



## A systematic review of management of scapular fractures

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There is no agreement within literature regarding management of scapula fractures. Our aim was to carry out a systematic review of literature on management of the scapular fractures.

Our search across multiple medical databases for studies on the scapular fractures until February 2014 yielded 32 studies. We have excluded case series <7 patients, case reports, review articles, articles without abstract, observational studies and articles on fractures following shoulder arthroplasty.

There were 8 prospective case series and one cohort study, however, majority of the included studies were retrospective studies. There were 1237 patients, follow up data were available for 941 patients who underwent either conservative (629) or operative management (512).

Non-operative management scapular body fractures had satisfactory results. The scapular neck fractures displaced <10mm have satisfactory outcome following non-operative management. Operative management of displaced glenoid fossa fractures and scapular neck fractures displaced >10mm lead in a better functional outcome.

**Keywords :** Scapula ; glenoid ; fractures ; management of scapula fractures ; scapular neck fractures.

### INTRODUCTION

Scapular fractures account for 0.4%-1% of all injuries and 3-5% of shoulder injuries<sup>14</sup>. A majority of scapular fractures occur as a result of high-energy trauma and are usually associated

with other injuries. Often these associated injuries take priority over scapular fractures. Nevertheless, there is no agreement within literature regarding recommended management of scapular fractures. There are articles that report satisfactory outcome with non-operative management (7,14,31,26) on the contrary, other articles that report poor outcome following non-operative management (1,4,29) Furthermore, there are reports that recommend operative management of scapular fractures (3, 5,8,13,18,20,30).

There are no prospective studies or randomized control trials to provide a reliable answer for the management of these fractures. There are studies comparing operative treatment with non-operative treatment, (19,32) ,however, the sample size of these studies are too small (31 and 21 respectively) to deduce any valid conclusion. Even though summation and analysis of data from individual case series can provide some evidence, the heterogeneity in both classification systems and assessment of outcome (Table I) makes it difficult to collate the available information to provide a better understanding regarding the management of these injuries.

Zlowodzki et al. (36) (2006) in his systematic review compared operative management with non-

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Table I. — Classification systems and outcome measures used in articles included in our review

Classification system	Outcome measures
Ada Miller classification	Pain and ROM
OTA classification	Functional ability and Power Rowe scoring
Euler and Ruedi classification	McGinnis and Denton rating. Constant score
Ideberg classification	Murley score Herscovici score
Mayo classification	UCLA Grading SF 36
Goss classification	Hardegger function evaluation system DASH score

operative management, but he concluded that the sample size for neck, body and the glenoid fractures were small to allow a valid comparison. In addition, they did not include information on, average follow up, time of surgery, indications for surgery and the degree of displacement. We have attempted to update the systematic review by including a larger sample, conducting a statistical analysis.

Also, we have compared our results with the results from other comparative studies. Dienstknecht et al. (9) and Lantry et al. (21) conducted a meta-analysis and systematic review respectively. But these dealt with the scapular neck fractures alone and only the operative management of scapular fractures respectively. Further, both these articles have performed analysis based on EBM level 4 evidence.

The aim of our study was to perform a meta-analysis, however the available literature, mostly comprised of case series without any randomization or blinding (EBM level 4 evidence). Hence we have performed a systematic review of literature to compare the results of operative and non-operative management of scapular fractures.

## MATERIAL AND METHODS

We included all the studies in the literature published until February 2014 on the scapular fractures. We have excluded case series with less than 7 patients, case reports, review articles, articles without abstract/results, articles dealing with fractures following reverse shoulder arthroplasty.

We have conducted the search in multiple medical databases like MEDLINE, EMBASE, and PUBMED. The literature search in this systematic review was conducted according to the PRISMA protocol. The primary terms were 'Scapula AND fractures', 'Glenoid AND fractures'. We identified a number of studies in various databases, specifically, with the PUBMED database using key words 'Scapula AND fractures'; 950 hits, 'Glenoid And fractures'; 494 hits, the MEDLINE with key words 'Scapula And/or Fractures'; 684 hits, 'Glenoid And/or fractures'; 569 hits and the EMBASE using key words 'Scapula AND fractures', 'Fractures / And Scapula': total 539 hits. Review of references helped identify additional 2 systematic reviews and one meta-analysis.

