Sports- and Work-Related Outcomes After Shoulder Hemiarthroplasty

Grant H. Garcia,*† MD, Gregory T. Mahony,† BA, Peter D. Fabricant,† MD, MPH, Hao-Hua Wu,‡ BA, David M. Dines,† MD, Russell F. Warren,† MD, Edward V. Craig,† MD, MPH, and Lawrence V. Gulotta,† MD
Investigation performed at Hospital for Special Surgery, New York, New York, USA

Background: With an active aging population, more patients expect to return to previous activities and work after surgery.

Purpose: To determine the rate and timing to return of sports and employment after shoulder hemiarthroplasty.

Study Design: Case series; Level of evidence, 4.

Methods: This was a retrospective review of consecutive patients who underwent shoulder hemiarthroplasty from 2007 to 2013. Follow-up consisted of a patient-reported questionnaire regarding physical fitness, sporting activities, and work status.

Results: From 105 patients screened, 79 were available for follow-up. The average follow-up time was 63.1 months, and the average age at follow-up was 69 years. Scores on the visual analog scale for pain improved from 6.2 to 2.1 ($P < .001$) postoperatively, and those on the American Shoulder and Elbow Surgeons (ASES) shoulder assessment improved from 34.6 to 71.3 ($P < .001$). Patients older than 65 years had significantly lower absolute postoperative ASES scores ($P = .041$) but experienced similar improvement from their preoperative baseline ($P = .158$) compared with patients younger than 65 years. There were 58 patients who played sports preoperatively, and 67.2% of these restarted at least 1 of their previous sports postoperatively. The average time to return to full sports was 6.5 months for those who returned. Direct rates of return were as follows: fitness sports (69%), swimming (65%), running (64%), cycling (63%), and doubles tennis (57%). Younger age was associated with highest demand level achieved ($P = .023$). Forty-nine patients worked preoperatively, with 69.4% returning to previous employment after surgery; the average time to return to work was 1.4 months. In comparative analysis, patients who did not return to work had a higher mean body mass index (32 ± 7 vs 27 ± 5 kg/m^2; $P < .008$).

Conclusion: In this hemiarthroplasty cohort, there was a 67.2% rate of return to 1 or more sports at an average of 6.5 months postoperatively. Patients older than 65 years experienced similar improvements in ASES scores compared with patients younger than 65 years, although absolute scores were lower on average. Those who returned to higher demand sports were younger on average. Of patients working preoperatively, 69.4% returned to their previous employment at an average of 1.4 months. Patients who did not return to employment had significantly higher body mass index on average. These findings will help surgeons manage expectations of shoulder hemiarthroplasty candidates preoperatively.

Keywords: hemiarthroplasty; work outcomes; sports after surgery

The primary purpose of shoulder hemiarthroplasty (HA) is to enhance function, decrease pain, and improve quality of life. As implants and techniques evolve, patients are expecting improved longevity and function. This desire is coupled with an increasing number of active patients undergoing shoulder arthroplasty. Despite exponential rises in total shoulder arthroplasty (TSA) and reverse total shoulder arthroplasty (RTSA), the rate of HA procedures continues to grow.[13] An advantage of HA over these other prostheses is that HA is technically less demanding and has shorter operative times.[15] Over the past decade, one of the main reasons for choosing HA over TSA has been to preserve glenoid bone stock in active patients,[1] necessitating an understanding of patients' expectations for return to previous activities and employment during preoperative consultation. Finally, conflicting opinions remain regarding worsening glenoid erosion in HA patients at long-term

*Address correspondence to Grant H. Garcia, MD, Hospital for Special Surgery, 535 East 70th Street, New York, NY 10021, USA (email: garciagr@hss.edu).
†Hospital for Special Surgery, New York, New York, USA.
‡University of Pennsylvania School of Medicine, Philadelphia, Pennsylvania, USA.

One or more of the authors has declared the following potential conflict of interest or source of funding: D.M.D. and R.F.W., and E.V.C. received royalties for intellectual property related to the subject of this work from Biomet Inc and have a patent with royalties paid. E.V.C. reports compensation from Biomet Inc outside the submitted work. L.V.G. received compensation related to the subject of this work from Biomet Inc for consulting and speaking, and reports personal fees from Biomet Inc outside the submitted work.

