Patient Perception of Robotic Total Hip Arthroplasty: A Qualitative Study

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ABSTRACT

INTRODUCTION

Total hip arthroplasty (THA) is one of the most commonly performed orthopedic surgeries, at a prevalence of around 0.8% in the United States. Robotic-assisted technology has the goal of optimizing outcomes by improving acetabular cup positioning, center of hip rotation, and more. Patient perceptions regarding this procedure are not clearly delineated in the literature; therefore, the purpose of this study was to assess why patients choose to undergo robotic-assisted THA and whether they would recommend a similar procedure.

METHODS

All patients who underwent robotic-assisted THA between May 31, 2017 and December 13, 2018 were given a 12-question survey to complete. The final cohort consisted of 51 patients composed of 32 men and 19 women with a mean age of 67 years (range, 40 to 84 years). All de-identified surveys were evaluated for assessment.

RESULTS

Ninety-two percent would recommend robotic-assisted THA as opposed to conventional THA, with 70% stating the main influencer in their decision was physician input. 68 percent believed they would achieve better outcomes with robotic THA as opposed to their conventional counterparts. Seventy-two percent thought their components would be placed in a more optimal position using robotics. 49% believed they would have less pain with robotic-assisted THA. However, most patients stated they believe they would have no difference in length-of-stay or infection risk compared to manual THA. 53 percent of patients stated there would be similar operating room time between robotic and manual THA.

DISCUSSION

The majority of our cohort believed there were benefits to undergoing robotic-assisted THA. **Physician input was the major contributing factor.** Larger prospective studies in the future with less limitations should evaluate how attitudes and beliefs may influence patient-reported satisfaction and outcomes post-operatively.

Keywords: Robotic-assisted tha, Patient perceptions, Acetabular cup positioning, Functional outcomes, Physician influence

Introduction

Total hip arthroplasty (THA) is a common major orthopedic procedure which has experienced a four-fold increase in prevalence in the United States from 1980 to 2010.[1] Though optimization has made THA safer as an outpatient procedure. Despite the well-known satisfactory patient-reported and clinical outcomes in 20 year follow-up, failure from combined intra-operative and patient-related risk factors is still a concern.[2,3] As such, minimally invasive techniques such as robotic-assisted THA have become a standard of care at some institutions in select patients.[4]

Robotic technology has the capability of recreating a computerized tomography (CT)-based three-dimensional model of the patient's hip anatomy using computer software. This allows the surgeon to achieve optimal implant positioning as well as precision in all bone cuts. It is thought to be beneficial to the patient both in immediately post-operatively and in regaining future functionality.[5] Robotic technologies, with Food and Drug Administration (FDA), approval for use in THA have been shown to improve accuracy, alignment, and fit of femoral stem positioning.[6,7] Improvement in acetabular reaming and cup placement have also been demonstrated.[8,9] Functionally, several studies have shown reduced pain scores, incidence of dislocation, and improved recovery in robotic-THA as opposed to their manual counterparts.[10–12]

As this new technology becomes more common, it is important that the attitudes and beliefs of patients regarding robotic hip arthroplasty specifically are evaluated. Therefore, the purpose of this study was to assess pre-operative attitudes, beliefs, and conceptions of patients in order to understand their motivations for choosing this specific modality.

Methods

Appropriate Institutional Review Board (IRB) approval was obtained prior to the initiation of the study. All patients who underwent robotic-assisted THA at one single institution were included in this study. Our final cohort consisted of 51 patients composed of 32 men and 19 women with a mean age of 67 years (range, 40 to 84 years). A 12-question survey was administered to each patient anonymously. These questions evaluated the attitudes, beliefs, and conceptions of patients regarding the use of robotic technology in their surgery. This study was done with accordance of the guidelines set out by the Journal of the Association of American Medical Colleges [13] (See Appendix A).

