

Significant benefit for older patients after arthroscopic subacromial decompression: a long-term follow-up study

Peter Biberthaler · Marc Beirer · Sonja Kirchhoff ·
Volker Braunstein · Ernst Wiedemann · Chlodwig Kirchhoff

Received: 25 October 2012 / Accepted: 14 December 2012 / Published online: 16 January 2013
© Springer-Verlag Berlin Heidelberg 2013

Abstract

Background Patients suffering from isolated subacromial impingement (SI) of their shoulder but who are resistant to other therapies benefit substantially from arthroscopic subacromial decompression (ASD) if they are young (<60 years). Although physical demands rise notably in the older population, it still remains unclear if surgery leads to better results in these patients. Therefore, the aim of this study was to focus on the impact of age on the functional outcome in elderly patients suffering from SI.

Methods In this retrospective analysis, 307 patients (age range: 42–63 years) with isolated SI were enrolled. The 165 patients were allocated to physical therapy whereas 142 underwent ASD. The patient cohort was divided into two groups according to the median age (<57 years). Functional outcome was recorded using the Munich Shoulder Questionnaire (MSQ)

allowing for qualitative self-assessment of the Constant, SPADI and Dark Scores.

Results Median age was 57 (25 %–75 %: 48–63) years, follow-up was 55 (25 %–75 %: 25–87) months. In group I (age < 57 years, $n=165$) no significant differences in outcome between physical therapy and ASD were detected. In contrast, in group II (age > 57 years; $n=142$) the patients reported significantly better results after ASD in the overall MSQs.

Conclusion Despite their higher age, elderly patients with isolated SI actually benefit significantly from ASD in comparison to physical therapy.

Introduction

Shoulder pain is the second most common musculoskeletal disorder and thereby a relevant problem disabling middle-aged and elderly patients in particular [1–5]. In this respect, a meta-analysis summarising 18 studies was recently published by Luime et al. reporting subacromial impingement syndrome (SIS) with a percentage of up to 44 % as one of the most frequently recorded disorders [6]. According to Linsell et al., an even higher prevalence of SIS was found in older patients above 60 years [7]. Although the pathogenesis is not fully understood, most authors describe SIS as a combined result of extrinsic and intrinsic mechanisms, leading to rotator cuff tearing (RCT) and spur formation under the coracoacromial arch [8–11].

Regarding SIS therapy, several authors reported in the past that physiotherapy aimed at strengthening of the muscular motors and stabilisers of the shoulder joint renders satisfactory results especially in patients aged under 60 and represents a cost-effective treatment [12, 13]. In contrast, for those individuals resistant to physical therapy, arthroscopic subacromial decompression (ASD) is the most successful surgical

P. Biberthaler · M. Beirer · C. Kirchhoff (✉)
Department of Trauma Surgery,
Technische Universität München, Ismaningerstrasse 22,
81675 München, Germany
e-mail: chlodwig.kirchhoff@lrz.tu-muenchen.de

S. Kirchhoff
Institute of Clinical Radiology-Großhadern,
Ludwig-Maximilians-Universität München,
Marchioninistrasse 27,
81366 München, Germany

V. Braunstein
Department of Surgery-Innenstadt,
Ludwig-Maximilians-Universität München,
Nussbaumstrasse 20,
80339 München, Germany

E. Wiedemann
OCM (Orthopaedic Surgery Munich), Steinerstrasse 6,
81369 München, Germany

procedure providing clear benefits [1, 11, 14]. Short- and mid-term follow ups of five years after ASD are generally considered advisable [15, 16]. Recent literature comparing conservative therapy and ASD suggests that at least in patients under 60 years equally good clinical results might be achieved [12, 17, 18]. Although physical demands and sports activity are rising notably in the older population, it remains unclear which treatment regimen is superior in isolated SIS [12, 19].

Hence, the aim of this study was to analyse the long-term outcome of patients, having been treated for SIS either conservatively or arthroscopically and to focus on the impact of age at initiation of therapy on the objective and subjective result.

Materials and methods

Study design

This study was designed as a retrospective cohort study with a median follow-up of 55 months. The study was approved by the local ethics committee of the Ludwig-Maximilians-University (reference number: 15/5/2009-GP/AC).