The American Journal of Sports Medicine, Vol. 44, No. 2
DOI: 10.1177/0363546515613077

follow-up with recent studies recommending caution in young, active patients.[14]

Despite a relative indication for HA in sporting activities, other studies have demonstrated improved functional results in TSA compared with HA.[17] Even with these recent conclusions, surgeons' apprehension for TSA is demonstrated from reports evaluating surgeons' preferences for types of sports allowed after arthroplasty. Magnussen et al[20] found more shoulder surgeons allowed return to higher intensity sports in the HA group in comparison to TSA. More recently, Golant et al[9] reported more surgeons allowed return to sports for HA versus TSA. Given these findings, activities after HA should remain a strong area of focus.

While there are a number of studies evaluating surgeon-recommended restrictions after shoulder arthroplasty, there is limited research evaluating these patients' postoperative sports outcomes. Zarkadas et al[36] evaluated 47 HA patients for postoperative activities. In addition, they evaluated postoperative employment, with 30% of their patients reporting current employment. Another study by McCarty et al[21] evaluated 21 HAs with an 81% rate of return to sports. Unfortunately, these rates reported were combined with 54 TSA patients without subanalysis by procedure type.

Given these small of number of patients studied and limited data on rates of return, further study is needed. As such, this study attempts to expand on the literature with the purpose of (1) evaluating time and direct rates of return to sports and employment after HA and (2) determining patient-reported outcome after HA using the American Shoulder and Elbow Surgeons (ASES) score. We hypothesized that overall rate of return to sports will be high, although patients who are able to return to high-intensity sports will be younger than those who return to low-intensity sports.

METHODS

After we obtained institutional review board approval, our institutional, prospectively collected shoulder arthroplasty registry was queried for all patients who underwent HA from 2007 to 2013. A minimum of 2 years of follow-up was required. Five surgeons at our institution performed all procedures, and each surgeon performed these HAs in a similar fashion. All HAs were performed by the deltopectoral approach. In all surgeries, the subscapularis muscle was taken down with a tenotomy.

Patients were contacted, and study personnel administered a questionnaire by telephone. Patients who were unreachable after 5 attempts and a mailed survey were considered lost to follow-up. No preoperative diagnosis was excluded to minimize selection bias. All patients in the cohort received a Biomet Comprehensive HA.

Social Security records were used to determine living/deceased status. Preoperative ASES and visual analog scale (VAS) pain scores were taken from the prospective registry.

A total of 105 consecutive patients (108 shoulders) were screened. At the completion of the study, 17 patients were lost to follow-up, 2 declined to participate, and 7 patients were deceased. As such, 79 patients (82 shoulders) remained available for follow-up. Because only 3 patients underwent staged bilateral HA, all analyses were performed on a per-patient basis.

TABLE 1
Demand Level and Upper Extremity Use by Sport

	Sport
Demand level	
Low	Bowling, fishing, swimming, yoga, golf
Medium	Cross-country skiing, baseball, softball, dancing, doubles tennis, downhill skiing, horseback riding, cycling
High	Basketball, singles tennis, running
Upper extremity use	
Low	Cycling, dancing, skiing, fitness sports, yoga
High	Basketball, baseball, bowling, doubles and singles tennis, fishing, rowing, softball, swimming, cross-country skiing, golf

A retrospective review of eligible patients' records was performed to obtain preoperative diagnoses, body mass index (BMI), age, medical comorbidities, and operative complications. Depression was defined as a previous diagnosis in the patient's medical record. This information was also verified with the patients during the phone questionnaire.

The questionnaire included both sports- and work-related questions (see the Appendix, available online at http://ajsm.sagepub.com/supplemental). The sports items were designed similar to those used in previous studies on TSA and HA,[21] in addition to other joint arthroplasty literature.[9,34] Demand level of each sport was assigned based on previous definitions in the orthopaedic literature,[36] and the highest demand level achieved was determined for each patient.[9,20] Sports participation was considered if patients participated in their sport weekly. Demand categorization was based on previous return-to-sport shoulder studies.[9,11,36] To further define any handicap from an upper extremity arthroplasty, all sports were categorized by high or low upper extremity usage. No study to date has grouped sports by amount of upper extremity usage, so the senior authors determined upper extremity usage levels for each sport by consensus (Table 1). Direct rates of return were calculated for each sport for those patients who participated in sports preoperatively, to avoid any overestimation of these rates by patients starting a new sport postoperatively.

