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SHOULDER

Sclerosing polidocanol injections to treat chronic painful shoulder impingement syndrome-results of a two-centre collaborative pilot study

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Abstract The histological changes found in the supraspinatus tendon have similarities with the findings in Achilles-, patellar- and extensor carpi radialis brevis (ECRB)-tendinopathy. In recent studies, we have found a vasculo-neural ingrowth in chronic painful Achilles and patellar tendinopathy, and demonstrated good short-term clinical effects with injections of the sclerosing substance polidocanol. In this collaborative two-centre pilot study, 15 patients (10 males and 5 females, mean age 46 years) with a long duration of shoulder pain (mean 28 months), and given the diagnosis chronic painful shoulder impingement syndrome, were included. They had tried rest, traditional rehabilitation exercises and multiple subacromial corticosteroid injections, without effect. We found vascularity (neovessels) in chronic painful, but not in pain-free, supraspinatus tendons, and prospectively studied the clinical effects of ultrasound (US) and colour Doppler (CD)-guided injections of polidocanol, targeting the area with neovessels. The patients evaluated the amount of shoulder pain during horizontal shoulder activity on a visual analogue scale (VAS), and satisfaction with treatment. Two (median) (range 1–5) polidocanol treatments (with 4–8 weeks in between) were given. In four patients (considered treatment failure), cortisone was injected into an inflamed subacromial bursa at one separate occasion weeks after the last polidocanol injection. At follow-up, 8 (median) (range 4–17) months after the treatment, 14 patients were satisfied with the result. Using the visual analogue scale evaluation (VAS), the pain dropped from 79 before treatment to 21 at follow-up ($P < 0.05$). In the short-term perspective, sclerosing polidocanol injections targeting the neovessels in the supraspinatus tendon and/or bursa wall seems to have a potential to reduce the pain during shoulder loading activity.

Keywords Shoulder · Impingementsyndrome · Chronic pain · Vascularity · Sclerosing injections

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Introduction

Shoulder pain is relatively common in the general population [19], and the chronic painful shoulder is well known to be difficult to treat [5, 6, 10, 11, 21]. Subacromial impingement syndrome is commonly associated with chronic pain-symptoms [5, 10, 15], but the source of pain has not been scientifically clarified. There are many theories about the pain in this condition [4, 7, 9, 20, 22]. Is it from the subacromial bursa, the rotator cuff tendons, the acromion, or is it from a combination of pathology in these different tissues [8, 9, 12]? In the chronic stage, surgical treatment (acromioplasty) is often instituted [11]. Histological examinations of the rotator cuff (supraspinatus tendon) in patients with impingement syndrome have shown tendon changes described as tendinosis, similar to what

have been found in chronic painful Achilles and patellar tendons [12]. In chronic Achilles tendinosis, increased vascularity (neovessels) demonstrated with Doppler technique, has been demonstrated to be closely related to chronic tendon pain [16]. In following studies, sclerosing polidocanol injections, targeting the area with neovessels, have shown good clinical results with significant pain relief during Achilles tendon loading activity [2, 17, 18].

To our knowledge, it is not known whether there is an increased vascularity (neovessels) in the supraspintus tendon and/or subacromial bursa in chronic painful shoulders, compared to normal pain-free shoulders.

The aim with this pilot study was to investigate vascularity in the supraspinatus tendon and overlaying subacromial bursa in chronic painful shoulders with the diagnosis chronic painful impingement syndrome, and in contralateral normal and pain-free shoulders. If increased vascularity was found in chronic painful shoulders, we also wanted to study the clinical effects of treatment with injections of the sclerosing substance polidocanol, targeting the area with neovessels.

Materials and methods

Sixteen patients (ten males and six females) with the diagnosis chronic (pain symptoms > 3 months) painful shoulder impingement syndrome were recruited for the study. One patient was excluded because she had pronounced mechanical impingement visible during dynamic ultrasound examination. Fifteen patients (ten males and five females, mean age 46 years, range 32–57 years) with a long duration of pain symptoms (mean 28 months, range 6–78) diagnosed as impingement syndrome, but without mechanical impingement interfering during dynamic ultrasound examination, were included.

Inclusion criterias

All patients had tried different treatment regimens like rest, NSAIDs, and different types of shoulder rehabilitation exercises (concentric muscle training, range of motion exercises), without permanent effect on the pain. A majority of the patients had been treated with subacromial corticosteroid injections. The diagnosis was based on clinical examination, ultrasonography (US) + colour Doppler (CD), X-ray or MRI.

The clinical examination included positive Neers and Hawkins tests. Dynamic ultrasound examination was performed with a linear transducer (Acuson Sequoia 8L5, with 5–8 MHz frequency in Umeå, Sweden, and Antares Sonoline (Siemens) VFX, with 5–13 MHz frequency in Stavern, Norway).