Patient collective

All patients suffering from SI and presenting in our shoulder outpatient clinic were identified retrospectively and enrolled in the study. Patients were identified according to an age range between 20 and 82 years, presence of shoulder pain for more than three and less than six months and meeting the following criteria:

- pain on abduction of the shoulder with a painful arc
- positive Neer and Hawkins testing
- positive impingement test (relief of pain after injection of local anaesthetics into the subacromial space)

Preoperative standard radiographs of the shoulder and an outlet view were performed. Patients with any other pathology such as rotator cuff tear, gleno-humeral instability, cartilage damage (> Outerbridge II), clinically verified acromio-clavicular (AC) joint osteoarthritis, calcifying tendonitis, biceps pathology or signs of cervical root or temporomandibular symptoms verified clinically or during the arthroscopic examination were excluded from the study. Furthermore, patients were excluded if any additional surgical procedures other than subacromial decompression with or without AC joint surgery were performed.

All identified patients were contacted with a letter explaining the purpose of the study, an informed consent sheet for participation in the study and a standardised, validated self-assessment questionnaire (Munich shoulder questionnaire MSQ) along with a pre-stamped return envelope for easy

return. If any questionnaire was not returned, the patient was reminded twice. Patients who did not respond at all were excluded from the study.

For assessing the impact of age on the type of treatment of SIS, the patient cohort was divided in two groups according to the median age.

Therapy

Conservative therapy

Patients allocated to conservative treatment received a standardised protocol of physiotherapy, heat, cold pack or/and soft issue treatment (16 sessions with 60 min each for 12 weeks). Then, the patients had active training of the periscapular muscles and strengthening of the stabilising muscles of the shoulder joint at least twice per week over a period of three months. Patients were encouraged to repeat the exercises at home on a daily basis. After 12 weeks, patients were instructed perform home exercises two to three times per week.

Arthroscopic subacromial decompression (ASD) and rehabilitation

In all patients in the surgery treatment group, an investigation of the stability of the shoulder joint under general anaesthesia was performed followed by arthroscopic examination of the glenohumeral joint, the rotator cuff, and the subacromial bursa. All three surgeons (Peter Biberthaler, Volker Braunstein, Ernst Wiedemann) performing the procedures are experienced shoulder surgeons. The ASD was performed with the scope positioned in the posterior portal and included a bursectomy and a release of the coraco-acromial ligament. Acromioplasty was performed, transforming the undersurface of the acromion into a flat type I acromion. Spurs or osteophytes on the undersurface of the AC joint were debrided. Patients started physiotherapy on the day after surgery and performed a standard rehabilitation protocol starting with active assisted range of motion on day 1. With decreasing pain, this training was progressed with strengthening exercises of the rotator cuff and shoulder muscles.

Outcome measurements

The Munich Shoulder Questionnaire (MSQ) presents an innovative tool for self-assessment of shoulder function. It was especially designed for an effective follow-up of shoulder patients allowing for a quantitative assessment of the Constant, Shoulder Pain and Disability Index (SPADI) and Disabilities of the Arm, Shoulder and Hand (DASH) score consisting of a 30-items questionnaire. The MSQ had been validated previously and its accuracy and effectiveness for follow-up was demonstrated [20].

Statistics

Data are given as median values (25–75 % interquartile ranges). The results of the different groups were compared for each indicator using the Mann–Whitney *U* test. The level of significance was set at $p < 0.05$. Statistical analysis was performed using Sigma Stat 3.5 software (Systat® Inc., Chicago, IL, USA).

Results

Patient collective

Between January 2000 and December 2009, a total of 1,257 patients were identified. After exclusion, 331 with isolated SIS remained (26.3 %). Follow-up data for 307 (92.8 %) (151 males, 156 females) of these patients were recorded. The 165 (53.8 %) patients were treated conservatively and 142 (46.2 %) surgically by ASD. The median age was 57 (25 %–75 %: 48–63) years. The median interval between initiation of therapy and follow-up was 55 (25 %–75 %: 25–87) months. Group I (age < 57 years) consisted of 165 patients with a median age of 49 (25 %–75 %: 42–53) years. Eighty-two (49.7 %) of the group I patients were treated conservatively and 83 (50.3 %) received ASD, respectively. In contrast, group II (age > 57 years) comprised 142 patients. Their median age accounted for 63 years and (25 %–75 %: 60–67). 83 (58.5 %) patients underwent conservative therapy, whereas 59 (41.5 %) underwent surgery by ASD (for patient characteristics see Table 1).