For work-related outcomes, if patients were employed, they were categorized by intensity of work performed (sedentary, light, or moderate) as defined by the United States Department of Labor.[7] If retired, they were stratified by rationale for retirement (due to shoulder, medical causes, or other). These categories were designed based on a previous study by Cowie et al,[6] and the questionnaire designed was based on previous return-to-work studies in the hip and knee arthroplasty literature.[8,18,19,25]

Statistical Methods

Data were analyzed using SAS Software version 9.3 (SAS Institute). After ensuring normally distributed data, continuous variables were reported using means and standard

deviations, and frequencies were used to describe count variables. Comparative analyses were performed using independent-samples Student *t* tests (continuous outcome variables with dichotomous predictor variables), paired-samples Student *t* tests (preoperative vs postoperative ASES and VAS scores), analysis of variance (ANOVA) with Tukey adjusted pairwise comparisons (continuous outcome variables with categorical predictor variables), and Pearson correlation analysis (continuous predictor and outcome variables), as appropriate.

Because this was an analysis of all patients enrolled in a prospective registry, an a priori power calculation was not performed. All comparative analyses were 2-tailed and used $P = .05$ as the threshold for statistical significance.

RESULTS

Demographics

Among the 79 patients (75.2%) available for follow-up, the average time to follow-up was 63.1 months (range, 24.6-90.2 months), average age at follow-up was 69 years (range, 27.6-97.1 years), and average age at surgery was 63.8 years (range, 21.6-91.0 years). The average preoperative BMI was 28.3 kg/m^2 (19.8-49.3 kg/m^2). There was a female predominance of the cohort (69.6%; 55/79). Diagnoses were 40 patients (50.6%) with osteoarthritis, 17 (21.5%) with proximal humerus fracture, 11 (13.9%) with avascular necrosis, 8 (10.1%) with rotator cuff arthropathy, and 3 (3.8%) with rheumatoid arthritis. The procedure was on the dominant extremity in 62 patients (78.4%); 30 patients (37.9%) had previous surgery on their opposite shoulder. Only 5 patients (6.3%) had revision surgeries.

Regarding patient-reported outcome scores, preoperative VAS scores (average ± SD) improved from 6.2 ± 2.4 to 2.1 ± 2.7 ($P < .001$), and preoperative mean ASES scores improved from 34.6 ± 16.5 to 71.3 ± 26.4 ($P < .001$). On subanalysis by age group, patients older than 65 years had significantly lower absolute postoperative ASES scores on average (65.6 ± 27.9 vs 77.6 ± 24.1; $P = .041$), although they experienced a similar postoperative improvement compared with patients younger than 65 years ($P = .158$).

The most common postoperative complaints were chronic pain in 43.0% of patients (34/79) and stiffness in 31.7% (25/79). Despite these complaints, 55% (11/20) of patients with chronic pain returned to sports and 61.5% (8/13) with stiffness returned to sports. For all patients, 79.7% (63/79) were fairly satisfied to very satisfied with the HA procedure, and 20.3% (16/79) were dissatisfied. Seven of these dissatisfied patients participated in sports preoperatively, with only 1 patient (14.7%) returning to any sports postoperatively.

The complication rate in this cohort was 10.1% (8 patients); all complications occurred after 2 years of follow-up, and the average time to complication was 4.6 years (range, 2.5-7 years). Four patients had a revision HA: 2 for a dislocation and 2 after fracturing their humerus from a ground-level fall. Of the remaining 4 patients, 3 were revised to TSA, and 1 patient was revised to reverse TSA due to continued pain and glenoid wear. No patient had a postoperative joint infection.

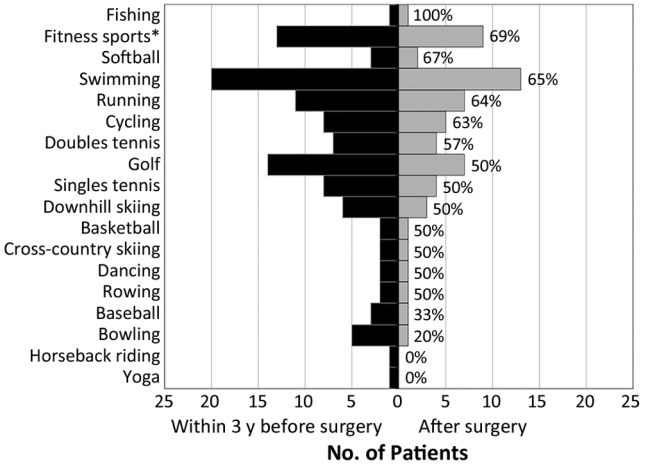

Figure 1. Sports that patients participated in pre- and postoperatively. Direct rates of return are listed in the postoperative column on the right. *Includes weightlifting.

