Table 2 Failure by age

Failure by age	Failures	Total Patients (n)	Percentage
60-64	7	26	27%
65-69	8	31	26%
70-74	7	23	30%
75-79	10	20	50%
80-84	6	13	46%
85-89	6	12	50%
90+	0	6	0%
	44	131	34%

frozen shoulder requiring injection, and 1 case of asymptomatic rotator cuff failure.

Most patients with radiographic or clinical failure did not undergo reoperation. The overall reoperation rate was 11% (14 patients). This correlated with fracture type, with 7% of 2-part fractures (4 shoulders), 14% of 3-parts (8 shoulders), and 18% of 4-parts (2 shoulders) requiring reoperation. Revision operations were reverse total shoulder arthroplasty (rTSA) in 8 patients, hardware removal in 5 patients, and revision ORIF in 1 patient.

Clinical outcomes

Overall patient reported outcomes were satisfactory in patients without failure. VAS for pain averaged 0 at rest and 1 with activity. The average SANE score of this cohort was 92. At final follow up, for patients with failure (including those who had required revision operation), the VAS (rest) was 1, VAS (activity) was 2, and average SANE score was 77.

Discussion and Conclusions

Internal fixation of proximal humerus fractures with locking plates in patients over the age of 60 resulted in a 44% complication rate, including a 34% failure rate defined as reoperation or radiographic failure. Higher complication and failure rates were observed in older patients and more complex fractures. However, the reoperation rate was relatively low (11%), which may be partly due to unwillingness to offer revision surgery to older patients with failed fixation if clinically well tolerated. Improvements in fracture fixation techniques, implants and instruments are required to improve the surgical management of proximal humerus fractures.

Figure 1 Illustrative Case—3 part fracture in 78 YO female. Progressive, symptomatic avascular necrosis postoperatively. Given activity demands, she elected to have isolated hardware removal without reconstruction.

Paper #28 CEMENTLESS REVERSE TSA FOR PROXIMAL HUMERAL FRACTURE: RESULTS OF A MODERN TECHNIQUE

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Introduction: Reverse total shoulder arthroplasty (RTSA) has been successfully used for the treatment of proximal humeral fractures (PHFx). Traditional surgical technique has utilized cemented fixation of the humeral stem to restore anatomic humeral height and version. The use of cement has been associated with both intraoperative cardiopulmonary issues as well as postoperative difficulty if revision is required. To this end, we report here the results of cementless RTSA for the treatment of acute and chronic PHFx.

Methods: Fifty-five consecutive patients underwent hybrid cementless RTSA for proximal humeral fracture. There were 30 acute fractures (Neer 3- and 4 part fractures) and 25 chronic fractures (Boileau Types 2, 3, and 4). Mean age was 67 years (range 35-91 years). Mean clinical and radiographic followup was 28 months (range 12-60 months).

Results: At final review, mean range of motion was as follows: active anterior elevation 152.6°(range 80-170°), active external rotation 52.7°(range 0-80°), and active internal rotation 65.7°(range 0-80°). ASES score improved from 8.82 to 90.6, Simple Shoulder Test improved from 4.91 to 91.58, and Visual Analog Score improved from 6.67 to 0.39.

Overall, 47 of 55 (85%) of greater tuberosities demonstrated osseous healing (28/30 = 93% acute PHFx, and 19/25 = 76% chronic PHFx).

Overall, 6/55 (10.9%) of major complications occurred postoperatively (including 5 periprosthetic fractures and 1 wound infection requiring implant removal).

Conclusion: Cementless RTSA for PHFx utilizing a modern reproducible surgical technique demonstrates successful clinical and radiographic outcomes compared with traditional techniques.

Paper #29 OUTCOMES USING SUPERIOR AND POSTERIOR-SUPERIOR AUGMENTED BASEPLATES IN REVERSE TOTAL SHOULDER ARTHROPLASTY FOR GLENOID WEAR: SHORT TERM FOLLOW UP COMPARED TO MATCH CONTROL

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Objective: Augmented base plates are used to address asymmetric glenoid wear while avoiding excessive eccentric reaming in reverse shoulder arthroplasty (RSA). The purpose of this study is to evaluate the short-term outcomes of superior and posterior-superior augmented baseplates used in patients undergoing reverse shoulder arthroplasty in patients with superior or posterior-superior glenoid wear.

Methods: A multi-institutional database was used to retrospectively analyze patients that underwent RSA with superior or posterior-superior augmented glenoid baseplates (RSA-A) for superior glenoid wear between 2009-2015. A total of 58 patients with minimum 2-year follow up were included and matched with a control group of 58 patients (RSA-C) that underwent RSA with a standard glenoid baseplate. The primary outcome measure was failure of the glenoid baseplate requiring revision shoulder arthroplasty. Secondary outcomes included range of motion, pain scores, SST and ASES scores.

Results: The average follow up in both groups was 33.19 (±12.3) months. The average age was 72.16 (±8.5) years. There was one revision in the RSA-C group due to glenosphere loosening likely secondary to infection. Radiographic glenoid loosening was

Table 1

	Forward elevation (degrees)	External rotation (degrees)	Internal rotation Score	SST score	ASES score
RSA-A	132.19	36.14	4.36	9.86	81.58
RSA-C	145.6	41.76	4.64	10.27	84.25
P-value	.0013	.0647	.3195	.3055	.3760

reported in one patient in the RSA-SA group but did not result in a revision during the study period. The RSA-C group had significantly higher forward elevation than the RSA-A group. There were no significant differences in external rotation, internal rotator score, SST scores, or ASES scores between the RSA-A and RSA- C groups (Table 1).