We conducted the search and the full texts of all articles included in the study were obtained. The bibliography of these articles was manually checked to identify any missing studies. English language articles and few Chinese studies for which English translation was available were included. (Table II)

We collected and analysed the data and compared these results with the outcome of other comparative studies to validate our findings. We used Microsoft Excel to create a database, and data were extracted about the type of study and year, the number of patients or fractures, age and sex distribution, anatomical region wise incidence of fractures, type of management (operative or non-operative), follow up, time to surgery, outcome and complications. We have assessed the individual case series in

accordance to EQUATOR guidelines for reporting of case series<sup>17</sup>. We have used STROBE checklist {for cohort, case-control, and cross-sectional studies (combined) PLOS Medicine requirements} as our reporting guideline.

Statistical comparison of operative and non-operative management was not possible due to heterogeneity in the way the functional outcome was expressed. Hence we categorized the outcome as satisfactory and unsatisfactory (Table III) and the results were expressed as percentages. Other continuous variables like age, duration of follow up and time to surgery were expressed as mean and ranges. We have employed Chi-square test to compare the categorical data; the significance level was set at 0.05.

## RESULTS

Our search strategy initially yielded 904 articles out of which 614 were excluded as those dealt either with fractures other than the scapula fractures or other unrelated topics on the scapula. Further, there were 91 case reports, 11 case series with less than 7 patients, 12 articles describing operative approach to scapula, 19 reviews, 3 studies investigating the causes and incidence of scapular fractures and 39 articles without an abstract. The duplications, letters to the editor, fractures of scapula following reverse shoulder and articles on floating shoulder (124 articles) were excluded.

32 studies met the inclusion criteria, of these two were systematic reviews and one was a meta-analysis (only dealing with operative management), the other 29 articles were all case series (EBM level 4) (Figure 1). A majority of the included studies were retrospective studies (20) but there were 8 studies prospective case series and one cohort study (Table II). These studies were used for the collation of evidence. There was a meta-analysis and 2 systematic reviews, which we used to check the completeness of our included studies. The total number of patients included in our systematic review 1237 (1329 fractures).

Complete data were available only in 941 patients, who underwent either conservative (629) or operative management (512) for scapular

fractures. The base line demographics are presented in the Table II. The age at presentation range from 3 years to 85 years (Average 29.2 years). The follow up ranged from 9 weeks to 14 years (Average 35.3 months). The scapular fractures were more common in males (609) than females (213). The body is most commonly injured site followed by neck and glenoid. Most of the body fractures are managed non-operatively, and neck fractures are most commonly operated injuries. (Figure 2)

## All regions

11 articles provided results of management for all anatomical regions of scapula i.e., operative (5 articles) or non-operative (6 articles) management of all fractures of scapula. There are 647 patients (679 fractures) in this group, and out of which 541 patients were managed non-operatively and 143 patients were managed operatively. Those who had operative management had surgery between 4 - 60 days after trauma and post-operative mobilization was started between 3 days - 2 weeks after surgery.