Sports Outcomes

Of the 58 patients who played sports preoperatively, 67.2% (39 of 58) restarted at least 1 of their previous sports. Average time to return to full sports was 6.5 months (range, 1-24 months) for those who returned. On average, patients participated in 2.93 hours of sports per week. The direct rates of return were fitness sports (69%), followed by softball (67%), swimming (65%), running (64%), cycling (63%), doubles tennis (57%), downhill skiing (50%), singles tennis (50%), golf (50%), dancing (50%), and bowling (20%) (Figure 1). Return rates were also analyzed by age and sex (Table 2). For revision surgery patients, only 2 played sports preoperatively, and both returned to their previous sports. There was no significant difference in return to sport based on BMI ($P = .49$), sex ($P = .78$), age ($P = .44$), or history of depression ($P = .99$). Of the 39 patients who returned to sports, 51% felt their physical fitness improved after surgery, and 87% felt their sports outcome was good or excellent.

Of the 58 patients who played sports preoperatively, rates of return to at least 1 sport by diagnosis were 76.9% (10/13) of fracture patients, 75.0% (3/4) of those with cuff tear arthropathy (CTA), 71.4% (5/7) of those with avascular necrosis (AVN), 64.5% (20/31) of patients with osteoarthritis, and 33.3% (1/3) of patients with rheumatoid arthritis (RA). In patients with CTA, all 3 patients who returned to sports did postoperative swimming, 1 returned to cross-country skiing, and 1 to singles tennis. There was no significant association between fracture patients' functional outcomes and the rest of the cohort.

Of the 39 patients who returned to sports, 20 (51%) returned to low-demand, 10 (26%) returned to moderate-demand, and 9 (23%) returned to high-demand sports. The average age was significantly younger for those who

TABLE 2
Top Activities for Patient Groups Before and After Surgery

	Preoperative		Postoperative		
	No. of Participating Patients	Participation, % of Total Active Patients	No. of Participating Patients	Participation, % of Total Active Patients	Direct Rate of Return, %
Top preoperative sports, women[a]					
Swimming	11	32.4	6	17.6	54.5
Fitness sports	9	26.5	7	20.6	77.8
Downhill skiing	4	11.8	2	5.9	50
Golf	4	11.8	2	5.9	50
Running	4	11.8	3	8.8	75
Singles tennis	4	11.8	2	5.9	50
Walking	4	11.8	3	8.8	75
Top preoperative sports, men[b]					
Golf	9	37.5	5	20.8	55.6
Swimming	9	37.5	7	29.2	77.8
Running	7	29.2	4	16.7	57.1
Cycling	6	25	4	16.7	66.7
Doubles tennis	4	16.7	2	8.3	50
Fitness sports	4	16.7	2	8.3	50
Singles tennis	4	16.7	2	8.3	50
Top preoperative sports, older patients (≥66 y)[c]					
Swimming	7	33.3	4	19	57.1
Fitness sports	4	19	3	14.3	75
Cycling	4	19	2	9.5	50
Bowling	3	14.3	0	0	0
Top preoperative sports, younger patients (<66 y)[d]					
Swimming	13	35.1	9	24.3	69.2
Golf	12	32.4	6	16.2	50
Running	10	27	7	18.9	70
Fitness sports	9	24.3	6	16.2	66.7
Singles tennis	6	16.2	4	10.8	66.7
Doubles tennis	5	13.5	4	10.8	80

[a]n = 34 patients; average age at surgery, 62.3 years.
[b]n = 24 patients; average age at surgery, 58.8 years.
[c]n = 21 patients; average age at surgery, 73.4 years.
[d]n = 37 patients; average age at surgery, 53.6 years.

returned to high-demand sports (51.2 ± 12.7 years) versus low-demand sports (65.7 ± 10.1 years) (P = .023, ANOVA with Tukey adjusted pairwise comparisons). There were no statistically significant differences in postoperative ASES scores (P = .284, ANOVA) or VAS pain scores (P = .925, ANOVA) between each demand category.

