

Effectiveness of ultrasound-guided injections combined with shoulder exercises in the treatment of subacromial adhesive bursitis

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Abstract The aim of this study was to evaluate whether the association of exercises for the shoulder with ultrasound-guided injection into the bursa significantly improves the treatment outcome in adhesive bursitis. Two groups of 35 patients, one treated with ultrasound-guided injection (UGI) and the other one with ultrasound-guided injection and home exercise program (UGI-exercise) for 1 month, were assessed for pain and shoulder function before treatment, 1 and 3 months post-treatment. Fourteen patients in UGI group and 23 patients in the UGI-exercises group were completely free of pain after 1 month ($p = 0.031$). At 3 months' follow-up, patients in the UGI-exercise group showed a significant improvement with respect to the other group ($p = 0.005$). No differences were found in function assessment. The UGI combined with shoulder exercises in the treatment of subacromial adhesive bursitis is effective to ensure a more frequent complete pain relief in the medium term.

Keywords Subacromial adhesive bursitis ·
US-guided injection · Rehabilitation

Introduction

Shoulder subacromial bursitis (SSB) is one of the most common causes of pain in the anterior and superior part of

the shoulder. The subacromial bursa is an anatomical structure particularly rich in proprio- and nociceptors, and therefore, it is one of the main sites of pain generation.

Following overloads of effort (e.g., a repetitive sport activity) or incorrect posture [1], a flogosis of the bursa may set in, which may trigger a fibrotic process involving the adhesion of the bursal membranes and hence giving rise to an adhesive bursitis.

The clinical examination of the patient allows a direct diagnosis of the condition. Nonetheless, ultrasound scanning appears to be essential to confirm and highlight the specific features of bursitis, to estimate the extent of flogosis and to obtain indications on the need for an ultrasound-guided injection [1, 2].

The main goal in treating SSB is to reduce pain and improve the range of movement. Several aspects must be considered in planning treatment options, such as the patients' age, how active they are as well as their general health status. Conservative treatments usually include drugs administration, such as NSAIDs, rest, local application of ice and modifications of the routine physical activity, avoiding movements that require lifting the hand over the head [1, 2].

Non-guided local injection of steroids and lidocaine in the treatment of painful pathologies of the shoulder leads to a pain decrease as well as to a good recovery of function over short lapses of time (2 weeks). Such benefits appear to increase when the drugs are directly injected within the bursa via an ultrasound-guided procedure [1, 3–6]. In this case, the therapeutic effect lasts for over 6 weeks after injection and disappears at week 12, about half of the treated patients returning to the pre-treatment clinical condition [4].

To date, the only clearly efficacious treatment for subacromial pain is the corticosteroid injection in the subacromial bursa, albeit in short term [7].

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Few trials have compared the results of physiotherapy with subacromial injections for shoulder pain [8]; these studies suggest that physiotherapy may play an additional role in the treatment of shoulder pain, although at present the available data do not permit specific recommendations.

Based on these previous reports, the aim of the present study was to retrospectively evaluate whether the association of a set of physical exercises for the shoulder with ultrasound-guided injection into the bursa significantly improves the treatment outcome in adhesive bursitis.

Materials and methods

Study design

Between 2009 and 2011, a sample of 135 patients with adhesive bursitis without other associated pathologies has been treated with ultrasound-guided injection (UGI). Diagnosis had been obtained through objective examination and ultrasound scanning. Several patients had undergone previous conservative treatments with no improvement. All patients had been evaluated for pain and for function by means of Visual Analogic Scale 0–10 (VAS), before, 1 and 3 months after treatment, along with the ultrasound check. Only during the last year, the VAS for functionality was substituted with the Constant–Murley scale as a more appropriate validated instrument for shoulder impairment assessment. In the last year, based on the recurrence of pain after injection and on the hypothesis that rehabilitation is an effective therapeutic intervention also in these patients, a program of rehabilitative exercises for the shoulder has been associated with the ultrasound-guided injection for four weeks after the procedure.

