Functional Outcomes of Scapular Resection: Is a New Classification System Needed?

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INTRODUCTION:

Surgical resection of bone tumors of the shoulder girdle which includes the scapula can impart substantial functional impairment. Previous outcome studies have focused on preservation of the glenohumeral joint. As such resection classifications have focused on the glenoid, and even resections only including the glenoid are considered “total scapular resections.” These classification systems are over 50 years old, and advances in surgical techniques has improved functional outcomes; however, these historic resection classifications may not account for these advances. The purpose of the current study was to evaluate our institutional outcome of patients undergoing scapular to 1) determine if a different classification system should be developed and 2) examine patient function based on resection levels.

METHODS: A total of 107 (43 females, 64 males; mean age 42±20 years) patients undergoing an en-bloc shoulder girdle resection including the scapula were reviewed (Table 1). The mean tumor size was 8±4 cm. The scapula was divided based on the status of the scapular spine and glenoid (Figure 1). Fifty-two (49%) resections included the humerus (n=52, 49%). Functional outcome measures included Musculoskeletal Tumor Society (MSTS93) Score, American Shoulder and Elbow Surgeons Score (ASES), and Simple Shoulder Test (SST).

RESULTS:

Patients with a total scapular resection had worse functional outcomes compared to those undergoing a partial resection. Patients with preservation of the glenoid and the scapular spine had improved functional outcomes compared to those with the glenoid or scapular spine resected (Table 2).

When examining the status of the glenoid in relation to the scapular spine, there was no difference in functional outcomes when examining patients who had preservation of both the scapular spine and glenoid or just the scapular spine based on the MSTS93 (73% vs. 68%, p=0.15), ASES (73% vs. 67%, p=0.28), and SST (7 vs. 6, p=0.15). This was also apparent when examining the location of a horizontal osteotomy of the scapula. If the osteotomy was inferior to the scapular spine, patients had improved outcome when compared to patients where the osteotomy was through or above the spine in terms of the mean MSTS93 (85% vs. 67%, p<0.01), ASES (86% vs. 64%, p<0.01), and SST (10 vs. 5, p<0.01). However, when it was only the glenoid/coracoid/acromion remaining, with a vertical osteotomy at the level of the scapular notch, there was no difference in patient function between patients who had preservation of the glenoid/coracoid/acromion and those that did not in terms of MSTS93 (73% vs. 71%, p=0.85), ASES (70% vs. 71%, p=0.71), and SST (7 vs. 6, p=0.89).

DISCUSSION AND CONCLUSION:

Contrary to previous functional classifications, resection of the glenoid should not be considered a total scapular resection if the scapular spine is able to be maintained. In addition to the glenoid, the scapular spine is essential for shoulder function. As such we propose a new classification system that accounts for this.