Conclusion: Results of RSA with superior and posterior-superior augmented baseplates demonstrate improved clinical outcomes without increased risk of glenoid baseplate failure in patients with superior and posterior-superior glenoid wear.

Paper #30 TUBEROSITY HEALING IMPROVES ROM AND FUNCTIONAL OUTCOME FOLLOWING TREATMENT OF PROXIMAL HUMERUS FRACTURES WITH REVERSE SHOULDER ARTHROPLASTY

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Introduction: Reverse shoulder arthroplasty (RSA) is a common treatment for proximal humeral fractures in the elderly. The aim of this study was to evaluate the influence of tuberosity healing on functional outcome following a 135° humeral inclination RSA for proximal humeral fracture.

Methods: A retrospective evaluation was performed of all patients during a two-year period with an acute proximal humeral fracture treated with a 135° humeral inclination RSA at 4 centers were included. Minimum follow-up (FU) was 1 year. Visual analog pain scale (VAS)), range of motion, Constant score, American Shoulder and Elbow Surgeons (ASES) score and subjective shoulder-value (SSV) were recorded. In addition, tuberosity healing and glenoid notching were analyzed.

Results: Sixty-four patients with a mean age of 76 ± 7 years were available for follow-up at 22 ± 8 months postoperative. The mean adjusted-constant score was 72%, the mean ASES score was 72 ± 15, the mean SSV was 71% ± 14 and the mean VAS was 2 ± 2. The healing rate of the greater tuberosity (GT) was 77%. Healing of the GT resulted in significantly improved forward flexion (116° vs. 92°; $P = .002$), external rotation (33° vs. 17°; $P = .02$) and adjusted-constant score (78% vs. 54%, $P < .001$). Only 33% of the cases with an inferior eccentric glenoid demonstrated tuberosity healing. The complication rate was 8% and revision rate was 3%; however, the implant survival rate was 100%.

Conclusion: RSA with a 135° humeral inclination leads to acceptable functional outcome and a high rate of tuberosity healing in the treatment of proximal humerus fractures. The revision rate is low in the short-term. Tuberosity healing is associated with improved ROM and functional outcome.

Paper #31 SALVAGE REVERSE TOTAL SHOULDER ARTHROPLASTY FOR FAILED OPERATIVE TREATMENT OF PROXIMAL HUMERAL FRACTURES IN PATIENTS YOUNGER 60 YEARS: LONG-TERM RESULTS

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Introduction: Serious concerns exist about the longevity of salvage RTSA in the working population. It was the purpose to analyze the long-term outcome of RTSA as a salvage procedure for failed operative treatment of complex proximal humeral fractures in patients younger than 60 years.

Methods: Thirty patients with a mean age of 52 (range, 30-59) years were personally reviewed after a mean follow-up of 11 (range, 8-18) years. There were seven patients (23%) with RTSA for failed ORIF and 23 patients (77%) for failed hemiarthroplasty. Clinical and radiographic outcome were assessed longitudinally.

Results: At final follow-up, the absolute and relative, mean Constant scores improved from preoperatively 21 (range, 5-45) to 49 (range, 19-82) points ($P < .001$); and from 25% (range, 5-53%) to 58% (range, 25-94%; $P < .001$), respectively. Significant improvements were seen in mean SSV (20% to 56%), active elevation (45° to 106°), abduction (42° to 99°), pain scores and strength ($P < .001$). Clinical outcome did not significantly deteriorate over 10 years and the functional results of patients with RTSA for failed primary hemiarthroplasty (n = 10) were not inferior to those after failed ORIF (n = 6). Patients with RTSA for failed secondary hemiarthroplasty (n = 8) compared with those after failed ORIF showed inferior elevation (93° vs. 113°; $P = .190$) and abduction (77° vs. 116°; $P = .023$). Patients with a healed greater tuberosity (n = 8) showed significantly better external rotation compared with patients with a resorbed greater tuberosity (n = 13; 8° vs. 15°; $P = .014$). One or more complications occurred in 21 shoulders (71%), and six (20%) resulted in explantation of the RTSA.

Conclusion: Although salvage RTSA in patients younger than 60 years is associated with a substantial complication rate, it leads to significant subjective and functional improvement without clinical deterioration beyond 10 years. Inferior shoulder function is associated with greater tuberosity resorption and with RTSA for failed secondary hemiarthroplasty.

Paper #32 EFFECTS OF AGING ON THE MOLECULAR PROFILE OF CULTURED TENDON CELLS

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Introduction: Rotator cuff tears affect millions of individuals each year, with increased prevalence in the elderly. Although surgical repair improves function and reduces pain, rotator cuff repair failure is common. To improve surgical outcomes, repair augmentation has been investigated. We recently found that autologous biceps cells delivered via scaffold during supraspinatus repair improved healing in juvenile and aged rats, but not adult rats. However, the molecular mechanisms behind these differential effects are not well understood. The objective of this study (funded by the American Shoulder and Elbow Surgeons Research Grant) was to determine the differences in the RNA signature of primary tendon-derived cells cultured from the long head of the biceps of juvenile, adult, and aged rats. This study is the first in a planned sequential line of work to determine the "ideal" autologous or allogeneic cell source for rotator cuff repair augmentation. Our hypotheses for this study were: 1) Tendon-derived cells from juvenile rats would exhibit a molecular profile with a more stem-cell character than other ages, and 2) Tendon-derived cells from aged rats would show increased expression of genes associated with tendon homeostasis and differentiation.