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Title:

Against surgeons' advice: the return to sport in high-demand weightlifters following anatomic total shoulder arthroplasty at average 3.6 years' follow-up

Authors: Authors: Andrew Ames, DO, Sarav S. Shah MD, Robert Pettit MD, Lambert Li BS, Matthew Chilton BS, Brendan Gaylord Bs, Naser Alnusif MD, Alaia Christensen BS, Katharine Ives, Glen Ross, MD





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Disclosures:

Andrew Ames is a paid consultant, speaker and/or presenter for Enovis, Inc. Sarav Shah is a paid consultant, speaker, and/or presenter for Exactech, Inc., a board member of the American Academy of Orthopaedic Surgeons, and an editorial or governing board member of Arthroscopy. Glen Ross is a paid consultant, speaker, and/or presenter for Arthrex, Inc., and Stryker and a paid consultant for Tornier. The other authors, their immediate families, and any research foundations with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.



Background

- Purpose: determine the incidence of return to sport, patient-reported outcomes, patient satisfaction, performance, and failures in high-demand weightlifters that continue lifting after undergoing total shoulder arthroplasty
- Return to sport in high-demand weightlifters following total shoulder arthroplasty has rarely been investigated, as most surgeons recommend against returning to heavy lifting postoperatively.
- As the number of total shoulder arthroplasty patients throughout the world is increasing, and technology advancing, patients are asking not only for return of baseline function but return to sport
- Elderly and recreational athletes have been shown to have good to excellent outcomes, but what about the high level athlete? What about the recommendations of their surgeon?



Methods

- Retrospective review of high-demand weightlifters that underwent anatomic total shoulder arthroplasty with minimum 1-year clinical follow-up.
- Prospective surveys determining pre- and postoperative participation in weightlifting included maximum weight, frequency, and duration of workouts, Single Assessment Numeric Evaluation (SANE), patient satisfaction, and postoperative range of motion were collected.
- Secondary outcomes included: failure, revision surgery, risk factors for not returning to weightlifting, and performance measured as both absolute value and percentage of prior maximum weight lifted in different exercises.
- Bivariate and multivariate analysis was performed to compare cohorts and identify risk factors, respectively.



Results

- 42 shoulders in 36 patients who met inclusion criteria, average age 57.9 years.
- No patient underwent revision surgery at average 3.6 years' follow-up
- The majority of patients (23/42 shoulders) report returning to heavy weightlifting postoperatively against senior surgeon's recommendations.
- Mean SANE score for current weightlifters and retired weightlifters were 86.9 and 91.6

Table I Demographic data, average lifting performance

Measure	Currently weightlifting	Not weightlifting	P value
Age at surgery, yr, mean (95% CI)	55.7 (52.5-59.0)	60.6 (56.7-64.5)	.052
Sex, % male	100	89.5	.111
Competed prior to surgery, %	17.4	21.1	.764
Presymptomatic maximum bench press, mean (95% CI)	315 (269-362)	305 (253-357)	.758
Presymptomatic maximum shoulder press, mean (95% CI)	215 (183-247)	217 (176-257)	.957
Presymptomatic maximum latissimus pull down, mean (95% CI)	216 (178-256)	195 (153-237)	.445
Preoperative maximum bench press, mean (95% CI)	194 (137-252)	213 (111-315)	.708
Preoperative maximum shoulder press, mean (95% CI)	134 (86.9-181)	138 (48.9-227)	.923
Preoperative maximum latissimus pull down, mean (95% CI)	188 (151-225)	182 (97.9-266)	.870
Current bench press, mean (SD)	140 (67.0)	N/A	
Current shoulder press, mean (SD)	93.8 (48.2)	N/A	
Current latissimus pull down, mean (SD)	155 (82.6)	N/A	

CI, confidence interval; SD, standard deviation.

Table II SANE score, satisfaction, range of motion

Measure	Current weightlifters (n = 23)	Nonlifters (n = 19)	P value	
SANE score, mean (95% CI)	86.9 (82.4-91.4)	91.6 (86.7-96.5)	.148	PASS = 83.3%
Satisfaction, %				
Average	8.7	10.5	.922	
Good	26.1	21.1		
Excellent	65.2	68.4		Good-excellent: 90.5%
Satisfaction with return to sport, %				
Average	17.4	22.2	.927	
Good	17.4	16.7		
Excellent	65.2	61.1		Good-excellent: 80.5%
Range of motion, degrees, mean (95% CI)				
Forward flexion	157 (152-161)	152 (145-158)	.183	
External rotation	68.3 (64.2-72.5)	66.7 (59.8-73.5)	.654	

SANE, Single Assessment Numeric Evaluation; CI, confidence interval.