Outcome measures—Overall data

The median MSQ score in patients (> 57 year) of group I amounted to 83 points (25 %–75 %: 65–92), in group II (age > 57 year) the MSQ score accounted for 84 points. (25 %–75 %: 67–93). Equivalent results were found for the DASH (group I: 12 pts.; group II: 10 pts.), the SPADI (group I: 88 pts.; group II: 91 pts.) and the Constant score (group I: 74 pts.; group II: 74 pts.) (overall data not shown).

Outcome measures—Conservative vs. ASD treatment

The subgroup analysis of group I (age < 57 years) revealed a MSQ of 84 points (25 %–75 %: 65–93 pts.) in conservatively treated patients and of 83 points (25 %–75 %: 66–91 pts.) in patients after ASD ($p = 0.37$). Concurrently, no difference was found for the DASH score (conservative: 12 pts. 25 %–75 %: 1–32 pts.; ASD: 12 pts. 25 %–75 %: 5–37 pts.) as well as for the SPADI score (conservative: 88 pts. 25 %–75 %: 66–98 pts.; ASD: 87 pts. 25 %–75 %: 64–96 pts.). There was also no significant difference in the Constant score comparing conservatively and surgically treated patients (75 pts. 25 %–75 %: 64–83 pts. vs. 73 pts. 25 %–75 %: 61–80 pts.) (see Fig. 1).

In contrast, the analysis of group II (age > 57 years) showed a significantly lower MSQ score of 81 points (25 %–75 %: 64–90 pts.) in patients who had had physiotherapy, in comparison to those who had undergone ASD with 89 points (25 %–75 %: 75–94 pts.) ($p < 0.05$). This significant difference was also found when comparing all other evaluated outcome parameters (DASH: 15 pts. 25 %–75 %: 4–29 pts vs. 5 pts. 25 %–75 %: 1–22 pts; SPADI: 87 pts. 25 %–75 %: 65–97 pts vs. 95 pts. 25 %–75 %: 77–100 pts; Constant: 71 pts. 25 %–75 %: 59–78 pts vs. 77 pts. 25 %–75 %: 63–83 pts; for data see Fig. 2).

Discussion

In this study, we demonstrated a retrospective long-term follow-up of patients having been treated for SIS either conservatively by physiotherapy or arthroscopically by ASD. Regarding the impact of age on the functional outcome, we found superior results in patients older than 57 years of age following ASD in comparison to conservative treatment ($p < 0.05$). In patients younger than 57 years, equivalently good to excellent results were found for both treatment regimens.

Subacromial impingement syndrome

Different theories regarding the pathogenesis of SIS and rotator cuff tear (RCT) have been suggested in the last decades. According to Neer, SIS is caused by extrinsic compression

Table 1 Outcome

	Overall	group I (<57 year)		group II (>57 year)	
		conservative	ASD	conservative	ASD
<i>n</i>	307	82	83	83	59
Age	57 (48–63)	50 (43–54)	48 (42–53)	64 (61–67)	62 (59–68)
♂/♀	151/156	39/43	41/42	42/41	34/25