With the aim to retrospectively define comparable sample sets among patients who had performed prescribed exercises and those who did not, a power analysis was conducted. With a statistical significance of 0.05, a power not less than 0.8 and a minimal clinically significant difference of 3 VAS points (30 %), the minimum number of cases for a comparative study was calculated to be 70 patients. Two groups of patients were randomly selected from the available 135. UGI group included 35 patients who had only undergone UGI, whereas UGI-exercise group included 35 patients who also have undergone the rehabilitative program. The overall sample set included 46 women (66 %) and 24 men (34 %) with an average age of 50 ± 9 years. Thirty-nine patients (56 %) presented with a right-hand side bursitis. Data of patients in the two groups are reported in Table 1.

Treatment

Upon preparation of the sterile field, we proceeded under ultrasound guidance with the positioning of a needle

Table 1 Differences between the two groups in age, sex and side of adhesive bursitis

	UGI	UGI-exercise
Age	47.8 (SD 8.5)	51.4 (SD 8.7)
Sex	14 males 21 females	10 males 25 females
Side	22 right 13 left	17 right 18 left

directly into the bursa, attached to a syringe containing 5 ml of lidocaine and 1 ml of methylprednisolone. A 21-gauge needle [1] was usually used (Fig. 1a–c). The mobilization of the shoulder after treatment is useful for the complete detachment of the bursa.

The patient's home exercise program was introduced just after the injection and performed under the supervision of a physical therapist. The exercise program, recommended always below the pain threshold, was focused on [1] (1) exercises for shoulder lowering and decoaptation that the patient must remember to reproduce during all the common daily activities; (2) assisted active self-mobilization for the recovery of range of motion in all planes; (3) isometric strengthening with elastic bands of rotator cuff muscles and deltoid; (4) stretching in elevation, abduction and rotation performed statically by placing the patient-specific postures that allow the lengthening of the shortened muscles and the recovery of the last degrees of movement.

Statistical analysis

Continuous variables have been summarized in terms of mean and standard deviations (SD) if normally distributed, median, 25th and 75th percentiles if not normally distributed, whereas qualitative ones have been summarized in terms of frequency and percentage. Percentage differences between the two groups were analyzed using the exact Pearson chi-square test. In order to define the percentage of pain improvement, the following formula was used: $\text{Improvement \%} = [(\text{VASpre} - \text{VASpost})/\text{VASpre}] \times (100)$. On the basis of these results, the number of patients who underwent complete remission of pain symptoms (100 %) was calculated. Differences between the two scores at different follow-up were assessed using paired *t* test with Sidak correction for multiple comparisons; differences between Constant–Murley scores were assessed using Wilcoxon non-parametric test evaluated by Monte Carlo method for small samples with Sidak correction for multiple comparisons. In the presence of non-homogeneous variance and not-normal distribution, the non-parametric Mann–Whitney test was used.

