Treatment of Scapula Fractures: Systematic Review of 520 Fractures in 22 Case Series

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Background: Fractures of the scapula account for 3% to 5% of all fractures of the shoulder girdle[39–41] and make up less than 1% of all broken bones.[42] Scapula fractures typically occur after high-energy trauma, and approximately 90% of the patients have associated injuries.[39,43]

Objective: (1) To determine the incidences of nonoperative and operative treatment of different scapula fracture types, (2) to systematically stratify the reported results of nonoperatively and operatively treated scapula fractures on the basis of different fracture types and to summarize functional results, and (3) to quantify infection and secondary surgical procedure rates after operative treatment.

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METHODS

Eligibility Criteria

Eligible studies for this systematic review were only studies that included more than 5 scapula fractures regardless of the location of the fracture (body, neck, glenoid, coracoid, and/or acromion) and reported either a categorical functional result (eg, excellent, good, fair, and poor) or at least a combination of pain assessment and range of motion (ROM) for each individual patient. Studies that reported the results of pain and ROM separately and studies that presented average outcome scores with no categorical assessment were not included. Also excluded were studies that presented data on individual fractures instead of patients, for example, presented a patient with scapula fractures at different locations as different cases.

Study Identification (Search Date: April 2005)

1. Cochrane Database: Keywords: "(scapula OR glenoid OR shoulder OR acromion OR coracoid AND fracture)"; 47 hits in The Cochrane Database of Systematic Reviews, 2 hits in the Database of Abstracts of Reviews of Effect, 32 hits in The Cochrane Central Register of Controlled Trials; None relevant.
2. Pubmed Search: Search query: "(Scapula* [ti] OR glenoid* [ti] OR shoulder* [ti] OR acromion* [ti] OR coracoid* [ti]) AND fracture* [ti]"; 520 hits, 31 potentially relevant.
3. Review of bibliographies of identified articles: 3 potentially relevant.
4. OTA online abstracts database of the 1996 to 2004 annual meetings: Keyword: "scapula" with 30% agreement; 7 hits; 1 relevant but redundant with subsequent publication.
5. AAOS online abstract database of the 2003 and 2004 annual meetings: Keyword: "scapula"; 1 hit; none relevant.

Eleven studies were excluded because of one or more above-mentioned exclusion criteria.[1–11] Two papers seemed to present the same data, and therefore only one was included.[12,13] No paper was excluded because of language barriers.

The total number of case studies included after the review was: 22[13–34] (17 English, 4 German, and 1 French)

Highest Available Evidence

No study claimed to be prospective; therefore, we assume that all 22 identified case studies were retrospective case series (EBM-Level IV).

Data Abstraction

A database was created using Microsoft Access (Microsoft Inc, Redmond, WA) and the following variables were extracted: average age of patients, average follow-up, number of patients, type of treatment (operative vs. nonoperative), fracture type (body, neck, glenoid, coracoid, acromion, spine, or a combination of those), associated clavicle fractures, functional results on a categorical scale, and the type of scale that was used to assess the functional result. If no average follow-up was reported, we used the minimal follow-up if it was reported. In fractures that were treated operatively, infection rates and secondary surgical procedures were recorded. Patients with bilateral fractures were documented as 2 cases. In each study, the data were stratified by different fracture types whenever it was possible.

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TABLE 1. Results by Fracture Type: Mean Percentages, 95% Confidence Intervals of the Mean and Absolute Numbers

	Operative: Excellent/Good	Nonoperative: Excellent/Good
Glenoid only[15,17,19,21,26,29,34,38]	82% (95%CI: 69-91%); (45/55)	67% (95%CI: N/A); (6/9)
Neck with/without other associated scapula fractures (excl. glenoid)[16,18,19–21,23,24,29,30,32–34]	92% (95%CI: N/A); (23/25)*	79% (95%CI: 71-85%); (110/140)†
Neck only[15,16,18–21,24,30,33,34]	88% (95%CI: N/A); (7/8)*	77% (95%CI: 68-85%); (80/104)†
Acromion and/or Coracoid (with/without other associated scapula fractures)[15,16,21,25,34]	70% (95%CI: N/A); (7/10)	82% (95%CI: N/A); (9/11)
Body only (including spine)[16,19,21,24,29,30,34]	100% (95%CI: N/A); (2/2)	86% (95%CI: 79-92%); (106/123)
Spine only[16,30,34]	—	86% (95%CI: N/A); (6/7)

Data could not have been extracted for all series. Therefore, the patient number does not add up to 520.
*There was 1 fracture with glenoid involvement.
†There was 1 fracture with glenoid involvement and there was 1 fracture treated operatively.
N/A indicates cannot be calculated because of low absolute numbers.

Data Analysis

The data were analyzed descriptively by using proportions and frequencies for categorical variables and means, standard deviations and ranges for continuous variables. Statistical comparisons between operative and nonoperative treatment for different fracture types was not possible due to insufficient sample sizes.