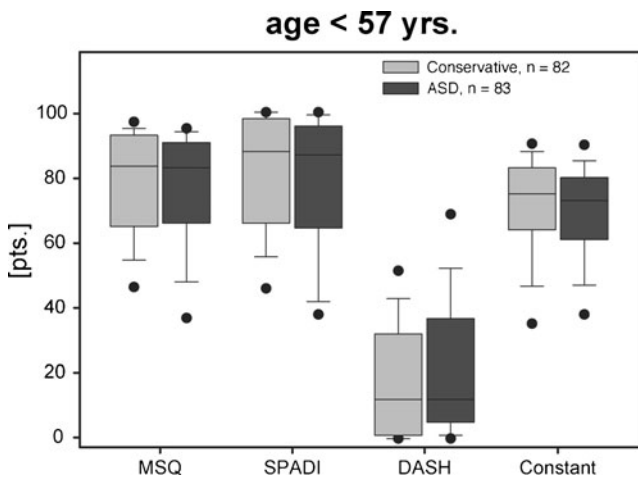


Fig. 1 Outcome results of patients younger than 57 years (group I). *Light grey*: conservative treatment; *dark grey*: Arthroscopic subacromial decompression (ASD) Data are given as *vertical boxplots* (median: *horizontal boxline*; 25–75 % interquartile ranges; standard deviations: *horizontal line*). There is no statistical significant difference between the sub-collectives. Abbreviation: MSQ Munich Shoulder Questionnaire; DASH: Disability of the Arm, Shoulder and Hand; SPADI: Shoulder Pain and Disability Index; CS: Constant Score

and mechanical wear of the RC against the coraco-acromial arch during elevation. This subject of extrinsic impingement was supported by Bigliani et al., who added their results on the correlation of the prevalence of RCT and the acromion shape. In this context, the propagation of ASD by eliminating the extrinsic factors is supported by a considerable number of clinical studies. However, intrinsic degenerative processes within the hypovascular zone on the greater tuberosity obviously contribute to RCT as well. In this context, Ozaki et al.,

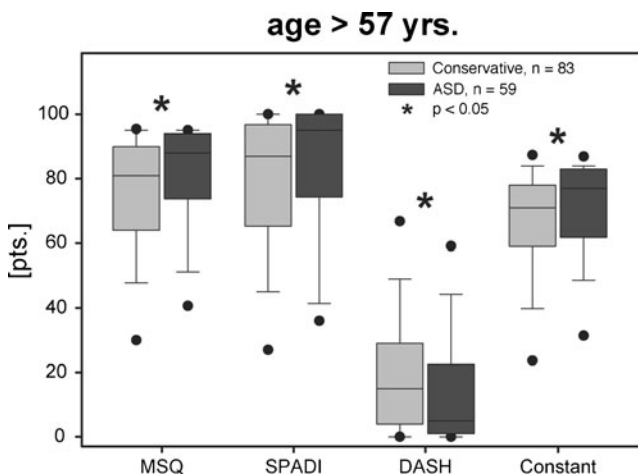


Fig. 2 Outcome results of patients older than 57 years (group II). *Light grey*: conservative treatment; *dark grey*: Arthroscopic subacromial decompression (ASD) Data are given as *vertical boxplots* (median: *horizontal boxline*; 25–75 % interquartile ranges; standard deviations: *horizontal line*). * $p < 0.05$ group conservative vs. group ASD, Mann-Whitney U. Abbreviation: MSQ Munich Shoulder Questionnaire; DASH: Disability of the Arm, Shoulder and Hand; SPADI: Shoulder Pain and Disability Index; CS: Constant Score

reported that although a lesion in the anterior third of the undersurface of the acromion was always associated with a tear of the rotator cuff, the converse was not true [10]. Summarising, the pathogenesis of SIS is not yet fully understood, but most authors describe it as a combined result of extrinsic and intrinsic mechanisms, contributing to RCT [8–11].

Patients

In this study patients with an age between 20 and 82 years were included. The lower age limit is in accordance with previous studies, although it is acknowledged that glenohumeral instability is the most common cause of symptoms in younger patients. Regarding the upper age limit, most authors did not report a clear cut-off. Therefore, in most studies, the mean age ranged from 42 to 57 years. Beyond doubt, the utmost problem of patients >70 years is not an isolated SIS, but degenerative RCT. In this context, the dropout of >70 % of patients after following the exclusion criteria was mainly caused by confounding RCTs. Though, 142 patients >57 years with isolated SIS have still been included.

Reviewing the further inclusion criteria, several authors emphasised the impact of duration of symptoms on the outcome [21, 22]. In this context, Patel et al., have analysed some of the factors possibly influencing the results of ASD and pointed out that besides the response to the impingement test, especially the duration of symptoms of over one year is correlated to a significantly worse outcome. Further criteria such as occupation or insurance status, that were not considered in our study, have been previously shown to be of inferior relevance [16].