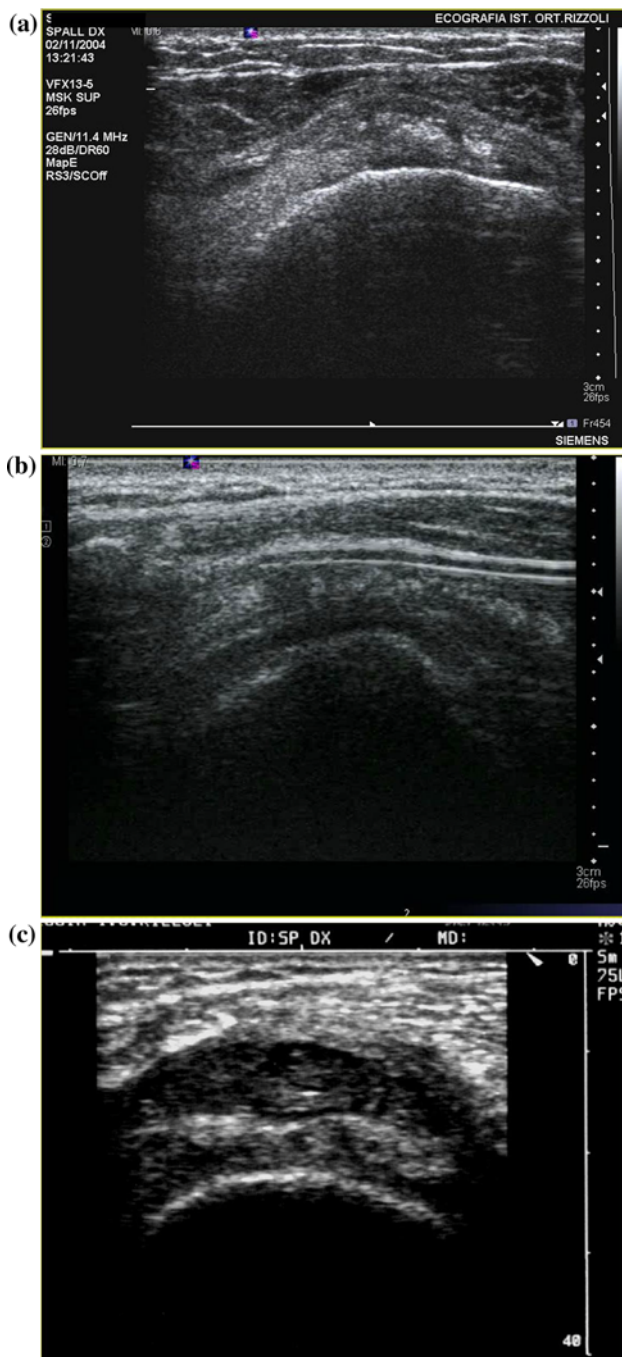


Fig. 1 Echosonographic images of adhesive bursitis **a** before treatment, **b** during treatment with needle inserted in the bursa and **c** after injection

Logistic regression with the Wald backward method was used as a multivariate analysis in order to identify the best predictive model of pain symptoms remission. An odds ratio with a confidence interval of 95 % was used to express the results of the logistic regression. A significance of $p < 0.05$ was considered for all the analyses. Statistical analysis was done using SPSS 16.0 (SPSS, Chicago, IL, USA).

Results

No differences were found between the two groups as far as regards mean age, sex and side of adhesive bursitis.

Before UGI, the mean value of pain reported on VAS was 7.57 (SD 2.2) in the UGI group and 8.03 (SD 1.8) in the UGI-exercise group. A month after treatment, the VAS-pain in UGI group was 1.94 (SD 2.1) and 2.06 (SD 2.8) in the UGI-exercise group. At 3 months' follow-up, VAS-pain remained quite unchanged in UGI group with a mean value of 1.86 (SD 2.4), while it significantly improved ($p = 0.009$) in the UGI-exercise group with a mean value of 1.31 (SD 2.2). However, since VAS-pain values were not homogeneously distributed, the non-parametric Mann–Whitney test was preferred and, in this case, the difference was no more significant (Table 2; Fig. 2).

Fourteen patients (40 %) had a complete resolution of the pain (100 %) in UGI group after 1 month, whereas 23 patients (65.7 %) were completely free of pain in the UGI-exercise group. This difference was found to be statistically significant ($p = 0.031$).

The improvement % is reported in Table 3. A significant change was found between the follow-up at 1 month and 3 months in the UGI-exercise group ($p = 0.005$).

Five patients within UGI group (14 %) and one patient in the UGI-exercise group (3 %) repeated the treatment for recurrence of pain after the last follow-up ($p = 0.08$). No complication occurred in any of the two groups.