All questionnaires were administered pre-operatively. All patients underwent robotic-assisted THA using the Accolade II Femoral Hip Stem System (Stryker Orthopaedics, Mahwah, New Jersey) and the Trident Acetabular Shell System (Stryker Orthopaedics, Mahwah, New Jersey). The MAKO Robotic Arm-Assisted System (Stryker Orthopaedics, Mahwah, New Jersey) was used in all operations. All patients underwent pre-operative

CT of the operative pelvis, which was then loaded into the computer system to create an operative template for the surgeon.

All surgeries were performed by a board-certified orthopedic surgeon who had undergone certification for the use of robotic technology. All patients received 24 hours of peri-operative antibiotics and at least 30 days of venous thromboembolic prophylaxis. All patients began physical therapy within 24 hours of their arthroplasty. All de-identified data was tabulated and inputted into an Excel spreadsheet (Microsoft Corporation, Redmond, Washington) for tabulation and calculation.

Results

Among the cohort, over 92% (n = 47) stated that overall, they would recommend undergoing robotic-assisted THA as opposed to conventional THA. Patients were confident about the reliability of the robotic system, with only 1 patient in the cohort (2%) being concerned about computer malfunction at any point of their treatment. Although most patients do recommend this surgery, most of the cohort stated they would not be willing to pay for extra costs associated with use of robotic technology (n = 29 of 51; 56%). Over 70% of patients (n = 36) cited that, out of several factors, physician input was the most important when deciding whether or not to undergo the procedure (Figure 1).

Sixty eight percent (n = 35) believed they would achieve higher functional outcomes with robotic THA **as opposed to** their conventional counterparts. When evaluating the attitudes of patients toward the procedure itself, 72% of patients (n = 37) stated they thought their components would be placed in a more optimal position using robotics. However, only 49% (n = 25) believed that the surgeon required robotic technology to achieve an optimal result.

Fifty-three percent (n = 27) of all patients thought there would be no difference between total operating room time in a robotic arthroplasty versus a conventional THA. Only 6% (n = 3) thought robotic THA would take longer while the remaining 41% (n = 21) thought their robotic operation would be shorter.

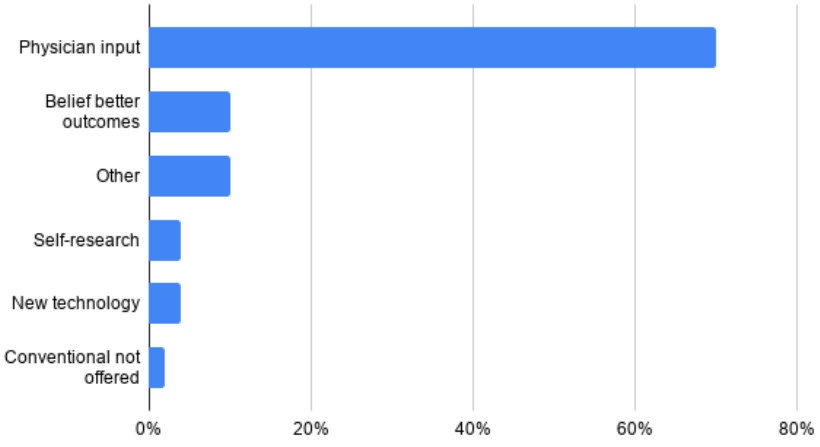

Fig 1 | Reason for choosing robotic THA

Among those who thought there would be a difference in operating room time, 42% (n = 10 out of 24) thought there would be difference of no greater than 30 minutes. Furthermore, 38% (n = 9) thought there would be a 30 to 60-minute difference in surgical time while the remaining 3 patients thought there would be a greater than 60-minute difference. Two patients answered questions regarding belief on length of surgery inconsistently.