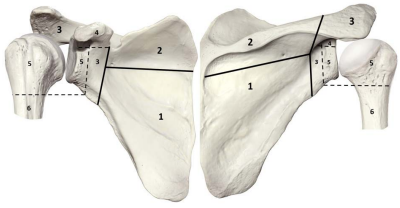

Table 1: Functional Outcomes Following Shoulder Girdle Resection

Outcomes		MSTS93	P Value	ASES	P Value	SST	P Value
Any Type of Resection	*Status of Glenoid*						
	Resection Preserves the Glenoid (n=34)	85±14%	<0.01	82±16%	<0.01	9±3	<0.01
	Resection Includes the Glenoid (n=73)	66±16%		63±15%		5±2	
	Status of Scapular Spine						
	Resection Preserves Scapular Spine (n=61)	76±18%	<0.01	77±16%	<0.01	8±3	<0.01
	Resection Includes the Scapular Spine (n=46)	60±15%		62±13%		5±2	
	Combined Scapular Spine and Glenoid						
	Resection Preserves Scapular Spine and Glenoid (n=73)	73±17%	0.15	73±18	0.28	7±3	0.15
	Preservation of Scapular Spine and Glenoid Resection (n=34)	68±18%		67±13		6±2	
Horizontal Osteotomy							
	Below Scapular Spine (n=27)	85±14%	<0.01	86±14%	<0.01	10±3	<0.01
	Above Scapular Spine (n=80)	67±16%		64±12%		5±2	
Vertical Osteotomy							
	Medial to Glenoid Through Scapular Notch Only Preserving Glenoid/Coracoid/Acromion (n=7)	73±17%	0.85	70±20%	0.71	7±4	0.89
	All Other Resections (n=100)	71±17%		71±16%		6±3	
Humerus Involvement							
	Humerus Included (n=52)	66±16%	<0.01	62±15%	<0.01	5±2	<0.01
	Humerus Preserved (n=55)	76±17%		76±16%		8±3	
Scapular Resection							
	Total Scapular Resection (n=34)	69±19%	0.01	69±9%	<0.01	5±2	<0.01
	Partial Scapular Resection (n=73)	75±16%		74±17%		7±3	
Deltoid Status							
	Preservation of at Least 2/3 of Deltoid (n=67)	76±16%	<0.01	75±16%	<0.01	8±3	<0.01
	Resection of >1/3 of Deltoid (n=40)	64±18%		61±12%		5±2	
Axillary Nerve							
	Axillary Nerve Involvement (n=18)	60±16%	<0.01	55±12%	<0.01	4±2	<0.01
	Preservation of Axillary Nerve (n=89)	74±16%		74±15%		7±3	
Rotator Cuff							
	Preservation of Rotator Cuff (n=92)	73±23%	0.21	77±18%	<0.01	8±4	0.01
	Resection Involving Rotator Cuff (n=55)	70±13%		66±13%		5±2	

Table 2: Shoulder Motion Following Shoulder Girdle Resection

Operative		Forward Elevation	P Value	External Rotation	P Value
Any Type of Resection	*Status of Glenoid*				
	Resection Preserves the Glenoid (n=34)	111±55°	<0.01	39±21°	<0.01
	Resection Includes the Glenoid (n=73)	23±16°		17±9°	
	Status of Scapular Spine				
	Resection Preserves Scapular Spine (n=61)	81±64°	<0.01	27±24°	<0.01
	Resection Includes the Scapular Spine (n=46)	27±34°		9±14°	
	Combined Scapular Spine and Glenoid				
	Resection Preserves Scapular Spine and Glenoid (n=73)	68±63°	0.04	22±23°	0.03
	Preservation of Scapular Spine and Glenoid Resection (n=34)	31±18°		13±18°	
Horizontal Osteotomy					
	Below Scapular Spine (n=27)	118±52°	<0.01	42±19°	<0.01
	Above Scapular Spine (n=80)	18±15°		11±16°	
Vertical Osteotomy					
	Medial to Glenoid Through Scapular Notch Only Preserving Glenoid/Coracoid/Acromion (n=7)	73±57°	0.31	26±27°	0.44
	All Other Resections (n=100)	57±60°		19±22°	
Humerus Involvement					
	Humerus Included (n=52)	17±18°	<0.01	9±13°	<0.01
	Humerus Preserved (n=55)	86±62°		28±24°	
Scapular Resection					
	Total Scapular Resection (n=34)	18±17°	<0.01	7±9°	<0.01
	Partial Scapular Resection (n=73)	74±62°		25±24°	
Deltoid Status					
	Preservation of at Least 2/3 of Deltoid (n=67)	72±60°	<0.01	24±24°	0.01
	Resection of >1/3 of Deltoid (n=40)	12±13°		11±14	
Axillary Nerve					
	Axillary Nerve Involvement (n=18)	7±9°	<0.01	5±9°	<0.01
	Preservation of Axillary Nerve (n=89)	68±59°		23±23	
Rotator Cuff					
	Preservation of Rotator Cuff (n=92)	79±67°	0.02	28±27°	<0.01
	Resection Involving Rotator Cuff (n=55)	37±42°		12±13°	