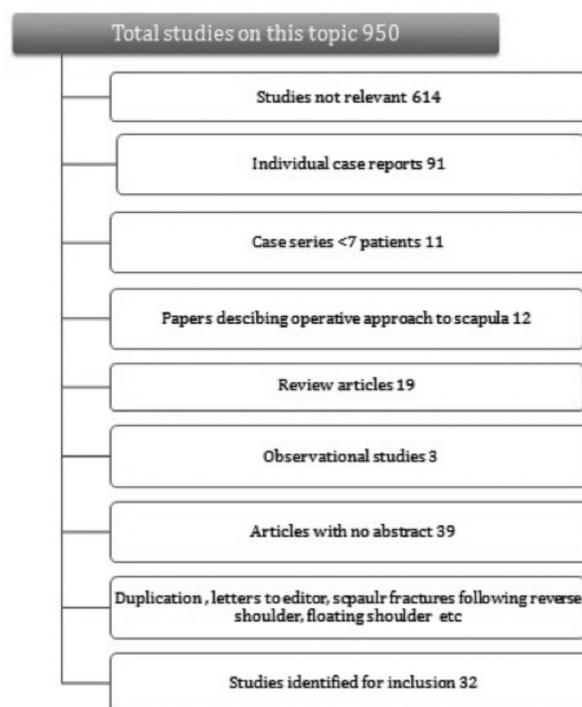


Fig. 1. — Flow chart of method of identification of studies

Table II. — Summary of articles included in our review

Year	Author	Journal	Level	Number of patients	Distribution of fractures	Age in years	Follow up	Indication	Treatment	Outcome Measures	Outcome
1980	McGahan <sup>2</sup>	Journal of trauma	4	121 (137 fractures)	Body 59, Spine 8, Coracoid 10, Acromion 11, Glenoid 14, Neck 35	3-82 (average 37)	8 year data	-	137 non operative	Pain ROM, return to function	Satisfactory
1984	Armstrong and Van der spuy <sup>6</sup>	Injury	4	64	Body 35, Spine 4, Coracoid 2, Acromion 6, Neck 11, Glenoid 3	20-67	6 months	-	64 non operative	ROM Functional ability	Neck and glenoid fractures unsatisfactory
1984	Hardegger et al <sup>3</sup>	Journal of bone and joint surgery B	4	37	Coracoid+ Acromion 4, Glenoid 23, Neck 8	17- 85	78 months	-	37 operative	ROM Pain Power	79% Satisfactory
1985	Thompson et al <sup>5</sup>	Journal of trauma	4	56 (58 fractures)	Coracoid+ Acromion 7, Glenoid + Neck 19, Body 30	3 (15-83)	NA	-	Non operative	Mode of trauma	-
1989	McGinnis and Denton <sup>33</sup>	Journal of bone and joint journal A	4	39	All regions	-	Adequate	-	39 non operative	Subjective complaints Strength ROM	73% satisfactory
1991	Ada et al <sup>7</sup>	Clinical orthopaedic related research	4	113 (148 fractures)	Neck 16, Glenoid 6, Spine 11	5- 75	Minimum 15 months	Displaced neck , glenoid, comminuted spine	140 non operative 8 operative	Pain Movements	Unsatisfactory
1992	Nordquist and Petterson, <sup>3</sup>	Clinical orthopaedic related research	4	129 (68 with follow up and clinical examination)	Body 37, Neck 22, Spine 5	7- 85 years (Median 46)	14 years	Displaced and undisplaced body, neck and spine	68 non operative	Pain Deformity Function	Satisfactory
1993	Leung and Lam <sup>30</sup>	Journal of bone and joint surgery A	4	15	Neck + clavicle	18-41	14 months	-	15 operative	Rowe scoring	Satisfactory
1995	Bauer et al <sup>17</sup>	Actaorthop trauma surgery	4	25	Glenoid 6, Neck 16, Coracoid 6, Acromion 4	16-69	6.1 years	-	20 operative	Constant score	Satisfactory (19/20)

1996	Ogawa et al <sup>26</sup>	Journal of bone and joint surgery B	4	67	Type 1- 53, Type 2-11	37.1(14-72)	37 months (Mean)	Type 1-31, Type 2-3, Uncertain -1	67 operative	McGinnis and Denton rating	Satisfactory
2000	Edwards et al <sup>28</sup>	Journal of bone and joint surgery A	4	20	Neck + Body 13, Neck 2, Body 4, Glenoid 1	16-60 ( avg 40 years)	28 months (9-79 Months)	-	20 non operative	Rowe score Constant score	Satisfactory
2002	Oh et al <sup>36</sup>	SICOT	4	13	Neck + clavicle 13	20-63(mean 42)	1 year	-	10 operative 3 non operative	Rowe score	Neck fractures >10 mm displacement unsatisfactory 9/10 satisfactory
2002	Adam et al <sup>22</sup>	International orthopaedics	4	10	Glenoid	average age 38(22-54).	18-84 months	-	10 operative	Power Activity	9/10 satisfactory
2002	Schandelmaier et al <sup>14</sup>	Journal of bone and joint surgery B	4	22	Floating shoulder 3, Neck 9, Body 11, Acromion 5, Coracoid 2	34 (16-68)	10 years (mean)	-	22 operative	Constant and Murley score	Satisfactory
2005	Bozkurt et al <sup>27</sup>	Injury	4	18	Neck	23-62	25 months	12 Stable, 6 Unstable	18 non operative	Constant score	GPA positive correlation with function
2005	Ding et al <sup>25</sup>	Chinese journal of reparative and reconstructive surgery	4	30	Neck 12 Non operative 18 Operative	-	14 days -9 years	-	12 non operative 18 operative	Herscovici score	8/11 non operative satisfactory. All operative satisfactory
2006	Zhou et al <sup>34</sup>	Chinese journal of surgery	4	21	Body 11 Neck 10 Glenoid 15 Spine 9 Acromion 6	34 (mean)	21 months (6 months - 4 years)	-	21operative (data available only for 18)	Rowe Score	17 satisfactory 1 unsatisfactory
2006	Khallaf et al <sup>13</sup>	Journal of kuwiat university health sciences	4	14	Neck	Average34 (19-44 years)	Average 20 (range 6-30 months).	>10 mm displacement Angulation >40 degrees	14 operative.	UCLA Grading	Satisfactory
2003	Esenkaya et al <sup>11</sup>	Acta orthopaedica	4	11	Neck+Body	Mean37.3 (19 to 52)	Mean 39.8 (12-77 months)	Comminuted body,> 40 degrees angulation, displaced body	11 operative	Herscovici scoring system	Satisfactory
2005	Van Noort A <sup>34</sup>	Acta Orthop trauma surgery	4	13	Neck	45(15-65)	Mean 5.5 years (1.6-12 years)	-	13 non operative	SF 36	Satisfactory