Conservative treatment

Patients having been treated conservatively received a standard physiotherapy for 12 weeks on an outpatient basis. The protocol with focus on strengthening of the rotator cuff and the scapular stabilising muscles is comparable to previous studies. Although patients thereby did not undergo formal training by physiotherapists, we regard this to be not statistically significant. In this context, Andersen et al., in 1999 analysed the effectiveness and outcome following a physiotherapeutically supervised vs. an unsupervised self-training following ASD and demonstrated clearly significant poorer results in the supervised group [23].

Arthroscopic subacromial decompression

The ASD, as performed in our study, is an established technique, having been used by the surgeons involved for several years. This is of distinct importance as several authors clearly proved that there is a learning curve associated with the

technique of ASD and underlined this with inferior results in their own patients and a significant correlation of the learning curve and improving clinical results. Concerning the question of lateral clavicle resection, patients with AC joint arthritis and consecutive AC joint resection have been excluded in our study. This is in line with the results of Kharrazi et al., who do not recommend routine AC joint resection at the time of subacromial decompression but favoured a removal of the osseous excrescences on the undersurface of the joint.

Limitations

This study has distinct weaknesses. The first one is of course its retrospective nature. Facing the high number of enrolled patients and strict exclusion criteria, we nevertheless regard it as a significant contribution to the knowledge of the outcome of SIS. The major drawback is of course that we cannot exclude the possibility that bias in patient selection might have influenced the results of the older patients. As we found no difference in the young patients comparing both treatment regimens, we however regard the selection bias to be negligible.

Conclusion

Accurate diagnosis of the impingement syndrome requires a thorough patient history and a careful clinical examination followed by special investigations to exclude other conditions. According to our data, arthroscopic subacromial decompression in older patients with isolated subacromial impingement seems to be a promising therapeutic tool.

Acknowledgments We thank Florian Schmidutz for his outstanding assistance throughout the pre-study and Wolf Mutschler for having created an excellent cluster with all possibilities to develop and conduct frontier science.

Conflict of interests The authors declare that they have no competing interests.

