■ SHOULDER AND ELBOW

Frozen shoulder after simple arthroscopic shoulder procedures

WHAT IS THE RISK?

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Frozen shoulder is a recognised complication following simple arthroscopic shoulder procedures, but its exact incidence has not been reported. Our aim was to analyse a single-surgeon series of patients undergoing arthroscopic subacromial decompression (ASD; group 1) or ASD in combination with arthroscopic acromioclavicular joint (ACJ) excision (group 2), to establish the incidence of frozen shoulder post-operatively. Our secondary aim was to identify associated risk factors and to compare this cohort with a group of patients with primary frozen shoulder.

We undertook a retrospective analysis of 200 consecutive procedures performed between August 2011 and November 2013. Group 1 included 96 procedures and group 2 104 procedures. Frozen shoulder was diagnosed post-operatively using the British Elbow and Shoulder Society criteria. A comparative group from the same institution involved 136 patients undergoing arthroscopic capsular release for primary idiopathic frozen shoulder.

The incidence of frozen shoulder was 5.21% in group 1 and 5.71% in group 2. Age between 46 and 60 years ($p = 0.002$) and a previous idiopathic contralateral frozen shoulder ($p < 0.001$) were statistically significant risk factors for the development of secondary frozen shoulder. Comparison of baseline characteristics against the comparator groups showed no statistically significant differences for age, gender, diabetes and previous contralateral frozen shoulder.

These results suggest that the risk of frozen shoulder following simple arthroscopic procedures is just over 5%, with no increased risk if the ACJ is also excised. Patients aged between 46 and 60 years and a previous history of frozen shoulder increase the relative risk of secondary frozen shoulder by 7.8 (95% confidence interval (CI) 2.1 to 28.3)and 18.5 (95% CI 7.4 to 46.3) respectively.

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Frozen shoulder is characterised by pain and limitation of movement.[1] It is a cause of marked disability and can have a profound effect on the patient's quality of life.[2] Secondary frozen shoulder arising as a complication of surgery is therefore of significant concern to both patient and surgeon, and warrants a detailed understanding of its incidence and associated risk factors.

Anecdotally, post-operative limitation of movement is considered to be a common complication of arthroscopic surgery of the shoulder. Most cases resolve within six months, with symptoms steadily improving during this time,[3,4] but the outcome can be devastating for those who deteriorate and develop an established frozen shoulder. Although the combined complication rate following arthroscopic surgery of the shoulder is low, at between 5.8% and 9.5%,[5] the risk of permanent disability for work is reported to be 9.8% after elective shoulder surgery.[6] The incidence of post-operative stiffness following rotator cuff repair has been reported to range between 4.9% and 32.7%.[7] However, this rate is poorly defined following the simple arthroscopic shoulder procedures that do not require periods of post-operative immobilisation. Monga et al[3] found that no patients out of 74 who underwent arthroscopic subacromial decompression, and one of 22 patients who underwent arthroscopic subacromial decompression plus acromioclavicular joint excision, required hydrodilatation or arthrolysis for persistent stiffness. Spangehl et al[8] found that seven of 32 patients undergoing arthroscopic acromioplasty developed post-operative stiffness, one of whom required a manipulation. There are no reports of the rate of frozen shoulder as opposed to post-operative stiffness.

Our purpose was to define the incidence of post-operative frozen shoulder following simple arthroscopic surgery. The secondary aim was to compare the risk factors associated with the development of frozen shoulder with a comparator group of patients with primary frozen shoulder managed at the same institution, thereby providing evidence upon which clinicians can base pre-operative information and consenting processes.

Patients and Methods

This was a retrospective review of all patients who underwent simple arthroscopic surgery of the shoulder by the senior author (CS) between August 2011 and November 2013. Two groups of surgical procedures were assessed: arthroscopic subacromial decompression (ASD), with or without (±) arthroscopic biceps tenotomy (group 1); and ASD plus arthroscopic acromioclavicular joint excision (ASD + ACJ) (group 2). Those undergoing ASD ± arthroscopic biceps tenotomy were included in group 1 as this additional procedure does not require further bursal or capsular dissection and does not increase the duration of the surgical procedure.