Thirty-nine patients participated preoperatively in a high upper extremity–use sport; 56.5% of patients (22/39) participated in at least 1 high upper extremity–use sport postoperatively, while 43.6% returned exclusively to lower extremity–based sports. Average time to return to higher upper extremity–use sport was 7.7 months. Between these 2 subgroups, there were no differences in postoperative ASES scores (P = .720, t test) or VAS pain scores (P = .618, t test). Of those who returned to upper extremity use sports, 90.9% (20/22) were satisfied to very satisfied with their ability to play sports postoperatively, and 54.5% (12/22) stated their physical fitness had improved. For those who did not return to upper extremity sports, 88.2% (15/17) of patients were still satisfied to very satisfied with their ability to play sports, and 47.1% (8/17) stated their physical fitness improved.

Work Outcomes

Forty-nine patients worked preoperatively, with 69.4% (34) returning to previous employment. The average time to return to work was 1.4 months (range, 0.25-24 months). Of the remaining 30 patients who did not work preoperatively, 26 patients retired for personal reasons. These personal reasons were unrelated to any medical problems or shoulder symptoms, and all patients stated they planned retirement at that time, in advance of the surgery. Three patients retired as a result of their shoulder and 1 patient retired for medical reasons unrelated to the shoulder. Also, no patients were covered under workers' compensation.

Preoperatively, 40% of patient's jobs were classified as sedentary, 51% as light physical work, and 8% as moderate physical work. Rates of returns by job intensity were 75%

TABLE 3
Occupations of Working Patients (n = 49) Before and After Surgery[a]

Occupation Intensity	No. of Participating Patients		Time to Return to Work, mo	
	Before Hemiarthroplasty	After Hemiarthroplasty	Average	Median (Range)
Sedentary	20	15	1.9	1 (0.2-12)
Light	25	17	2.6	2 (0.5-10)
Moderate	4	2	13.1	13.1 (2.3-24)

[a]With increasing intensity, it took longer for patients to return to employment. Of 79 total hemiarthroplasty patients, 33 retired preoperatively for personal reasons; of the 49 patients working within 3 years before their surgery, 3 retired preoperatively due to their shoulder and did not return postoperatively, and 1 retired preoperatively due to other medical conditions and did not return postoperatively.

for sedentary, 68% for light work, and 50% for moderate work. Average time to return to employment varied by occupation intensity: 1.9 months for sedentary, 2.6 months for light, and 13.1 months for moderate. No patients changed job demand level postoperatively (Table 3).

In the study cohort, 40 patients (50.6%) participated in work and sports preoperatively. Of those, 21 (52.5%) returned to both work and sports, 11 (27.5%) returned to work only, 4 (10%) returned to sports only, and 4 (10%) returned to neither work nor sports postoperatively. There was no association noted between returning to work and returning to sports in this subgroup ($P = .444$, Fisher exact test).

Only 3 revision patients worked preoperatively, and there was a 33% (1/3) rate of return to employment. Also, there was no significant difference in rate of return to employment by depression ($P = .23$), age ($P = .27$), or sex ($P = .345$). Patients who did not return to work had higher BMI on average (32 ± 7 vs 27 ± 5 kg/m^2; $P < .008$).

DISCUSSION

In this cohort, 67.2% of patients returned to their original sport at an average interval of 6.5 months. Furthermore, a high number of employed patients returned to work (69.4%) at an average of 1.4 months postoperatively. Since Neer first introduced the hemiarthroplasty, its goal has been to improve function and limit pain while preserving glenoid bone stock. This functional role has been defined in different manners whether it is satisfaction, range of motion, or return to physical activities.[4,21,24,27,29] Emphasis on return to sports has been limited in the shoulder arthroplasty literature mainly involving TSA.[5,21,30,36] The reasoning for this may be that recent trends show more growth in TSA procedures than in HA, making study of TSA more desirable.[13] Despite this, patients continue to undergo HA, and expectations of return to sports and work will be asked of their surgeons.

A patient's ability to return to sports after surgery is an important consideration preoperatively, as it has been associated with improved satisfaction.[33,35] This cohort demonstrated an overall resumption of sporting activities of 67.2%, which appears lower than reported values in the total shoulder literature at 75% to 100%.[5,12,21] No HA study has evaluated direct rates of return by individual sports, so comparison of results must be done with TSA data. Analyzing individual sports, overall rates of return were as follows: swimming (65%), cycling (63%), doubles tennis (57%), downhill skiing (50%), singles tennis (50%), and golf (50%). These return rates appear on average 15% to 20% lower than those in TSA studies.[5,21,36] While the overall rate of return is lower than for TSA, the timing of return to full sporting activities was 6.5 months, which is similar to reports for TSA ranging from 4.5 to 11.2 months.[5,12,21,30] An additional finding was a significant association between highest demand levels achieved and age. This varies from Zarkadas et al,[36] who found no difference in these comparisons. Overall, grouping by demand level has less importance than by upper extremity use, and so we reclassified our patients' sports. For example, while running is considered high demand, there is minimal involvement of the upper extremities. To date, this study is the first to integrate upper extremity use categories, but using our recommended categorization may help further define return to sports after any upper extremity procedure.