References

- Klintberg IH, Svantesson U, Karlsson J (2010) Long-term patient satisfaction and functional outcome 8–11 years after subacromial decompression. *Knee Surg Sports Traumatol Arthrosc* 18(3):394–403. doi:10.1007/s00167-009-0963-1
- Bot SD, Terwee CB, van der Windt DA, Bouter LM, Dekker J, de Vet HC (2004) Clinimetric evaluation of shoulder disability questionnaires: a systematic review of the literature. *Ann Rheum Dis* 63(4):335–341
- Pope DP, Croft PR, Pritchard CM, Silman AJ (1997) Prevalence of shoulder pain in the community: the influence of case definition. *Ann Rheum Dis* 56(5):308–312
- Urwin M, Symmons D, Allison T, Brammah T, Busby H, Roxby M, Simmons A, Williams G (1998) Estimating the burden of musculoskeletal disorders in the community: the comparative prevalence of symptoms at different anatomical sites, and the relation to social deprivation. *Ann Rheum Dis* 57(11):649–655
- Picavet HS, Schouten JS (2003) Musculoskeletal pain in the Netherlands: prevalences, consequences and risk groups, the DMC(3)-study. *Pain* 102(1–2):167–178
- Luime JJ, Koes BW, Hendriksen IJ, Burdorf A, Verhagen AP, Miedema HS, Verhaar JA (2004) Prevalence and incidence of shoulder pain in the general population; a systematic review. *Scand J Rheumatol* 33(2):73–81
- Linsell L, Dawson J, Zondervan K, Rose P, Randall T, Fitzpatrick R, Carr A (2006) Prevalence and incidence of adults consulting for shoulder conditions in UK primary care; patterns of diagnosis and referral. *Rheumatology (Oxford)* 45(2):215–221. doi:10.1093/rheumatology/kei139
- Neer CS (1972) Anterior acromioplasty for the chronic impingement syndrome in the shoulder: a preliminary report. *J Bone Joint Surg Am* 54(1):41–50
- Codman EA, Akerson IB (1931) The pathology associated with rupture of the supraspinatus tendon. *Ann Surg* 93(1):348–359
- Ozaki J, Fujimoto S, Nakagawa Y, Masuhara K, Tamai S (1988) Tears of the rotator cuff of the shoulder associated with pathological changes in the acromion. A study in cadavera. *J Bone Joint Surg Am* 70(8):1224–1230
- Bjornsson H, Norlin R, Knutsson A, Adolffson L (2010) Fewer rotator cuff tears fifteen years after arthroscopic subacromial decompression. *J Shoulder Elbow Surg* 19(1):111–115. doi:10.1016/j.jse.2009.04.014
- Dorrestijn O, Stevens M, Winters JC, van der Meer K, Diercks RL (2009) Conservative or surgical treatment for subacromial impingement syndrome? A systematic review. *J Shoulder Elbow Surg* 18(4):652–660. doi:10.1016/j.jse.2009.01.010
- Ketola S, Lehtinen J, Arnala I, Nissinen M, Westenius H, Sintonen H, Aronen P, Konttinen YT, Malmivaara A, Rousi T (2009) Does arthroscopic acromioplasty provide any additional value in the treatment of shoulder impingement syndrome?: a two-year randomised controlled trial. *J Bone Joint Surg Br* 91(10):1326–1334. doi:10.1302/0301-620x.91b10.22094
- Jarvela S, Jarvela T, Aho H, Kiviranta I (2010) Arthroscopic subacromial decompression: outcome comparison between outpatient and hospitalized patients with 2- to 5-year follow-up. *Scand J Surg* 99(1):50–54
- Dom K, Van Glabbeek F, Van Riet RP, Verborgt O, Wuyts FL (2003) Arthroscopic subacromial decompression for advanced (stage II) impingement syndrome: a study of 52 patients with five years follow-up. *Acta Orthop Belg* 69(1):13–17
- Nicholson GP (2003) Arthroscopic acromioplasty: a comparison between workers' compensation and non-workers' compensation populations. *J Bone Joint Surg Am* 85-A(4):682–689
- Michener LA, Walsworth MK, Burnet EN (2004) Effectiveness of rehabilitation for patients with subacromial impingement syndrome: a systematic review. *J Hand Ther* 17(2):152–164. doi:10.1197/j.jht.2004.02.004
- Braman J, Flatow E (2005) Arthroscopic decompression and physiotherapy have similar effectiveness for subacromial impingement. *J Bone Joint Surg Am* 87(11):2595. doi:10.2106/JBJS.8711.ebo2
- Kirchhoff C, Braunstein V, Milz S, Sprecher CM, Fischer F, Tami A, Ahrens P, Imhoff AB, Hinterwimmer S (2010) Assessment of bone quality within the tuberosities of the osteoporotic humeral head: relevance for anchor positioning in rotator cuff repair. *Am J Sports Med* 38(3):564–569. doi:10.1177/0363546509354989

20. Schmidutz F, Beirer M, Braunstein V, Bogner V, Wiedemann E, Biberthaler P (2012) The Munich Shoulder Questionnaire (MSQ): development and validation of an effective patient-reported tool for outcome measurement and patient safety in shoulder surgery. *Patient Saf Surg* 6(1):9. doi:[10.1186/1754-9493-6-9](https://doi.org/10.1186/1754-9493-6-9)
21. Gartsman GM, Blair ME Jr, Noble PC, Bennett JB, Tullos HS (1988) Arthroscopic subacromial decompression. An anatomical study. *Am J Sports Med* 16(1):48–50
22. Jerosch J, Wustner P (2002) Effect of a sensorimotor training program on patients with subacromial pain syndrome. *Unfallchirurg* 105(1):36–43
23. Andersen NH, Sojbjerg JO, Johannsen HV, Sneppen O (1999) Self-training versus physiotherapist-supervised rehabilitation of the shoulder in patients treated with arthroscopic subacromial decompression: a clinical randomized study. *J Shoulder Elbow Surg* 8(2):99–101