Functional Results

Various outcome scales and scoring systems were used across all studies: Constant score,[15,35] Rowe shoulder score,[23,36] Neer score,[17,31,37] Herscovici score,[18,20,32] activities of daily living,[33] patient's assessment, and ROM[22,30] or a subjective surgeon's assessment that was at least on the basis of pain and ROM. In some studies, the surgeon's assessment also included strength, daily activity, deformity, patient complaints, or radiographic assessment.[13,16,19,21,24–29,34,38] In one study, the Herscovici score was preferred over the Constant and Rowe score to achieve better comparability with other studies classified as floating shoulders.[18]

We summarized the functional results into 2 categories, excellent/good and fair/poor. The following results were categorized as excellent/good: excellent, very good, good, satisfactory, mild/no impairment of activities of daily living, full pain free ROM, full ROM with slight pain on exertion, and "shoulder mobile and painless". The following results were categorized as fair/poor: fair, poor, unsatisfactory, average, failure, and moderate/severe impairment of activities of daily living.

RESULTS

A total of 520 fractures were identified in the studies reviewed. The average age of the patients was 38 years (based on 327 reported patients in 17 case series) and the average follow-up was 57 months (based on 313 reported patients in 16 case series). Overall, 427 out of 520 (82%) treated fractures had an excellent/good functional result and 93/520 (18%) a fair/poor result. In 2 series with 55 patients each, the results for operative and nonoperative treatment were not separated and the data could not be extracted for the 2 treatment groups. Of the remaining 465 cases, 325 (70%) were treated nonoperatively and 140 operatively (30%).

Approximately 80% (86/107) of all fractures with glenoid involvement, 83% (156/189) of all neck fractures with or without associated fracture types excluding the glenoid, and 52% (16/31) of all acromion and/or coracoid fractures with or without associated fracture types excluding the glenoid and neck were treated operatively, whereas 99% (135/137) of all isolated body fractures were treated nonoperatively. Results of the treatment are presented in Tables 1 and 2.

In the operative group (n = 141), 2 deep infections,[22,38] 2 superficial infections requiring irrigation and debridement,[13] and 1 superficial infection that healed with the use of antibiotics[38] were recorded, accounting for a total infection rate of 3.5%.

Twenty-three secondary surgical procedures were reported after operative treatment (n = 140) accounting for a secondary surgical procedure rate of 16.5% (8 manipulations under anesthesia, 7 hardware removals, 3 irrigation and debridements, 2 hematoma evacuations, 2 revision fixations, and 1 arthrodesis of the glenohumeral joint).

ARE THE RESULTS OF THESE STUDIES VALID?

All identified studies were case series (n = 22). The available literature includes neither randomized nor nonrandomized comparative studies. The conclusions

TABLE 2. Results of "Floating Shoulder" (Scapula Neck and Clavicle Fracture) Treatment: Mean Percentages and Absolute Numbers

	Excellent/Good
Nonoperative treatment of scapula neck and clavicle[18,20,32*]	94% (33/35)
Nonoperative treatment of scapula neck and operative treatment of clavicle[20]	100% (7/7)
Operative treatment of scapula neck and clavicle[23]†	93% (14/15)

In 1 additional series, it was not clear how the clavicle was treated.[4]
*One fracture may have had glenoid involvement and 2 fractures may have had scapula body involvement.[32]
†There was 1 fracture with glenoid involvement.[23]

that can be drawn from these case series are limited by the lack of a control group; the comparison between the operative and the nonoperative treatment group is potentially biased due to the lack of randomization, and the recorded functional outcomes are potentially biased by the lack of blinding. We summarized the functional results on the basis of the categorical results the authors reported. However, various different scales were used that might not be entirely comparable. In addition, the validity of the measured functional outcome is limited because (1) most of the used outcome scales were not validated and (2) severe additional injuries that are commonly associated with scapula fractures can have a significant impact on the functional outcome. Therefore, accuracy of data reporting and subsequently our data summary with regard to fracture types and associated clavicle fractures might be limited.

EVIDENCE-BASED BOTTOM LINE

Based upon the current available evidence, we report the following:

1. Eighty percent of all fractures with glenoid involvement are being treated operatively. Excellent or good results can be achieved with operative treatment of isolated glenoid fractures in 82% of the cases.
2. Ninety-nine percent of all isolated scapula body fractures are being treated nonoperatively. Excellent or good results can be achieved with nonoperative treatment in 86% of the cases.
3. Eighty-three percent of all neck fractures with or without associated fracture types excluding glenoid fractures are being treated nonoperatively. Excellent or good results can be achieved with nonoperative treatment of isolated neck fractures in 77% of the cases. Looking at a smaller subset of scapula neck fractures associated with ipsilateral clavicle fractures, excellent or good results can be achieved with nonoperative treatment of scapula neck and clavicle fractures in 94% of the cases.
4. Due to the low number of scapula neck and body fractures that were treated operatively and glenoid fractures that were treated nonoperatively, high variability between studies, the use of different nonvalidated and nonspecific outcome measures, the high incidence of additional injuries associated with scapula fractures, and methodological limitations of many studies, a valid comparison between operative and nonoperative treatment cannot be made for any fracture type.

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