The recovery of the function measured using both VAS-function and Constant–Murley scale was not significantly different between the 2 groups along the follow-ups, although a trend for improvement was observed at the 3 months' follow-up for patients in the UGI-exercise group (Fig. 3).

Multivariate analysis with logistic regression identified variables predictive of a complete resolution of pain: both the pre-treatment VAS value and the exercise enter in the model. In particular, considering a similar pre-treatment VAS-pain condition in the two groups, the additional exercise triples the likelihood of resolving the pain (Table 4).

Discussion

Ultrasound-guided injection of corticosteroids in the sub-acromial bursa allows us to obtain an improvement in function and pain in the short term for patients with adhesive bursitis [7]. Nevertheless, a correct program of shoulder exercises seems to contribute to the successful treatment of SSB. Actually, no specific study is available as far as specifically regard the condition of adhesive bursitis considered in the present study.

Table 2 Median, 25th and 75th percentiles and *p* value calculated with non-parametric Mann–Whitney test about VAS-pain score before treatment, 1 and 3 months post-treatment in the UGI and UGI-exercise groups

		Median	25th–75th percentile	Mann–Whitney
VAS pre	UGI	8	6.5–10	<i>p</i> = 0.47
	UGI-exercise	8	7–10	
VAS 1 month	UGI	1	0.5–3.5	<i>p</i> = 0.44
	UGI-exercise	1	0.5–2	
VAS 3 months	UGI	1	0–2	<i>p</i> = 0.08
	UGI-exercise	0	0–2	

Fig. 2 VAS-pain score before treatment, 1 and 3 months post-treatment in the UGI and UGI-exercise groups. Median, 25th and 75th percentiles, minimum, maximum and outliers values are reported

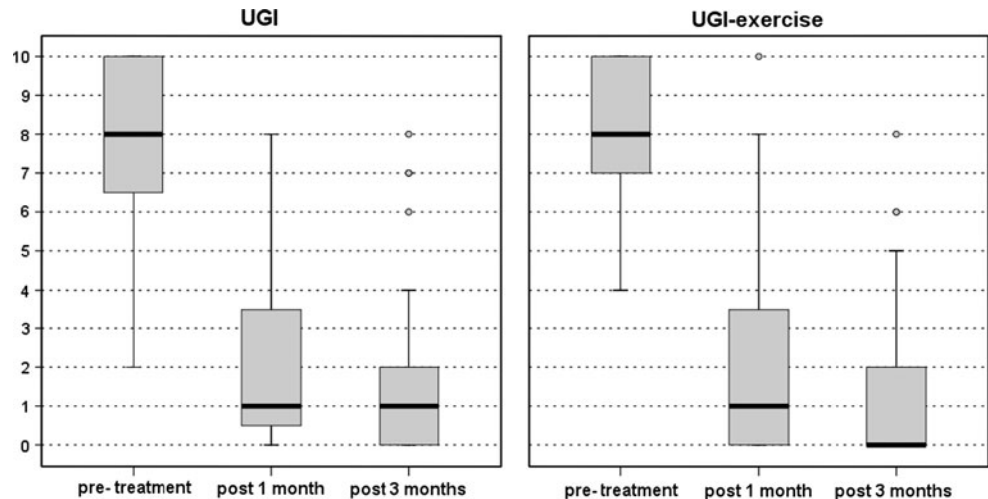


Table 3 Percentage of pain improvement (improvement % = [(VASpre – VASpost)/VASpre] × (100)) between the two groups at different follow-up

	Group	Percentiles			Mann–Whitney
		25	50	75	
Pre-1 month	UGI	55	85.7	95	<i>p</i> = 0.26
	UGI-exercise	53.6	90	100	
Pre-3 months	UGI	70.7	87.5	100	<i>p</i> = 0.07
	UGI-exercise	70.7	100	100	
1–3 months	UGI	0	50	100	<i>p</i> = 0.0009
	UGI-exercise	45	100	100	

There is a consolidated experience in our Institute of treatment of adhesive bursitis with UGI. Nevertheless, according to the literature [1], often results are satisfying only in the short period and a recurrence of the bursitis is possible. The hypothesis formulated in the present study was that a programmed exercise of the shoulder with the aim of lowering and decoapting the humeral head, to maintain the range of motion, to appropriately strengthen or stretch involved shoulder muscles may prevent the recurrence of fibrotic process involving the adhesion of bursal membranes and pain after UGI.