2008	Lin S <sup>31</sup>	China journal of orthopaedics and traumatology	4	52	Body 24, Neck 15, Glenoid 6, Spine 7	20-48	9 weeks – 48 months	-	17 non operative 35 operative	Hardeger function evaluation system GPA	15/17 Non –op satisfactory 35/35 Operative satisfactory
2009	Gossens et al <sup>1</sup>	Journal of shoulder elbow surgery	4	22	Body	25-50	63 months	-	22 non operative	DASH score SF36 Score ROM	Satisfactory in isolated injuries
2009	Herrera et al <sup>29</sup>	Journal of bone and joint surgery B	4	22	All regions	22-65	27 months	>4mm step, 15 mm medialisation, >25 degrees deformity, Double disruption	16 operated	DASH score SF36 score	Satisfactory
2009	Jones et al <sup>12</sup>	Journal of orthopaedic trauma	4	37	Neck 24, Glenoid 5, Body 8	16-68	12 months	>25 mm displacement, >25mm shortening Step >3mm Double disruption	37 operated	ROM Radiological healing	Satisfactory
2009	Anavian et al <sup>8</sup>	Acta orthopaedica	26 (27 fractures)	18-67	Acromion 13 Coracoid 14 (1 both)	22 months (12 – 42 months)	22 months (12 – 42 months)	Painful non union >10 mm displacement, >20mm medialisation >25 degrees angulation	26 operative	Union ROM Pain	Satisfactory
2009	Schofer et al <sup>4</sup>	Acta Orthopaedica	4	50 (51 fractures)	All regions	Average 44 (20-82) years	65 months	-	50 non operative	Constant score. Isokinetic testing. External rotation	94% satisfactory
2011	Jones et al <sup>15</sup>	Clinical orthopaedic related research	4	62 (182)	All regions	21-72 (43)	1.5 years (14-32 months)	> 20 mm medialisation > 45 degrees angular deformity >3mm step	31 operative 31 non operative	Pain ROM Return to function	No difference between in both groups
2011	Dimitroulias et al <sup>21</sup>	Clinical orthopaedic related research	4	124	Body	21-69 (Mean 46.9)	15 months (6-33 months)	Displaced body	49 non operative	DASH score	Satisfactory High ISS poor outcome

2011	Bartonicsek et al <sup>9</sup>	International orthopaedics	4	22	Body	19-56 (Mean 35)	26 months (12-48 months)	100% translation 30 degrees angulation Thoracic wall penetration	22 operative	Constant Score ROM	Satisfactory
2011	Cole et al <sup>10</sup>	Injury	4	84	Neck+Body	Mean 45 (18-76)	Mean 23.5 months (6-70)		84 operative	GPA	100% union
2014	Sen et al <sup>16</sup>	Indian journal of orthopaedics	4	21	Glenoid	18-59 (mean 290)	7.3 years	> 5mm displacement	13 non operative and 8 operative	Time to union Constant score	Displaced fractures satisfactory result after fixation
					Number						
Type of study					Retrospective	20					
					Prospective	8					
					Cohort	1					
					Meta-analysis	1					
					Systematic review	2					
Total						32					

The follow up data were available in 453 patients. The results were satisfactory in 90% of patients managed non-operatively, and, similarly 94% of patients managed operatively had satisfactory results. The complication rate following surgery was 3%. We could not identify a significant difference in results between both groups (p=0.36) (Table IV).