The rotator cuff tendons, long tendon of biceps, the subacromial bursa, acromion and acromio-clavicular (AC)-joint, were examined. The ultrasound examination was done to determine whether there were signs of substantial mechanical impingement between calcifications in the rotatorcuff tendons and the acromion, partial or total rotator cuff tears, changes of the subacromial bursa (thickening of the walls or effusion), and for evaluation of the AC-joint. Colour Doppler was used to show vascularity, and to locate where the vessels entered the tendon. Only high flows can be visualized with the Doppler technique, the normal vascularity in tendons cannot be visualized due to the low flow rate. The contralateral non-painful shoulders were also examined with US and CD.

Plain radiographs were taken to determine whether there were signs of arthrosis in the acromio-clavicular joint. In the Stavern group, radiography was not done if the ultrasound showed clear signs of arthrosis in the AC-joint.

Exclusion criterias

Patients with large calcifications in the rotator cuff causing severe mechanical impingement during horizontal abduction, total rotator cuff tears, or signs of severe arthrosis in the acromio-clavicular joint, were not included in the study.

Sclerosing injections

The technique for sclerosing injections has been described in details previously [2, 3, 21, 22]. The injection was performed with a 0.7×50 mm needle, or a 0.6×60 mm needle, connected to a 2-ml syringe. The injection was performed dynamically, with the aid of real-time grey-scale ultrasonography and colour Doppler technique, to inject at the target vessels (Figs. 1, 2, 3). Small volumes (0.2–0.4 ml, in total 1–2 ml) of the substances were injected into the areas of local vascularisation in the bursa wall and/or the supraspinatus tendon. We observed the immediate effect of the injection, using both ultrasound and colour Doppler, and an immediate closure of the vessels was seen. All patients had reduced pain immediately after the injection (local anaesthetic effect). The patients were encouraged to start range of motion exercises the first day after treatment, but no heavy shoulder-loading activity was allowed during the first 2 weeks after the treatment. After 2 weeks there were no restrictions in the activity.

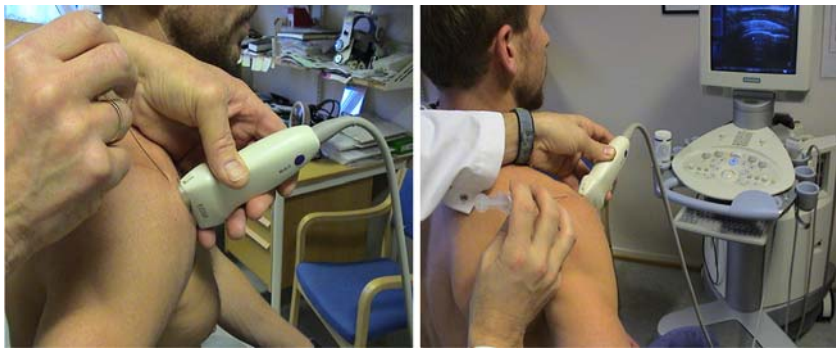

Fig. 1 The patient is sitting, and the injection is performed from the cranio-dorsal side. The needle is guided toward the vessel in line with the transducer

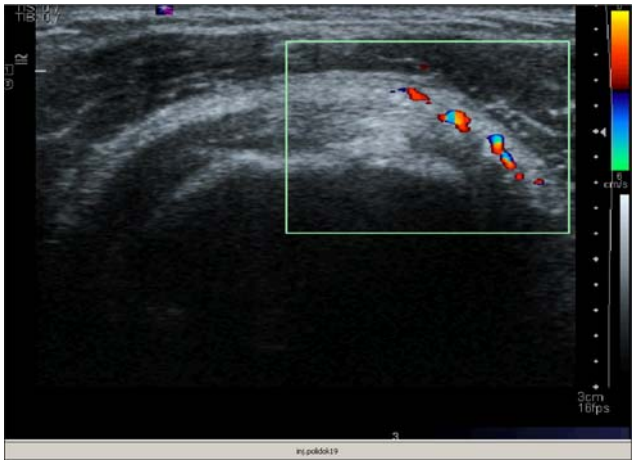

Fig. 2 The supraspinatus tendon is seen in the longitudinal plane. Doppler activity demonstrated just before injection of polidocanol