Given these study results and others, TSA continues to demonstrate higher rates of return to physical activities by indirect comparison. Despite these findings, surgeon restrictions on activities allowed postoperatively indicate that higher demand and upper extremity use sports are more acceptable in HA patients compared with TSA patients.[9,11,20] Most recently, a survey of ASES members by Golant et al[9] found that 87% of surgeons allowed return to sports for HA in comparison to 76.5% for TSA. In addition, the largest discrepancy was with regard to contact sports, in which only 45.4% of surgeons allowed participation after TSA compared with 64.9% after HA. Despite these results, 2 studies have directly compared these procedures and found no difference in rates of return to sports between TSA and HA.[21,36] Given these data, further research is needed to directly evaluate return to sports in TSA compared with HA, because through indirect comparison, the literature demonstrates improved return after TSA.

Few studies have evaluated HA patients and their return to functional activities. The first report by Skutek et al[31] evaluated 13 active HA patients with a 76% rate of return to original sport. While interesting, they evaluated only 4 sports (swimming, cycling, shooting, and

dancing), and for each patient, only 1 sport was considered preoperatively. More recently, Zarkadas et al[36] evaluated 47 HA patients and their postoperative activities. They did report on a large cohort, although no preoperative sports evaluation was done. In addition, more than 50% of the activities assessed were chores and activities of daily living. A study by McCarty et al[21] evaluated 21 HA patients combined with 54 TSA patients, determining an 81% rate of return to sports. While they did find a higher rate of return to sports in general, they did not report individual HA rates of return by sport. The results of this current study greatly improve on the previous literature.

Postoperative return to employment after HA has not been investigated to our knowledge. In this cohort, there was a 69.4% rate of return to employment. In comparison, this return rate appears higher than previous TSA and RTSA reports ranging from 28% to 38.5%.[5,23] This may be due in part to the lack of workers' compensation patients in the current study, which is a group found by Morris et al[23] to have lower return rates. With regard to timing, this population returned to full employment at an average of 1.4 months. Since no study has evaluated shoulder arthroplasty and return to work, the best comparison is to the hip and knee literature, ranging from 1 to 3 months.[6,18,25,28] For job physicality, our data suggest decreasing rates of return and slower timing to return with increasing job demand, which is similar to previous arthroplasty studies.[28,32] For differences in return by sex ($P = .23$) and age ($P = .27$), there was no significant association. These findings differ from the lower extremity arthroplasty studies, in which male sex has been associated with improved rates.[22,28] The most interesting association was that patients with a higher BMI were less likely to return to work. While numerous studies have found that postoperative function and complications increase with higher BMI,[2,10,16] obesity has not been associated with work-related outcomes in shoulder arthroplasty. The size of the study cohort limits further investigation, but it is an interesting topic and may have larger implications with employers.

Our complication rate was 10.1% in this series at midterm follow-up, with all patients undergoing revision procedures. At an average complication time of 4.6 years, this is similar to other reported series.[3,26] Overall complications remain a concern after HA, and the association with increased activity has yet to be determined. This should be discussed extensively with patients who are candidates for shoulder HA.

The limitations inherent to this study are primarily its retrospective nature and associated potential for selection and recall bias. In an effort to mitigate recall bias, we cross-referenced patient records. Another potential criticism is the combination of diagnoses (traumatic and degenerative) and inclusion of revision surgeries in our cohort. While historically more homogeneous cohorts have been reported,[21,36] the heterogeneity of this study increases the generalizability of our results. An additional limitation is a few of the analyses may have been underpowered to detect differences, such as by demand category or upper extremity use. Finally, we did not review postoperative radiographs or physical examination findings, which might have given further insight into outcomes, although these data have not been used in previous shoulder arthroplasty sport studies.[5,21,23,36] Without review of radiographs, we cannot comment on wear rates with increasing activity, which may have been prevalent in our patients. Rather, this current study focused on ASES and VAS pain scores in addition to tangible hard outcomes such as return to work and return to sports, which are more useful to surgeons when discussing surgical outcomes with surgical candidates. While this study experienced these defined limitations, it offers the medical community improved data that are crucial to managing physician and patient expectations with regard to employment and sports after HA.