**Scapular Body fractures**

We identified 3 articles, which discussed the treatment results of scapular body fractures. Two of them dealt with non-operative management (14, 10) and one paper dealt with operative management 5. They were 97 patients, of whom 75 were managed non-operatively, and 22 who were managed operatively. The indications for operative management were: 100% translation of the lateral border fragments, >15 mm medialisation of glenohumeral joint, 30 degrees of angular deformity of the lateral border and glenoid fossa, intra-articular extension, >25 degrees angulation in semi-coronal plane, >10mm displacement after double disruption of superior shoulder suspensory complex and fragment penetration in to thoracic wall. The time of surgery ranged from 11- 21 days. The follow up ranged from 6 - 85 months. The follow up data were available in all operated patients, and for 54/75 patients managed non-operatively. The results were satisfactory in 100% of patients managed non operatively and 95.4% of patients managed operatively. Wound related complications occurred in 9% of operated patients and the malunion rate was 9% after surgery. There was no significant advantage of operative management over non-operative management (p=0.28) (Table IV)

**Glenoid fracture**

We found 2 articles on operative management (2, 30) and 2 articles on non-operative management (1, 15) of displaced glenoid fractures. There were 44 patients, of which 12 were managed non-operatively and 32 operatively. The follow up ranged from 15 months - 14 years and this data was available for all patients. The time of surgery was < 1 week in 22/32 patients and 9/32 patients had delayed surgery. The results of non-operative management were satisfactory in only 25% of patients, and 90.2% patients who had operative

management had satisfactory results indicating better outcome with operative management ( $p < 0.0001$ ). We have not included the comparative study by Sen et al. (32) in our statistical analysis in order to allow validation of our results by comparing with their findings (Table IV).

### Scapular Neck fractures

Three articles were obtained in our literature review that had published the results of the scapular neck fractures. Two articles (7,34) studied the non-operative management and 1 article (20) presented results of operative management of scapular neck fractures. There were 53 patients, of which 39 were managed, non-operatively and 14 had surgery. 19/38 fractures managed non-operatively had displacement  $< 10$  mm and another 19/38 had  $> 10$  mm displacement. However, all the fractures which underwent fixation were displaced  $> 10$  mm. The follow up ranged from 6 months -14 years, and the follow up data were available for all the patients. Lastly, the time of surgery was between 3-14 days. The results of non-operative management was satisfactory in 94.7% of patients with fracture displacement  $< 10$  mm, on the other hand, in fractures with displacement  $> 10$  mm result was satisfactory only in 15.7%. All patients who had surgery had satisfactory results. Displaced scapular neck fractures have better outcomes with surgery. ( $p < 0.0001$ ) (Table IV). We have not included the data from Ding et al (11) in our analysis as there was no data about the degree of displacement in each group. Cole et al (8) presented only the radiological outcomes after scapular neck fractures managed by surgery (100% union).

### Coracoid fractures

Our search for articles dealing with coracoid fractures produced only one article (26). This study compared operative and non-operative management for coracoid fractures. In total there were 67 patients, out of which 55 were males and 22 females. In addition, the mean age at presentation was 37.1 years (14-72 years). Thirty-five patients were treated with surgery. The follow up data were available in 45 patients and follow up duration range was 12 -117 months. The results were satisfactory in all

45 patients (100%) and there were no difference between operative and non-operative groups.

### Fractures of the Scapular neck extending into the body

Esenkaya et al. (13) have analysed results of operative management of scapular neck and body fractures (Ada-Miller type 2 and 4). Nine patients (11 fractures) were operated (8 males, 1 female). The age at presentation ranged from 19- 52 years, and the time of surgery was 1-15 days (mean 7 days). The follow up ranged from 12-77 months. The results were satisfactory in all patients. In contrast, Ada et al. (1), have analysed the results of non-operative management of 16 patients with similar fractures and concluded that the results were non satisfactory in up to 50% of patients.