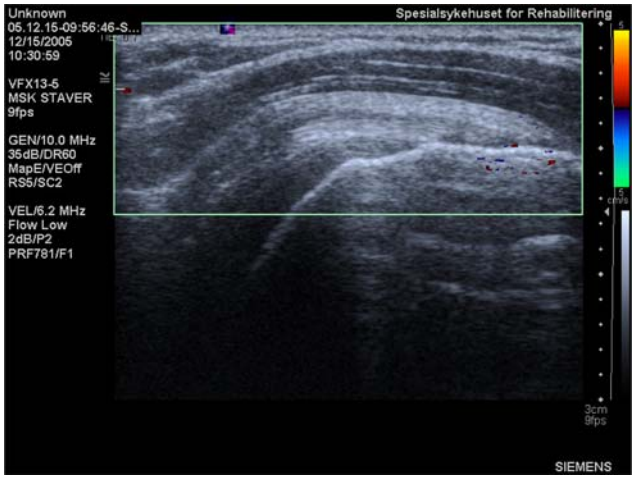

Fig. 3 After injection there is no Doppler activity

Four to 8 weeks after the first injection treatment a new evaluation was done. If the patient still had pain during horizontal arm activity, and US and CD showed remaining vascularity in the bursa wall and/or the supraspinatus tendon, another polidocanol injection was given. Injection treatment was only instituted for the combination shoulder pain together with vascularity. If there was remaining vascularity, but no pain, no injection treatment was given. It was decided that a maximum of five injection treatments should be given.

Outcome measures

The patients estimated the amount of pain in the shoulder during daily horizontal arm activity on a 100-mm long visual analogue scale (VAS), before and after treatment.

The amount of pain was recorded from 0 to 100 mm, where no pain was recorded as 0 and intolerable pain as 100.

Patient's satisfaction with treatment was assessed. The patients were asked if they were satisfied with the result of the treatment or if they wanted to try another type of treatment (No means not satisfied and do want to try another type of treatment, Yes means satisfied and do not want to try another type of treatment).

Data are presented as mean and range values.

Ethics

The study was approved by the ethical committee of the Medical Faculty at the University of Umeå. The study was in Norway approved by the Regional ethical committee for medical research.

All patients gave their written consent to participate.

Statistics

Wilcoxon signed rank test was used to compare the results of the VAS evaluations, before and after treatment. A P-value < 0.05 was considered significant.

Results

Specific data for each patient is presented in Table 1.

US and CD showed vascularity in the supraspinatus tendon and/or bursa wall in all painful shoulders. In pain-free contra-lateral shoulders, US + CD showed no vascularity in the supraspinatus tendon or bursa wall.

Two polidocanol injection treatments (median 2, range 1–5), with 4–8 weeks in between, were given. In four Norwegian patients, the polidocanol treatment failed. In these four patients, one cortisone injection was given into an inflamed subacromial bursa at one separate occasion (weeks after the last polidocanol injection treatment).

At clinical and US + CD follow-up after 8 (median) (range 4–17) months, 14 patients (14 shoulders) were satisfied with the treatment. Their mean VAS was significantly reduced (from 79 to 21; $P < 0.05$). US + CD in 13/14 satisfied patients showed no remaining vascularity in the bursa wall and/or supraspinatus tendon.

Shoulder range of motion was not measured. Instead, a comparison with the normal and pain-free shoulder was done (restriction or no restriction). Before treatment, all patients had a restricted range of motion (elevation and abduction) due to pain. The range of motion was normalized after subacromial injection of local anaesthesia. After treatment with sclerosing injections, in all patients, there was no difference in range of motion between the shoulders.

Discussion

In this pilot-study, using US and CD, we found neovascularisation in the supraspinatus tendon and/or bursa wall in patients with chronic painful shoulder impingement syndrome, but not in contra-lateral pain-free and normal shoulders. Treatment with injections of the sclerosing substance polidocanol, targeting the area with neovessels, significantly reduced the shoulder pain during horizontal shoulder activity in 10 out of 15 patients.

In four of five patients with a poor result of the polidocanol injections, there were clinical and ultrasonographic (in three of four) signs of subacromial bursitis (effusion in the bursa). These patients were cured with an ultrasound-guided corticosteroid injection into the bursa. These patients have been considered as failures. However, the corticosteroid injections were given because of a diagnosed overuse reaction in the bursa during the strength training period weeks after the last polidocanol injection was given, and it is our opinion that the major clinical ''turn around'' was after the polidocanol injections, when the patients regained the possibility to start range of motion and strengthening exercises.

In this group of patients with a long duration of pain symptoms and poor ability to use the arm in the horizontal plane, we decided to use patients evaluation of pain during horizontal arm activity in daily life (evaluated on a VAS), and patient satisfaction with the treatment (yes or no), for evaluation of the results of

Table 1 Age and gender, duration of symptoms, patients evaluation of the amount of pain during daily horizontal arm activity registered before and after treatment on a VAS (mm), follow-up time, patient satisfaction with the result of treatment (yes or no), number of injections, occupation and return to occupation (yes/no), in 15 patients with chronic painful shoulder impingement syndrome treated with sclerosing polidocanol injections