The patients were identified through a search of the senior surgeon's (CS) electronic logbook. A total of 200 consecutive cases were analysed. Of these, group 1 involved 96 cases (seven patients received bilateral surgery) with a mean age of 55.4 years (21 to 84; standard deviation (SD) 13.8) and group 2 104 cases (four patients received bilateral surgery) with a mean age of 58.0 years (24 to 76; SD 14.1). A total of 36 cases (37.5%) in group 1 and 58 (55.8%) in group 2 were female.

The diagnosis of a frozen shoulder was made clinically using the survey definition of the British Shoulder and Elbow Society,[9] with symptoms of true (deltoid insertion) shoulder pain and night pain of insidious onset. The signs consisted of painful restriction of active and passive movement, with passive movement limited to < 100° elevation, < 30° external rotation and internal rotation limited to L5 or less. Demographic data, a history of diabetes and any history of previous frozen shoulder was recorded.

All patients received an ultrasound-guided diagnostic injection of steroid and local anaesthetic and only progressed to surgery if this improved their symptoms and all were screened for the presence of pre-operative frozen shoulder using the same diagnostic criteria as used post-operatively. All also underwent an examination under anaesthetic immediately before arthroscopy.

Standardised post-operative rehabilitation protocols were used throughout with initial immobilisation for three to four days. All patients received standard guidance from a physiotherapist immediately after surgery and a leaflet describing exercises. All were referred to a community physiotherapist using the same guidelines for mobilisation.

The patients were reviewed by the senior author (CS) six weeks post-operatively. There was no loss to follow-up. If a patient was not discharged at this stage, their further follow-up documentation was also reviewed. Staged bilateral surgery on the same patient was analysed as two separate events.

All patients who developed a secondary frozen shoulder reported an initial period of good mobility following surgery, followed by a decline in movement and function.

A cohort of 136 cases (no bilateral surgery) with arthroscopically confirmed idiopathic frozen shoulder that were managed at the same institution between 2005 and 2010 was used as a comparison. Their mean age at the time of surgery was 52 years (34 to 72; SD 7.5), and 64 (47%) were female. All these patients underwent arthroscopic capsular release to treat the primary idiopathic frozen shoulder.

Statistical analysis. The incidences were calculated both independently and combined; 2 × 2 contingency square tables were created to allow statistical comparison between subgroups for age, gender, the presence of diabetes and a previous history of primary idiopathic or secondary frozen shoulder using Fisher's exact test. Risk ratios (RR) were calculated with 95% confidence intervals (CI), and p-values < 0.05 were considered statistically significant.

Results

The incidence of post-operative frozen shoulder was five of 96 cases (5.21%) in group 1 and six of 104 cases (5.77%) in group 2. The mean age of those developing frozen shoulder was 49 years (40 to 60; SD 9.5) in group 1, 54 years (46 to 68; SD 8.1) in group 2 and 52.3 years (40 to 68; SD 8.4) when the groups were combined. Of those who developed a frozen shoulder, three (60%) in group 1 and four (67%) in group 2 were female.

In group 1, three of the five patients who developed a frozen shoulder had previously had a primary idiopathic frozen shoulder, in group 2, one of the six had a secondary frozen shoulder following previous ASD. Only one of those who developed frozen shoulder was diabetic (insulin dependent), and that patient was in group 1.

Analysis of the entire cohort revealed that an age of between 46 and 60 years conferred a statistically significantly increased risk of secondary frozen shoulder compared with patients outside this age range, with a RR of 7.8 (95% CI 2.1 to 28.3; Fisher's exact test, p = 0.002). A previous contralateral frozen shoulder was also found to be a statistically significant risk factor, with a RR of 18.5 (95% CI 7.8 to 46.3; Fisher's exact test, p < 0.001) (Table I).