### Fracture of coracoid with acromion

Anavian et al. (3) analysed results of operative management for fractures involving both coracoid and acromion. In total, there were 26 patients (21 males, 5 females). The mean age at presentation was 36 (18- 67) years and the follow up data was available only for 13 patients. The follow up duration was 12 - 42 months, but there was no data on time of surgery. In addition the postoperative rehabilitation included active assisted and passive movements until 1 month. All patients (100%)

## DISCUSSION

Our review found that satisfactory results were obtained in 90.4% of patients treated without surgery and 93.7% of patients with surgery when all regions of scapula were included. Our view is supported by a retrospective study Jones et al. (19). They compared the results of 31 fractures managed operatively with 31 fractures conservatively matching age, occupation and gender. They concluded that operative treatment of displaced scapula fractures results in similar healing rates, return to work, pain, and complications as non- operative treatment.

There was a clear advantage of operative management in displaced glenoid fractures and displaced scapular neck fractures. Only 25% of displaced glenoid fractures managed without surgery had satisfactory results, but the results

of operative management were satisfactory in 90.2% of patients. Furthermore, scapular neck fractures which were displaced more than > 10mm had satisfactory results in 100% of patients after surgery, but results of non-operative management was satisfactory in only 15.7% of patients.

We found that 89.9 % of scapular body fractures were treated non-operatively and all patients (100%) had satisfactory results. This finding is consistent with fining of Zlowodzki et al (36) that 99% of scapular body fractures were managed non-operatively and 86% of these had excellent or good results.

Only 25% of patients with glenoid fractures had a satisfactory outcome following non-operative management, whereas the surgery produced satisfactory results in 90.2% of cases and this finding is consistent with the findings of Sen et al. (32) and Zlowodzki et al. (36). Sen et al. (32) conducted a retrospective study on 21 patients with glenoid fossa fractures. They reported that conservative management for undisplaced fractures has a satisfactory outcome, whereas only 55.6% of displaced fractures managed conservatively have satisfactory results. In short the operative treatment produced acceptable results in 87.5% of patients with displaced glenoid fractures. Zlowodzki et al. (36) reported that operative management of glenoid fossa fractures had excellent or good results in 82% of patients.

Our analysis of scapular neck fractures showed that results of non-operative management was satisfactory in 94.7% of patients if the fracture is displaced < 10mm, but for the fracture displaced > 10 mm the results of non-operative management was satisfactory only in 15.7% of patients. On the other

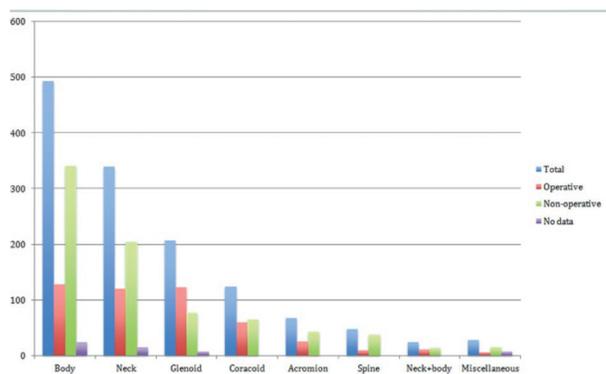


Fig. 2.

Table III. — Categorization of the outcome as satisfactory and non-satisfactory.

Satisfactory	Non-satisfactory
Outcome reported as excellent, good or satisfactory	Outcome reported as poor
Return to work	Unable to return to work
Minimal or no pain	Severe pain
Good/ slightly restricted ROM	Reduced ROM and high residual stiffness
	Popping out

hand, operative management of fractures displaced > 10mm had satisfactory results in all (100%) patients. This finding is not entirely consistent with the findings of Ding et al. (11) and Zlowodzki et al. (36). Ding et al. (11) compared the operative and non-operative management of scapular neck fractures in 30 patients, of which 9 fractures were displaced < 10 mm. 12 patients were treated without surgery and 18 with surgery. They have reported 72.7% of patients had satisfactory results in patients who were managed non-operatively and 100% satisfactory results in patients who were operated. Zlowodzki et al. (36) also concluded that excellent or good results were obtained in 77% of patients (scapular neck fractures) managed without surgery. Both of these studies have not mentioned how many of scapular neck fractures managed without surgery were displaced < 10mm. Nonetheless, Pace et al. (29) in their retrospective study of scapular neck fractures in 9 patients found out that none of the 9 patients managed non-operatively were pain free and also had poor Oxford and constant scores.

