Correlation between rotator cuff tears and repeated subacromial steroid injections: a case-controlled study

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ABSTRACT

INTRODUCTION Concern exists regarding potential damage to the rotator cuff from repeated corticosteroid injections into the subacromial space.

PATIENTS AND METHODS In this retrospective, case-controlled study, 230 consecutive patients presenting to three orthopaedic units with subacromial impingement and investigated as an end-point with magnetic resonance imaging (MRI) of the shoulder were divided into groups having received less than three or three or more subacromial injections of corticosteroids.

RESULTS With no significant difference in age and sex distribution, analysis by MRI showed no significant difference between the two groups in the incidence of rotator cuff tear ($P < 1.0$).

CONCLUSIONS This suggests that corticosteroid use in patients with subacromial impingement should not be considered a causative factor in rotator cuff tears.

KEYWORDS

Rotator cuff tear – Corticosteroid injection – Subacromial space

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Subacromial impingement as a clinical entity is a common cause of shoulder pain.^{1,2} Treatment can involve both operative and non-operative methods;^{3,4} for the latter, this can include subacromial injection of corticosteroids.^{5–7} This in itself is an area of controversy regarding potential benefits and deleterious effects.

Concern exists regarding damage to the rotator cuff from repeated corticosteroid injections into the subacromial space. Animal studies suggest that corticosteroids damage the ultra-structure of collagen molecules,⁸ reduce collagen density as well as inhibiting the reparative properties of tendon by inhibiting tendon cell migration and synovial fibroblast proliferation.⁹ This has been shown experimentally to weaken collagen fibres and precipitate rotator cuff ruptures.^{10–14}

In human subjects, repeated injections have been correlated with softening of the rotator cuff substance and an inferior result of surgical repair.¹⁵ Added to this is the possibility that such injections can be inaccurate and also result in infiltration of the cuff tissue.^{16,17}

To our knowledge, there is no study which has looked for an association between repeated steroid injections for subacromial impingement and rotator cuff tears. The aim of this retrospective, case-controlled study was to test for an association.

Patients and Methods

Patients who had undergone a magnetic resonance imaging

(MRI) scan as part of their treatment for subacromial impingement were identified from imaging and clinic attendance records at three different hospitals over the last 2 years. A total of 230 consecutive patients were recruited as suggested by a prior power analysis (significance level 0.05; power 0.80). Clinical data were then obtained by one observer (MB) from clinical notes, records from general practice and patient interviews using a designed questionnaire. A second observer (BS) was blinded to these clinical details and collated the MRI scans and reports for each of the patients. The cohort was divided into two groups – those who had received less than three subacromial injections and those who had received three or more prior to MRI scanning. The following exclusion criteria were used: age greater than 70 years, a clinical diagnosis of rotator cuff tear on first hospital visit and a history of trauma, diabetes mellitus, oral immunosuppressants or rheumatoid arthritis. This was to reduce the confounding factors associated with increased incidence of rotator cuff tears.

The data obtained were collected on a database and included patient age, sex, occupation, hand dominance, smoking, sibling affection and duration of symptoms. The number, type and dose of steroid injection in addition to the duration of symptom relief and administering physician were also recorded. The operative findings in patients undergoing surgery were recorded and compared with the MRI findings.

Figure 1 Number of subacromial corticosteroid injections received.

The two groups were compared with the chi-squared test using the SPSS statistical package (SPSS Inc., Chicago, IL, USA).

Results

Of the 230 patients recruited into the study, the mean age of was 58 years (range, 32–70 years), with a larger proportion of female patients in comparison to males (144:86). The right side was involved in 186 shoulders compared to 44 shoulders on the left. The average duration of symptoms was 27.7 months (range, 4–60 months). Of the study cohort, 208 patients had received one or more injections prior to MRI scanning, with an average of 2.4 injections per patient (Fig. 1).

In total, 128 patients had received less than three subacromial injections, and 102 three or more. No significant difference in age and sex distribution was identified between the two groups (Table 1).