Gender/age	Symptom duration (months)	VAS (mm)		Follow-up (months)	Satisfied Yes/No	Injection (*n*)	Occupation return to work Yes/No
		Before	After				
Male/57	36	92	57	9	Yes	2	Truck driver/Yes
Male/32	36	100	35	7	Yes	1	Teacher/Yes
Female/47	6	85	35	7	Yes	1	Retired 1983
Male/56	12	94	50	4	Yes	3	Office/Yes
Male/49	36	65	10	16	Yes	4	Industry worker/Yes
Female/47	24	90	20	13	Yes	5	Student/Yes
Female/35	24	90	0	16	Yes	1	Student/Yes
Male/42	36	90	0	13	Yes	1	Truck driver/Yes
Female/33	18	50	5	10	Yes	1	Teacher/Yes
Male/57	36	90	0	7	Yes	1	Retired
Female/49	36	95	25	8	Yes	1	Office/Yes
Male/54	36	50	10	6	Yes	3	Carpenter/Yes
Male/44	78	68	16	6	Yes	2	Office/Yes
Male/43	24	75	0	17[a]	Yes	2	Office/Yes
Male/44	24	53	53	6	No	2	Office/Yes

[a] Telephone follow-up

treatment. The main goal with the treatment was to reduce the pain during horizontal arm activity, and allow for the patient to be able to start shoulder range of motion and strengthening exercises.

We found vascularity in the supraspinatus tendon and/or bursa wall in patients with chronic painful shoulder impingement syndrome, but not in contralateral pain-free and normal shoulders. Interestingly, this correlation between vascularity and pain has previously been found also in chronic painful Achilles tendons [16].

All patients in our study had had a long duration of pain symptoms, and had tried rest, NSAIDs, multiple cortisone injections, and rehabilitation exercises without permanent effect on the shoulder pain. They were considered to be chronically injured, and four patients with a shoulder demanding occupation were on sick-leave. Despite having been treated with subacromial cortisone injections, the patients had never been able to perform pain-free range of motion and strengthening shoulder exercises. After treatment with polidocanol injections, there was a dramatic change with a remarkable decrease in shoulder pain, allowing for the majority of the patients to return to shoulder range of motion and strengthening exercises. Sclerosing polidocanol injections have recently been demonstrated to give good short-term clinical results in patients with chronic painful midportion Achilles tendinopathy [2, 17], chronic pain in the Achilles insertion [18], and chronic painful patellar tendinopathy/Jumper's knee [3]. Follow-ups, using US and CD, after sclerosing polidocanol injections in Achilles midportion tendinopathy have shown a decreased tendon thickness and an ultrasonographically more normal structure after successful treatment [13]. This could possibly indicate a remodelling potential after this type of treatment. Considering the shoulders in the current study, the US technique we used did not allow for an accurate evaluation of the thickness and structure of the supraspinatus tendon. The Achilles and patellar tendon are superficially positioned and well suited for US examination of tendon thickness and structure. The supraspinatus tendon is somewhat deeper positioned and overlaying the bone of the humeral head, making reliable US examinations of the tendon structure more difficult. Consequently, we cannot determine whether the structure of the supraspinatus tendon was changed after successful treatment. However, like in the majority of the successfully treated Achilles tendons, CD showed no remaining neovessels in the supraspinatus and/or bursa wall after successful treatment.

Where does the pain come from in patients with chronic painful impingement syndrome? This has still not been scientifically clarified. Biopsies taken from the rotator-cuff (supraspinatus) have shown grossly similar tendon changes as for other chronic painful tendons, possibly indicating large similarities between these conditions [12, 14]. Gotoh et al. [9] has suggested that the subacromial bursa is the site for pain, showing high amounts of substance-P (SP) nerve fibres localized around vessels in the bursa wall. Interestingly, recent scientific studies on chronic painful Achilles tendinosis have demonstrated a vasculo-neural (SP nerves) ingrowth most likely being the source of pain in that condition [1], Also, Chansky and Iannotti [4], found neovascularisation to be associated with symptomatic rotatorcuff disease secondary to mechanical impingement. These findings, together with the findings in the current study, indicate that the area with vascularity (and sensory nerves) might be the source of pain also in this condition?

A limitation of the current study is the relatively short (4–6 months) follow-up period in certain patients, however, it appears that a majority of the successfully treated patients are in the group with relatively long (13–17 months) follow up periods. Also, the group of patients is relatively small. Studies on larger groups, with longer follow-up periods, and randomized studies comparing different treatment methods, are needed.

In conclusion, from this relatively small material, it appears that neovessels in the supraspinatus tendon and/or the overlaying bursa wall is associated with chronic pain. Also, it appears that sclerosing polidocanol injections, targeting the area with vascularity in the supraspinatus tendon and/or bursa wall, has a potential to reduce the pain and allow for patients with a long duration of disabling pain to start shoulder exercises.

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