Lantry et al. (21) have performed a systematic review on operative management scapular neck and glenoid fossa fracture. They have analyzed 17 retrospective studies encompassing 243 patients and found that the posterior approach was most commonly used approach. Also, they concluded that 85% of patients who had surgery had good or excellent results; this finding is consistent with our findings. There is only one study (27) that

Table IV. — Statistical analysis of results

Site	Modality	Satisfactory results	Unsatisfactory results	p value (Fischer exact test)
All regions	Operative	119	8	0.36
	Non-operative	340	36	
Body	Operative	21	1	0.28
	Non-operative	54	0	
Glenoid	operative	29	3	<0.0001
	Non-operative	3	9	
Neck fractures (>10 mm displacement)	Operative	14	0	<0.0001
	Non-operative	3	16	

Table V. — Anatomic region wise indications and recommendations based on literature review and summary of results of operative and non-operative management in articles where results have not been expressed for each anatomical site. Excluded are studies without follow up and results.

Region	Management	Number	Follow up data available	Indication	Recommendation based on satisfactory results in review
Body	Conservative <sup>21,1</sup>	106	85	Displaced or undisplaced	Conservative management
	Operative <sup>09,11</sup>				
Glenoid	Conservative	44	44	Displaced intra-articular step 3-4 mm	Operative management
	Operative <sup>22,14</sup>				
Neck	Conservative <sup>02,24</sup>	105	105	Undisplaced (<10mm),	Conservative
	Operative <sup>05,25,13,30,36</sup>			Displaced (>10 mm),	Operative

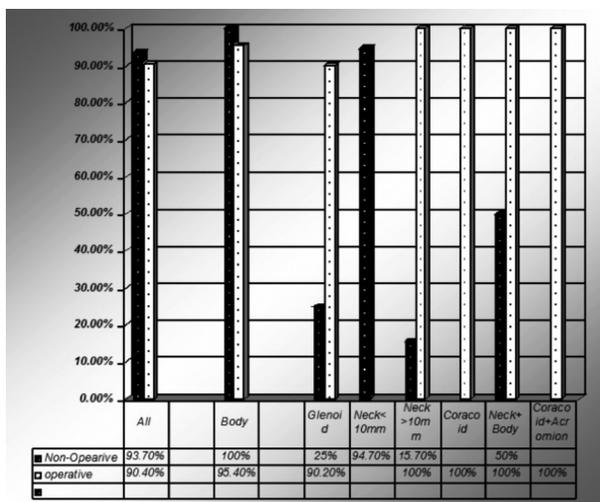


Fig. 3. — Outcome based on the anatomical region

investigates the management of coracoid fractures and concluded that there is no difference between operative and non-operative management. Even though papers analysing non-operative management of all regions mention coracoid fractures, none of them have specifically presented results for coracoid fractures.

The only previous meta-analysis on management of scapular neck fractures is from Dienstknecht et al. (9). They analyzed 23 manuscripts: 1 prospective and 22 retrospective studies. They found that patients who had surgery were more pain free and the outcome was worse in patients with multiple injuries, but there was no statistically relevant difference in restriction of activity and constant score after either option.

The strengths of our study are the relatively large number of cases included and degree of displacement (e.g. scapular neck fracture) and the anatomical region of the scapular fracture are discussed separately. The limitations of our study were that the articles available for review were all case series (EBM level 4). There were wide variations in both classification systems used and assessment of functional outcome. However, we made an attempt to overcome these limitations by categorizing the data according to anatomical regions. This allowed us to compare the results. We have categorized the functional results simply as satisfactory and non-satisfactory to analyse the outcome of management. Furthermore, we have compared our results with other comparative studies and systematic reviews presented in literature.

### CONCLUSION

We have found that all scapular body fractures in our review managed non-operatively had satisfactory results (Table V). Operative management of the displaced glenoid fossa (3-4mm) fractures has better functional outcome. In addition, Scapular neck fractures displaced < 10mm and minimally displaced glenoid had satisfactory outcome with non-operative management. Displaced scapular neck fractures (> 10mm) had a better functional outcome following operative management. There is not enough evidence for coracoid fractures. A multicentre randomised controlled trial is required to provide a more reliable data regarding indications for surgery.

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