A limit of the present study is the use of two different scales for the functional evaluation of the shoulder which prevented to obtain a full assessment of shoulder impairment and treatment outcome with respect to range of

motion, strength and function. Moreover, the correct execution and intensity of the home exercises was difficult to monitor, so that future controlled studies in which the protocol will include a monitoring of the compliance of patients are required.

However, this is the first study on the association of shoulder exercise with the UGI in the treatment of shoulder adhesive bursitis. The results are encouraging, since only one patient out of 35 patients who performed exercise needed a second intervention in comparison with five patients in the group who performed only UGI. Moreover, the complete resolution of pain in the UGI-exercise group was significantly greater, particularly in a mid-term follow-up.

No differences were found in recovery of function between the two groups, although there is a trend of greater

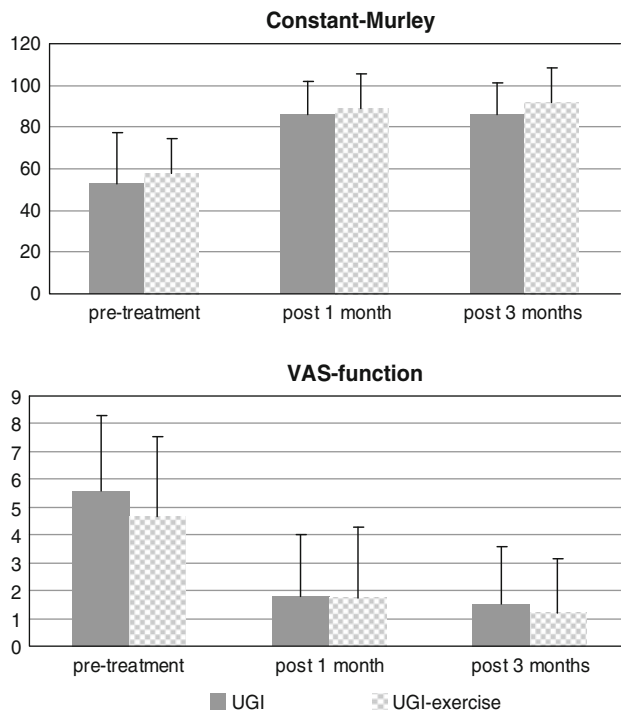


Fig. 3 Mean value and SD of Constant–Murley score (10 patients UGI and 10 patients UGI-exercise) and of VAS-function (25 patients UGI and 25 patients UGI-exercise) at different follow-up

Table 4 Variables predictive of a complete resolution of pain identified with multivariate analysis with logistic regression

	OR (95 % CI)	<i>p</i> value
Exercise	3.402 (1.222–9.471)	0.019
Pre-treatment VAS-pain	0.780 (0.601–1.012)	0.06

improvement in the UGI-exercise group, particularly in the follow-up at 3 months. It is possible that the subdivision of patients into two groups with respect to the use of different assessment tools for function weakened the power of the statistical analysis and did not allow us to obtain a reliable result.

Nonetheless, this study has confirmed that the shoulder exercise, even when performed at home and not under the continued direct supervision of the physical therapist, is an important adjuvant in combination with UGI.

In conclusion, the ultrasound-guided injection combined with shoulder exercises in the treatment of subacromial adhesive bursitis is effective to ensure a more frequent complete pain relief in the short and medium term.

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Conflict of interest None.

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