Of the 11 patients with secondary frozen shoulder, seven were diagnosed at three months following surgery, two at four months and one at five months. Their treatment involved either hydrodilatation or arthroscopic capsular release; these were undertaken at a mean of 6.9 weeks (2 to 12) after diagnosis. The choice of intervention was made following a discussion between the patient and the senior author (CS) with the consideration of anaesthetic risks and procedural discomfort. Of the patients in group 1, three underwent hydrodilatation and one an arthroscopic capsular release, with success in all. One female patient (56 years old) declined further intervention and her symptoms resolved with physiotherapy after eight months.

Table I. Incidence and risk ratios (RR) with 95% confidence intervals (CI) for isolated risk factors

	Age between 46 and 60 yrs		Female		Diabetes		Previous frozen shoulder	
	Incidence	RR (95% CI)	Prevalence	RR (95% CI)	Incidence	RR (95% CI)	Incidence	RR (95% CI)
Secondary frozen shoulder	8/11		7/11		1/11		4/11	
No frozen shoulder	43/189	7.8 (2.1 to 28.3)	87/189	2.0 (0.60 to 6.5)	17/189	1.0 (0.1 to 7.5)	2/189	18.5 (7.4 to 46.3)
p-value		p = 0.002		p = 0.27		p = 0.99		p < 0.001

Of the patients in group 2, one underwent arthroscopic capsular release and the others underwent hydrodilatation, which was repeated in one patient 20 weeks after the primary attempt owing to residual symptoms. Ultimately, symptoms resolved in all patients.

All 136 patients in the comparator group underwent arthroscopic capsular release for primary idiopathic frozen shoulder. Of these, 64 (47%) were female, 91 (67%) were aged 46 to 60 years, 23 (16.9%) were diabetic, and 43 (32%) have required treatment for primary idiopathic frozen shoulder on the contralateral side since their initial surgery.

No statistical differences were found for age (p = 1.00) gender (p = 1.00), diabetes (p = 0.69) or previous contralateral frozen shoulder (p = 0.74) between the secondary frozen shoulder group and the comparator primary idiopathic frozen shoulder group.

Discussion

Secondary frozen shoulder can be a devastating complication of shoulder surgery. In the context of simple arthroscopic procedures, it can render the patient more symptomatic than he or she was pre-operatively. Although subacromial surgery is deemed to have a low rate of complication,[5] identification of the incidence of frozen shoulder allows the surgeon to monitor practice, to guide and counsel patients, and to direct further research.

In this study we have shown that simple arthroscopic shoulder surgery carries a risk for developing frozen shoulder of just over 5%. Excision of the acromioclavicular joint, although requiring greater dissection than isolated ASD, does not appear to increase this risk. Furthermore, in our series, those patients aged between 46 and 60 years at the time of surgery conferred a 7.8-fold (95% CI 2.1 to 28.3) increased risk compared with those outside this range. Additionally, a previous history of frozen shoulder, which had only affected six of the 200 patients, conferred an 18.5-fold (95% CI 7.4 to 46.3) increased risk of secondary frozen shoulder.

Previous research has concentrated on the incidence of stiffness of the shoulder, severe enough to warrant further surgery, in arthroscopic rotator cuff repair, rather than isolated ASD. Reported incidences range from 3.1% to 4.9%,[10] and although this would appear comparable with the results presented in our study, it has often been concluded that the cause of this post-operative stiffness is related to the long period of immobilisation associated with rehabilitation after repair of the rotator cuff.[4,10] In a review by Denard et al,[4] they reported that resistant post-operative stiffness was reduced from 4.5% to 1.5% with immediate passive range of movement exercises. We have reported the incidence of frozen shoulder following arthroscopic surgery in patients who were all mobilised early in their rehabilitation. The similar primary incidence compared with arthroscopic cuff repair may point to an isolated pathological process, rather than post-operative immobilisation, as a causative factor.

