.0%) who tried the treatment. PT was the preferred treatment of 50 of 257 patients who received PT (19.5%) (Table 3). No differences were observed between hip and knee patients.

The most cost-effective treatments were OTC and prescription NSAIDs, narcotics, and acetaminophen (mean cost-effectiveness ratio were 2.2, 3.7, 4.0, and 5.4, respectively). The least cost-effective treatment by far was stem

### Table 3

| Nonsurgical Treatment                        | Number Selected (Percent of Total) | Percent, Adjusted for Respondents Who Used the Treatment | Mean CER (SD) |
|----------------------------------------------|------------------------------------|---------------------------------------------------------|--------------|
| Opioids                                      | 52 (11.9%)                         | 44.1%                                                   | 4.0 (7.3)    |
| Corticosteroid injection                     | 87 (20.0%)                         | 33.5%                                                   | 22.7 (31.4)  |
| Prescription NSAID                           | 67 (15.4%)                         | 33.5%                                                   | 3.7 (5.6)    |
| Gel injection                                | 41 (9.4%)                          | 26.3%                                                   | 104.0 (122.7) |
| Stem cell injection                          | 3 (0.7%)                           | 25.0%                                                   | 1966.7 (1428.1) |
| Over-the-counter NSAID                       | 77 (17.7%)                         | 23.3%                                                   | 2.2 (3.4)    |
| Physical therapy                             | 50 (11.5%)                         | 19.5%                                                   | 138.6 (166.1) |
| Platelet-rich plasma injection               | 3 (0.7%)                           | 19.5%                                                   | 520.8 (333.9) |
| Assistive walking device                     | 22 (5.0%)                          | 15.0%                                                   | 9.2 (13.3)   |
| Acetaminophen                                | 32 (7.3%)                          | 10.6%                                                   | 5.4 (6.3)    |

CER = Cost-effectiveness Ratio; NSAID = nonsteroidal anti-inflammatory drug
cell injections, followed by PRP injections and PT (mean cost-effectiveness ratios were 1966.7, 520.8, and 138.6, respectively) (Table 3).

Twenty-seven percent of respondents received opioids, and these patients were significantly younger and less educated compared with patients who did not try them (Table 4). Respondents who tried opioids as a nonsurgical treatment had significantly lower patient-reported effectiveness of other treatment modalities, including PT, acetaminophen, corticosteroid injections, and gel injections, compared with patients who did not try opioids ($P < 0.05$ for all) (Table 4). These were most commonly prescribed by primary care providers (48.2%) and orthopaedic surgeons (39.5%) (Table 5).

### Discussion

The results from this study demonstrated that opioids, intra-articular corticosteroid injections, and NSAIDs are reported by patients as the most effective nonsurgical modalities for reducing pain from hip and knee arthritis. These three treatments were also among the most cost-effective treatments surveyed. PRP injections, stem cell injections, and PT were reported by patients to be the least effective treatments for reducing pain and were the least cost-effective treatments surveyed.

These findings are reassuring because the use of NSAIDs is supported by the AAOS Clinical Practice Guidelines for both the hip and knee, whereas the use of intra-articular corticosteroids for the hip is also supported. It is well established that NSAIDs improve pain and function for the treatment of osteoarthritis and are generally considered safe and effective drugs. Before

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**Table 4**

| Demographic                  | Tried Narcotic | $P$     | Did Not Try Narcotic |
|------------------------------|----------------|---------|----------------------|
| Age (years)                  | 58.25 ± 11.7   | $<0.001^b$ | 62.88 ± 10.42       |
| College educated             | 28 (24.2%)     | 0.047$^c$ | 108 (34.4%)          |

**Table 5**

| Opioid Prescribing Doctor | Total Reported (Percent$^a$) |
|---------------------------|------------------------------|
| Primary care doctor (family medicine or internal medicine doctor) | 55 (48.2%) |
| Orthopaedic surgeon       | 45 (39.5%) |
| Pain management specialist | 21 (18.4%) |
| Other type of doctor (emergency medicine or leftover from previous surgery) | 10 (8.8%) |
| Rheumatologist             | 7 (6.1%) |
| Primary care sports medicine doctor | 3 (2.6%) |

$^a$ Percent totals to more than 100% because patients could report more than one prescribing doctor. One hundred fourteen patients answered this question when surveyed and percentages are of total.
recommend the use of opioids only in exceptional circumstances. 

Further prospective randomized controlled trials examining both the clinical and cost efficacy of these treatments are necessary before they should be routinely used for the conservative treatment of hip and knee osteoarthritis.

With increases in healthcare utilization and subsequently healthcare costs, a critical evaluation of how healthcare dollars are spent is necessary. Innovative new alternative payment models, such as bundle payments, have been developed to emphasize value, defined as the ratio of the clinical benefit of a treatment over the costs associated with that treatment, when making treatment decisions. Bundling of payments has to date been at the procedure level, but recent models have bundled payments for treatment of diseases, such as arthritis, to encourage value-based care throughout the care pathway. A recent study reported that the outpatient cost of knee osteoarthritis in the year before total knee arthroplasty was over $43 million. Our study found that AAOS-recommended treatment modalities, namely NSAIDs and intra-articular corticosteroid injections, were preferred by patients and were also of the most cost-effective treatments. Stem cell injections had the lowest rated clinical efficacy in our study and were by far the least cost-effective treatment. Similarly, hyaluronic acid injections are not recommended by the AAOS Clinical Practice Guidelines, yet it has been found that these injections alone account for 29% of the cost of nonsurgical treatment of the knee in the year before total knee arthroplasty. The value of nonsurgical treatment modalities in combination
with AAOS Clinical Practice Guidelines should be considered when choosing a treatment plan for patients with symptomatic arthritis. The results from our study suggest that for conservative treatment of arthritis NSAIDs and intra-articular steroid injections are of the most clinical efficacious treatments and also most cost-effective. These treatments should be the first-line treatments for conservative management of arthritis.

Several limitations should be considered when interpreting the results from this study. First, all survey participants were presenting to an arthroplasty clinic and thus had likely already failed conservative treatment of their arthritis. This may result in recall bias. In addition, there may be selection bias associated with our response rate of 77.2%. Third, the study was performed at a single academic institution, and the respondents were relatively homogenous. Most patients identified as Caucasian with at least some college education and the results should be considered in this context. Furthermore, because of the anonymous nature of the study, the severity of arthritis for each respondent cannot be assessed, and conclusions cannot be drawn regarding which treatment may be superior at different stages of disease severity. Our study focuses on treatment modalities in isolation, but patients may have used multiple treatment modalities concomitantly and we were not able to control for this occurrence. Finally, the questionnaire item regarding the single most effective treatment emphasized that patients should choose one and only one treatment, but many respondents failed to select an answer, whereas others chose more than one response. Each chosen response was considered in our results, as to not exclude patients who did not fully follow the instructions.

Intra-articular corticosteroids, NSAIDs, and opioids were reported to be the most effective and were among the most cost-effective treatments surveyed. PRP, stem cells, and PT were the least effective and were the least cost-effective treatments surveyed. Clinical practice guidelines support the use of exercise, weight loss, and anti-inflammatory drugs in the knee and exercise, anti-inflammatory drugs, and corticosteroid injections in the hip. A strikingly high number of patients received opioids for nonsurgical treatment, many given by orthopaedic surgeons. Given the deleterious effects of opioids on perioperative outcomes and the decreased efficacy of other nonsurgical treatments once opioids were given, greater education is needed to discourage their use preoperatively.

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