When assessing the beliefs of patients regarding post-operative outcomes, the majority of patients believed they would be in less pain with robotic-assisted THA (n = 25 of 51 patients; 49%). Twenty-two patients (43%) stated they would have pain levels similar to those who underwent conventional THA while four (8%) thought they would have more pain comparatively. However, 35 patients (68%) thought there would be no difference in length-of-stay (LOS) when comparing robotic-assisted and conventional THA. Only 1 patient (2%) thought there would be a longer LOS while the remaining 15 patients believed LOS would be shorter. Additionally, 31 patients (60%) among the cohort believed the infection risk between robotic and conventional arthroplasties would be similar. One patient (2%) believed infection risk is higher with robotic THA while the remaining 19 believed their risk would be lower.

Discussion

Robotic-assisted THA is a new technology introduced to optimize patient outcomes through precise component placement as well as planned osteotomies.[6,7] To the best of our knowledge, this is one of the first studies to evaluate the conceptions, attitudes, and beliefs of patients who undergo an innovative new procedure like robotic-assisted THA. We found that the majority of the cohort would recommend undergoing robotic-assisted THA to another patient, without knowledge of post-operative risks and benefits. Furthermore, the majority expected less pain and more optimal component placement. However, many of these patients expected no difference in LOS, operating room time, or risk of infection.

A model of shared decision making between surgeon and patient emphasizes the need for full disclosure of risks and benefits when considering any invasive procedure. While patient autonomy and informed consent is an important part of that decision to pursue surgery, most patient undergoing a surgical procedure continue to rely on the evidence-based recommendations of their surgeon, while trusting that all ethical standards are being met.[1,14] Our study confirms that surgeons and other healthcare providers were the most influential in patients deciding to undergo robotic THA. Similar data has been found specifically in relation to robotic TKA.[16] In a systematic review of seven qualitative studies evaluating factors influencing patient decision making in undergoing TKA, a major theme among several studies was the importance of the relationship with the physician.

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In a study of 61 robot assisted cases of THA, Bitar et al. studied the discrepancy between radiographic and robotic measured degree of acetabular cup anterversion and inclination degrees in order to measure whether robotic THA is a viable alternative to conventional surgeries.[17] They found an accuracy of 97% and 98% of robotic-measured values within 10° of radiographic-measured values for inclination angle and anteversion angle, respectively. Additionally, they found accuracy of 100% within 10 millimeters and 5 millimeters of leg length change. These results confirm the belief of our cohort having better component positioning in robotic assisted THA versus their manual counterparts.

There was an overall belief within our cohort that robotic THA has the capability of producing better outcomes than its conventional counterpart. There is some evidence in the literature to support these beliefs. Bukowski et al. conducted a retrospective cohort 1:1 matched study comparing robotic- to manual-THA (n = 200) performed by a single adult joint reconstruction surgeon.[18] After a follow-up of at least one year (24 ± 6 months), patients undergoing robotic THA had higher mean postoperative Harris Hip Score (92 vs. 86 points; p = 0.002) and University of California Los Angeles Activity Score (6.3 versus 5.8; p = 0.033) as compared with manual THA. Additionally, mean blood loss was lower in the robotic cohort as compared to their manual counterparts (374 ± 133 mL vs. 423 ± 186 mL, p = 0.035), with similar complications intraoperatively (p = 0.1).

This study has several limitations. This is a small study done at one single institution, which may lead to questions regarding extrapolation to different institutions. Additionally, our questionnaire did not assess if someone had a previous primary robotic or conventional surgery on their contralateral side, which could be a source of bias, or whether a a revision operation was being done. Furthermore, our study did not evaluate socioeconomic or comorbidity factors that may have limited full comprehension and skewed patients accurate answering of questions. Despite these limitations, this study provides insight into the motivations and attitudes that patients have regarding robotic arthroplasty technology.

In conclusion, we found the decision to undergo robotic-THA is one patients would recommend and state the major influencing factor was the counsel of their physician. Furthermore, patients indicated they believed robotic technology would lead to better functional outcomes. This study, and similar ones, may be useful to orthopedic surgeons who are integrating this new technology into their practice. Future studies should assess the potential post-operative outcomes of robotic-THA in comparison to manual TKA in larger prospective studies.

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