Results

- In the weightlifting cohort, only 78.3% of patients achieved patient-acceptable symptom state PASS threshold for SANE compared with 89.5% of patients in the retired cohort.
- Patient satisfaction and return to sport satisfaction in current weightlifting shoulders were good to excellent in 91.3% and 82.6
- Patients who continued lifting reported substantially decreased maximum weight in all lifts compared with the presymptomatic maximum

Table III Univariate analysis for percentage of maximum weight for exercises compared to patient-reported outcomes and satisfaction scores

Measure	Bench press			Shoulder press			Latissimus pull down		
	n	% of maximum (95% CI)	P value	n	% of maximum (95% CI)	P value	n	% of maximum (95% CI)	P value
<30 mo since surgery	6	79.9 (55.2-105)	.795	5	79.1 (27.6-131)	.924	7	94.2 (80.9-108)	.333
≥30 mo since surgery	9	76.1 (53.1-99.1)		8	83.2 (12.2-154)		9	109 (81.4-136)	
SANE score <85	8	72.3 (49.1-95.5)	.426	5	65.9 (22.5-109)	.541	6	91.9 (78.4-106)	.272
SANE score ≥ 85	7	83.8 (59.5-108)		8	91.4 (20.5-162)		10	109 (84.4-133)	
Satisfaction									
Average	2	89.0 (89.0-89.0)	.802	0		.883	0		.734
Good	5	78.8 (36.8-121)		5	77.8 (35.3-120)		4	97.9 (91.3-105)	
Excellent	8	74.1 (51.6-96.6)		8	84.0 (11.6-156)		12	104 (82.9-125)	
Satisfaction with return to sport									
Average	2	89.0 (89.0-89.0)	.318	1	60.00	.775	1	100	.797
Good	4	60.1 (7.1-113)		4	63.6 (0-135)		3	92.0 (45.1-139)	
Excellent	9	82.9 (63.8-102)		8	93.3 (23.8-163)		12	105 (85.0-125)	

SANE, Single Assessment Numeric Evaluation; CI, confidence interval.