Rotator cuff tears were identified on MRI in 113 of 230 patients (49% of shoulders). Of these, there were 33 partial thickness tears and 80 full-thickness tears, of which six were identified as massive tears (Table 2). No significant difference was identified between the two groups in terms of the number of injections received ($P < 1.0$). In addition, no association with a cuff tear was identified with the route of injection, steroid type, and duration of symptoms, sibling affection, dominant side affected or smoking. An increased incidence of cuff tear was identified in female patients ($P < 0.01$) and increasing age ($P = 0.001$).

Results were also analysed in terms of the duration of relief of symptoms from each injection (Fig. 2). No significant difference in the duration of pain relief was identified when we compared injections given in hospital or primary care.

Discussion

Concerns about the use of potentially deleterious corticosteroids in treatment of subacromial impingement exist regarding possible damage to the rotator cuff. It remains a condition where conservative methods of treatment can be successful in almost two-thirds of patients.⁶ The efficacy of

Figure 2 Duration of pain relief with subacromial injection.

subacromial injection of corticosteroids has been shown to be superior to controls for the treatment of symptomatic subacromial impingement syndrome in a recent prospective, randomised, controlled, double-blind, clinical study,⁷ as well as in a number of other prospective and retrospective studies.^{18,19} Our study was not designed to assess efficacy and our belief is that it is an accepted method of treatment. The aetiology of rotator cuff disease itself is multifactorial. We accept that there are confounding variables which might affect rotator cuff tear incidence. However, we have attempted to minimise the influence of these variables by our exclusion criteria.

There is evidence in the literature to link full-thickness tear of the rotator cuff with increasing age,^{20,21} a factor confirmed

Table 1 Steroid injections given

	Control (< 3 injections; $n = 128$)	Cases (≥ 3 injections; $n = 102$)
Number	128	102
Age (years)	57.5 ± 11.9	58.6 ± 10.2

Table 2 Rotator cuff tears identified on MRI

	Control (< 3 injections; $n = 128$)	Cases (≥ 3 injections; $n = 102$)
Cuff tear	65 (50.8%)	48 (47%)
Partial thickness tear	12	21
Full-thickness tear	50	24
Massive tear	3	3

from our data. Both of our study groups (less than three injections and three or more injections) have a similar age distribution, and the incidence of rotator cuff tear in both groups would be the same prior to steroid injection.

Genetic factors are also known to play a role in rotator cuff disease. The relative risk of symptomatic full-thickness tears in siblings versus controls has been estimated to be 2.42 in a retrospective cohort study.²² The role of smoking in the pathogenesis of rotator cuff tear is questionable.²³ None of these were identified as risk factors in our study.

In a histological study involving 40 patients with chronic rotator cuff tears, there was no evidence to suggest that the larger tears had received a greater number of injections.²⁴

The results of our study with a much larger sample size confirm that there is no significant association between the number of corticosteroid subacromial injections and an increase in the incidence of rotator cuff tears.

The accuracy of MRI in diagnosis of rotator cuff tears could also be brought in to question. MRI has previously been shown to have high accuracy in diagnosis.^{25–27} In our cohort, 80 patients went on to have surgery. A comparison of operative findings with the MRI findings revealed an accuracy of 84%, a comparable figure. Either way, the limited accuracy of MRI should affect both groups and not bias the overall results.

This retrospective, case-controlled study no doubt has limitations; a prospective study design with an MRI scan prior to commencing steroid injections to rule out a rotator cuff tear followed by another scan at the completion would have been more robust. However, this study design would mean inappropriate use of MRI scanning as some patients improve with conservative treatment and do not require further investigations. It is, therefore, not cost effective. It may also be considered unethical to carry out a prospective randomised and controlled study in which one group would receive a larger number of injections.

Conclusions

We have investigated a specific question of the relationship between steroid injections and subsequent rotator cuff tendon rupture. This study does not undermine the importance of earlier diagnosis and surgical treatment if steroid injections are not effective or have short-lived response.

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