CONCLUSION

Postoperative return to sports and employment are important considerations for patients undergoing shoulder arthroplasty. In this cohort of 79 HA patients, there was a 67.2% rate of return to 1 or more sporting activities at an average of 6.5 months after surgery. High-demand sports patients were younger than low-demand sports patients on average. Furthermore, 69.4% of patients returned to their previous employment at an average of 1.4 months postoperatively. There was a lower rate of return and longer time to return at higher levels of job physicality. Finally, patients who did not return to employment had significantly higher BMI on average. These reported outcomes will aid physicians in managing expectations of patients undergoing shoulder HA.

Scan the QR code with your smartphone to view the In-Depth podcast associated with this article or visit http://sageorthopaedics.sage-publications.libsynpro.com/

REFERENCES

1. Bailie DS, Llinas PJ, Ellenbecker TS. Cementless humeral resurfacing arthroplasty in active patients less than fifty-five years of age. *J Bone Joint Surg Am*. 2008;90(1):110-117.
2. Beck JD, Irgit KS, Andreychik CM, Maloney PJ, Tang X, Harter GD. Reverse total shoulder arthroplasty in obese patients. *J Hand Surg*. 2013;38(5):965-970.
3. Brown TD, Bigliani LU. Complications with humeral head replacement. *Orthop Clin North Am*. 2000;31(1):77-90.
4. Bryant D, Litchfield R, Sandow M, Gartsman GM, Guyatt G, Kirkley A. A comparison of pain, strength, range of motion, and functional outcomes after hemiarthroplasty and total shoulder arthroplasty in patients with osteoarthritis of the shoulder: a systematic review and meta-analysis. *J Bone Joint Surg Am*. 2005;87(9):1947-1956.
5. Bulhoff M, Sattler P, Bruckner T, Loew M, Zeifang F, Raiss P. Do patients return to sports and work after total shoulder replacement surgery? *Am J Sports Med*. 2015;43(2):423-427.
6. Cowie JG, Turnball GS, Ker AM, Breusch SJ. Return to work and sports after total hip replacement. *Arch Orthop Trauma Surg*. 2013;133(5):695-700.
7. *Dictionary of Occupational Titles (DOT)*. Revised 4th ed. US Department of Labor, Office of Administrative Law Judges. http://www.oalj.dol.gov/PUBLIC/DOT/REFERENCES/DOTAPPC.HTM. Updated 1991. Accessed October 28, 2014.