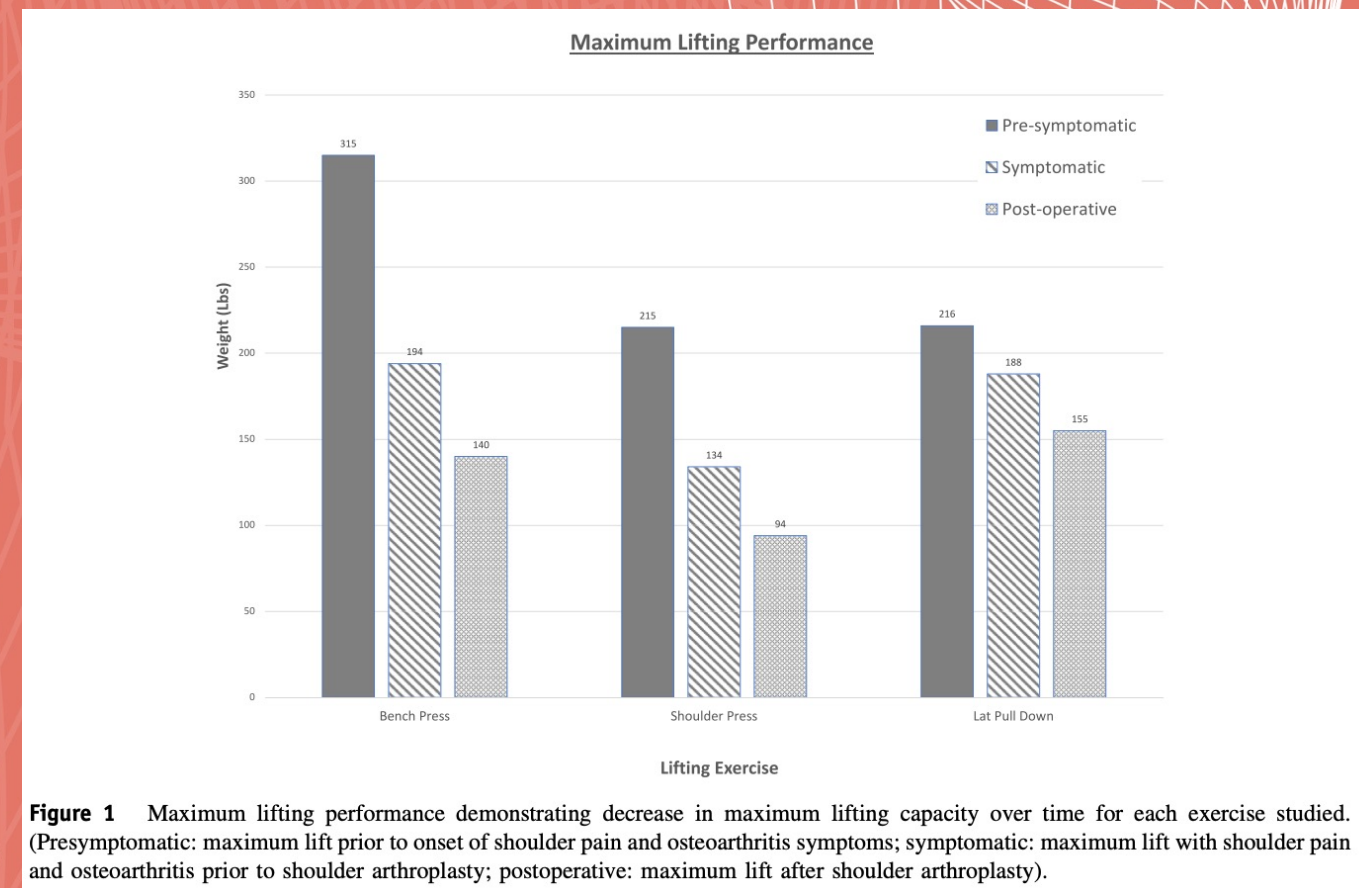


Figure 1 Maximum lifting performance demonstrating decrease in maximum lifting capacity over time for each exercise studied. (Presymptomatic: maximum lift prior to onset of shoulder pain and osteoarthritis symptoms; symptomatic: maximum lift with shoulder pain and osteoarthritis prior to shoulder arthroplasty; postoperative: maximum lift after shoulder arthroplasty).

Discussion

- Several studies have assessed return to sporting activities following TSA. Zarkadas et al reported that 60% of TSA patients reported having high use of their shoulder, including free weights and hunting after surgery.
- In a study on TSA in patients under 55 years old, Garcia et al reported 83.8% of patients were able to return to high-level upper extremity sports after TSA.
- Mannava et al reviewed return to recreational sporting activities after TSA in 112 athletes and found a high proportion (93.7%) of patients returned to recreational sports, with most (69.7%) achieving similar postoperative level of competition. They stratified patients into 8 groups based on sport played and found that only 9.1% of 21 patients engaged in weightlifting were unable to RTS after TSA.
- In contrast, our study examined a larger cohort of exclusive high-demand weightlifters, but found overall lower return to sport, and lower return to presymptomatic performance.
- This is not surprising given the high intensity of weight training by athletes in our cohort and recommendations against high-resistance weightlifting postoperatively



Discussion

- Interestingly, 5 patients who had resigned their bench press secondary to pain levels prior to surgery regained the ability to bench press after TSA.
- We found that the majority of patients were approaching 50% of their presymptomatic bench press and shoulder press, and most patients were able to achieve >90% of their presymptomatic latissimus pull down maximum.
- These findings may indicate an agonistic effect of the “pull” mechanism of the rotator cuff, deltoid, and triceps brachii muscles, which may provide theoretical protection against implant loading during this movement vs. the “push” mechanism of the pectoralis and biceps muscles that are activated during the bench press.



Table III Univariate analysis for percentage of maximum weight for exercises compared to patient-reported outcomes and satisfaction scores

Measure	Bench press			Shoulder press			Latissimus pull down		
	n	% of maximum (95% CI)	<i>P</i> value	n	% of maximum (95% CI)	<i>P</i> value	n	% of maximum (95% CI)	<i>P</i> value
<30 mo since surgery	6	79.9 (55.2-105)	.795	5	79.1 (27.6-131)	.924	7	94.2 (80.9-108)	.333
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Excellent	9	82.9 (63.8-102)		8	93.3 (23.8-163)		12	105 (85.0-125)	

SANE, Single Assessment Numeric Evaluation; CI, confidence interval.



Discussion

- Glenoid component failure is one of the most cited reasons for revision TSA and drives the recommendation to restrict high-demand activities
- In a study by Garcia et al evaluating return to sport in patients undergoing TSA there were high rates of return to fitness and high-demand sports and at average 61-month follow-up, no patients required glenoid component revision.
- Similarly, our study demonstrates no revision surgeries in a comparable age group with 3.6 years' follow-up.
- Although caution is still advised with returning to heavy weightlifting, the current data highlight the positives of modern fixation techniques, fourth-generation implants
- Diminished lifting capability may also play a role in implant survival
- However, we do not suggest altering the recommended weightlifting limitations without further future study



Take Away Points

- Most patients who participated in preoperative weightlifting returned to high-demand weightlifting after surgery against their surgeon's recommendations.
- Patients did demonstrate lower lifting performance postoperatively.
- There were no early clinical catastrophic failures and high patient-reported outcome scores.
- Although caution is still advised with returning to heavy weightlifting, the current data highlight the advances of modern fixation techniques and fourth-generation implants on implant load and activity limits after TSA.
- Further study is warranted to determine if postoperative restrictions may be lifted after anatomic TSA in the future.



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