The characteristics of the secondary frozen shoulder cohort have been compared with those of a group of 136 patients with primary frozen shoulder from the same institution and geographical region. The mean age of those developing primary (52 years) and secondary frozen shoulder (52.3 years) were similar. Primary frozen shoulder is generally regarded to present in patients aged between 40 and 70 years,[11] most commonly between 49 and 57 years.[12-16] Our study reflects these findings. We identified that being aged between 46 and 60 years increased the relative risk of developing secondary frozen shoulder 7.8-fold, compared with being aged outside this range.

We found that seven of 11 (64%) of the patients with secondary frozen shoulder were women, compared with 64 of 136 (47%) in the primary idiopathic group, this difference was not statistically significant. Only one patient (9.1%) with a secondary frozen shoulder was diabetic, and 17 (9.0%) of those who did not develop frozen shoulder were diabetic. The prevalence of diabetes in United Kingdom was reported to be 4.6% in 2012.[17] In total 17% of the primary idiopathic frozen shoulder cohort were diabetic, however this apparent difference between secondary and primary idiopathic frozen shoulder groups was not statistically significant. Diabetes is a risk factor for primary idiopathic frozen shoulder, with a reported prevalence of up to 38%.[18] We acknowledge that it has not been identified as an independent risk factor in secondary frozen shoulder, and this study cannot support any association as the 95% CIs for relative risk of diabetes in secondary frozen shoulder in this study span 1. However, as only one patient with secondary frozen shoulder was identified as diabetic, a larger cohort of secondary frozen shoulders may be required to assess this further.

A previous history of contralateral frozen shoulder was found in four (36.4%) of those who developed a secondary frozen shoulder. Previous contralateral frozen shoulder increased the relative risk of developing a secondary frozen shoulder 18.5-fold. The prevalence of bilateral involvement has been reported to be between 6% and 34%[16,19-21] in idiopathic frozen shoulder, and the prevalence in our primary idiopathic comparator group was 32%. This supports the assertion that previous frozen shoulder greatly increases the risk of developing a contralateral frozen shoulder post-operatively.

The diagnosis of frozen shoulder in the post-operative setting remains a challenge to the surgeon. The differentiation between post-operative stiffness and true frozen shoulder requires careful deliberation, as mild limitation of movement does not require aggressive input.[3] There has recently been acknowledgement that Codman's[1] original definition of frozen shoulder required modification, and both the British[9] and the American[22] Shoulder and Elbow Societies have undertaken this. This study has adopted the British Elbow and Shoulder Societies'[9] consensus diagnosis as an indication that the patient requires treatment, though we recognise that these guidelines were conceived for primary idiopathic frozen shoulder. The resolution of symptoms following intervention in all but one patient goes some way to justifying this stance. The symptoms in the patient who chose not to have a further intervention resolved with physiotherapy.

A criticism of this study might be the assumption that the original diagnosis of impingement and/or acromioclavicular joint arthropathy was correct. Both the common demographics and the clinical presentation of these conditions and frozen shoulder overlap somewhat. In all patients with secondary frozen shoulder the clinical presentation was altered from the pre- to the post-operative state; all patients also underwent a diagnostic ultrasound-guided local anaesthetic and steroid injection into either the subacromial space or the acromioclavicular joint pre-operatively. At the time of primary arthroscopy, vascular granulation tissue at the rotator interval was not reported in any patient with secondary frozen shoulder. We also recognise the limitations associated with this being a retrospective cohort where the diagnosis of frozen shoulder was undertaken by a single surgeon.

In conclusion, this large retrospective study found that the incidence of secondary frozen shoulder following simple arthroscopic shoulder surgery was just over 5%. There was no difference in incidence if the acromioclavicular joint was excised in addition to ASD. An age of between 46 and 60 years and a previous history of contralateral frozen shoulder were statistically significant risk factors. This study also confirms that, if diagnosed in accordance with the British Elbow and Shoulder consensus guidelines, intervention can be successful.

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J. P. Evans: Contributed to study design, Data collection, Data analysis and Interpretation, Writing and revision of the manuscript, Approval of final manuscript.
P. M. Guyver: Contributed to data collection and interpretation and approval of final manuscript.
C. D. Smith: Contributed to study design, Data interpretation, Revision and approval of final manuscript.

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