8. Foote J, Smith H, Jonas S, Greenwood R, Weale A. Return to work following knee arthroplasty. *Knee*. 2010;17(1):19-22.
9. Golant A, Christoforou D, Zuckerman JD, Kwon YW. Return to sports after shoulder arthroplasty: a survey of surgeons' preferences. *J Shoulder Elbow Surg*. 2012;21(4):554-560.
10. Griffin JW, Novicoff WM, Browne JA, Brockmeier SF. Morbid obesity in total shoulder arthroplasty: risk, outcomes, and cost analysis. *J Shoulder Elbow Surg*. 2014;23(10):1444-1448.
11. Healy WL, Iorio R, Lemos MJ. Athletic activity after joint replacement. *Am J Sports Med*. 2001;29(3):377-388.
12. Jensen KL, Rockwood CA. Shoulder arthroplasty in recreational golfers. *J Shoulder Elbow Surg*. 1998;7(4):362-367.
13. Kim SH, Wise BL, Zhang Y, Szabo RM. Increasing incidence of shoulder arthroplasty in the United States. *J Bone Joint Surg Am*. 2011;93(24):2249-2254.
14. Levine WN, Fischer CR, Nguyen D, Flatow EL, Ahmad CS, Bigliani LU. Long-term follow-up of shoulder hemiarthroplasty for glenohumeral osteoarthritis. *J Bone Joint Surg Am*. 2012;94(22):e164.
15. Levy O, Copeland SA. Cementless surface replacement arthroplasty (copeland CSRA) for osteoarthritis of the shoulder. *J Shoulder Elbow Surg*. 2004;13(3):266-271.
16. Linberg CJ, Sperling JW, Schleck CD, Cofield RH. Shoulder arthroplasty in morbidly obese patients. *J Shoulder Elbow Surg*. 2009;18(6):903-906.
17. Lo IK, Litchfield RB, Griffin S, Faber K, Patterson SD, Kirkley A. Quality-of-life outcome following hemiarthroplasty or total shoulder arthroplasty in patients with osteoarthritis: a prospective, randomized trial. *J Bone Joint Surg Am*. 2005;87(10):2178-2185.
18. Lombardi AV Jr, Nunley RM, Berend KR, et al. Do patients return to work after total knee arthroplasty? *Clin Orthop Relat Res*. 2014; 472(1):138-146.
19. Luyckx L, Luyckx T, Donceel P, Debeer P. Return to work after arthroscopic subacromial decompression. *Acta Orthop Belg*. 2011; 77(6):737.
20. Magnussen RA, Mallon WJ, Willems WJ, Moorman CT III. Long-term activity restrictions after shoulder arthroplasty: an international survey of experienced shoulder surgeons. *J Shoulder Elbow Surg*. 2011;20(2):281-289.
21. McCarty EC, Marx RG, Maerz D, Altchek D, Warren RF. Sports participation after shoulder replacement surgery. *Am J Sports Med*. 2008;36(8):1577-1581.
22. Mobasheri R, Gidwani S, Rosson JW. The effect of total hip replacement on the employment status of patients under the age of 60 years. *Ann R Coll Surg Engl*. 2006;88(2):131-133.
23. Morris BJ, Haigler RE, Laughlin MS, Elkousy HA, Gartsman GM, Edwards TB. Workers' compensation claims and outcomes after reverse shoulder arthroplasty. *J Shoulder Elbow Surg*. 2015; 24(3):453-459.
24. Norris TR, Iannotti JP. Functional outcome after shoulder arthroplasty for primary osteoarthritis: a multicenter study. *J Shoulder Elbow Surg*. 2002;11(2):130-135.
25. Nunley RM, Ruh EL, Zhang Q, et al. Do patients return to work after hip arthroplasty surgery. *J Arthroplasty*. 2011;26(6):92-98.e3.
26. Pfahler M, Jena F, Neyton L, Sirveaux F, Mole D. Hemiarthroplasty versus total shoulder prosthesis: results of cemented glenoid components. *J Shoulder Elbow Surg*. 2006;15(2):154-163.
27. Rasmussen JV, Polk A, Sorensen AK, Olsen BS, Brorson S. Outcome, revision rate and indication for revision following resurfacing hemiarthroplasty for osteoarthritis of the shoulder: 837 operations reported to the Danish shoulder arthroplasty registry. *Bone Joint J*. 2014;96(4):519-525.
28. Sankar A, Davis AM, Palaganas MP, Beaton DE, Badley EM, Gignac MA. Return to work and workplace activity limitations following total hip or knee replacement. *Osteoarthritis Cartilage*. 2013;21(10):1485-1493.
29. Schoch B, Schleck C, Cofield RH, Sperling JW. Shoulder arthroplasty in patients younger than 50 years: minimum 20-year follow-up. *J Shoulder Elbow Surg*. 2015;24(5):705-710.
30. Schumann K, Flury MP, Schwyzer HK, Simmen BR, Drerup S, Goldhahn J. Sports activity after anatomical total shoulder arthroplasty. *Am J Sports Med*. 2010;38(10):2097-2105.
31. Skutek M, Fremerey R, Bosch U. Level of physical activity in elderly patients after hemiarthroplasty for three-and four-part fractures of the proximal humerus. *Arch Orthop Trauma Surg*. 1998;117(4-5):252-255.
32. Styron JF, Barsoum WK, Smyth KA, Singer ME. Preoperative predictors of returning to work following primary total knee arthroplasty. *J Bone Joint Surg Am*. 2011;93(1):2-10.
33. Weiss J, Noble P, Conditt M, et al. What functional activities are important to patients with knee replacements? *Clin Orthop Relat Res*. 2002;404:172-188.
34. Wylde V, Blom A, Dieppe P, Hewlett S, Learmonth I. Return to sport after joint replacement. *J Bone Joint Surg Br*. 2008;90(7):920-923.
35. Wylde V, Hewlett S, Learmonth ID, Cavendish VJ. Personal impact of disability in osteoarthritis: patient, professional and public values. *Musculoskeletal Care*. 2006;4(3):152-166.
36. Zarkadas PC, Throckmorton TQ, Dahm DL, Sperling J, Schleck CD, Cofield R. Patient reported activities after shoulder replacement: total and hemiarthroplasty. *J Shoulder Elbow Surg*. 2011;20(2):273-280.