Resection arthroplasty of the sternoclavicular joint for the treatment of primary degenerative sternoclavicular arthritis

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We describe the mid-term clinical results of the surgical treatment of primary degenerative arthritis of the sternoclavicular joint in eight women. They had not responded to conservative treatment and underwent a limited resection arthroplasty. For pre- and postoperative clinical evaluation we used the Rockwood score for the sternoclavicular joint. Postoperatively, the Constant score was also determined. The mean follow-up was 31 months (10 to 82).

The median Rockwood score increased from 6 to 12.5 points. The median postoperative Constant score was 87 (65 to 91). Four patients had an excellent, three a good, and one a poor result. All patients were pleased with the cosmetic result.

Resection arthroplasty is an effective and safe treatment for chronic, symptomatic degenerative arthritis of the sternoclavicular joint with a high degree of patient satisfaction.

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Primary degenerative arthritis of the sternoclavicular (SC) joint is most commonly seen in postmenopausal women. With increasing age, asymmetry and local bony prominence are common clinical findings.¹⁻⁴ Postmortem studies have shown degenerative changes in the SC joint in all patients after the fifth decade.^{5,6} Silberberg et al⁶ distinguished between changes due to ageing and those arising from degenerative arthritis. In symptomatic patients pain is usually related to activity, but may be present at rest. The pain is felt in the clavicular region and often radiates to the shoulder. If untreated, the acute local pain and swelling usually settle after one or two months, and other symptoms resolve gradually over nine to 12 months.⁷ Conservative

treatment with non-steroidal anti-inflammatory drugs may be sufficient.⁸⁻¹⁰ Westermann¹¹ and Kowallik,⁸ however, diagnosed degenerative SC arthritis, clinically and radiologically, equally in men and women from the third decade onwards. They found a preponderance in housewives and manual labourers. Westermann¹¹ excised the medial aspect of the clavicle with excellent results in a 60-year-old man and a 50-year-old woman. Disappointed with the outcome after conservative treatment, he subsequently operated on an unreported number of patients obtaining equally good results. Although primary arthritis of the SC joint is common, the place of surgical treatment is not well documented.^{7,12} We therefore present our mid-term results of resection arthroplasty of the SC joint.

Patients and Methods

We treated eight women with primary degenerative arthritis of the SC joint by resection arthroplasty. The mean age at surgery was 54 years (47 to 61) and the mean follow-up was 31 months (10 to 82). Clinical evaluation was carried out before and after operation using the scoring system described by Rockwood et al¹³ (Table I). This is a self-assessment score with four grades available each for pain, range of motion, strength, limitation and subjective result. The overall result is considered excellent for scores of 13 to 15, good for scores of 10 to 12, fair for scores of 7 to 9 and poor for scores of less than 7. The score of Constant and Murley¹⁴ was also determined at the most recent follow-up examination.

In all patients no contributing factors could be elicited with the exception of one who reported a fall on to the affected side three months before the onset of symptoms. In all patients the side of the dominant arm was affected. All except one reported pain at rest occasionally disturbing sleep. This was localised in the upper chest radiating to the shoulder, the ipsilateral side of the neck and occasionally to the ipsilateral arm. It was aggravated by overhead activities. The mean duration of symptoms before surgery was 20 months (3 to 36). The symptoms did not respond to conservative treatment in the form of non-steroidal anti-inflammatory agents, local cryotherapy, and physiotherapy. Two patients were also treated with WHO stage-II opioids and four had local injections of steroid and local anaes-

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Table I. The scoring system of Rockwood et al¹³ for clinical evaluation of degenerative arthritis of the SC joint, and the preoperative and postoperative scores for the eight women treated by resection arthroplasty.

Category	Case number															
	1	2	3	4	5	6	7	8								
Points	Preop	Postop	Preop	Postop	Preop	Postop	Preop	Postop	Preop	Postop	Preop	Postop	Preop	Postop	Preop	Postop
Pain																
None	3		3		3								3		3	
Slight	2			2				2								
Moderate	1	1				1	1							1		1
Severe (at rest)	0							0		0	0	0				
Range of motion																
Normal	3				3		3		3	3	3	3		3	3	3
Slight restriction (<25%)	2	2	2	2		2							2			
Moderate restriction (25% to 50%)	1															
Severe restriction (>50%)	0															
Strength																
Normal	3		3		3		3					3		3	3	3
Slight weakness (<25%)	2					2		2	2		2		2			
Moderate weakness (25% to 50%)	1	1		1						1						
Severe weakness (>50%)	0															
Limitation																
None	3		3		3										3	
Slight	2						2		2				2	2		
Moderate	1	1		1		1					1	1				
Severe	0							0		0						
Subjective result																
Excellent	3		3		3											3
Good	2								2				2		2	
Fair	1						1									
Poor	0	0		0		0		0		0	0	0		0		0
Total score (points)	15	5	14	6	15	6	10	5	11	4	6	7	11	9	14	9

Fig. 1

Case 2. Preoperative CT shows an asymmetrical loss in height of the joint space and a vacuum phenomenon in the right SC joint.

thetic. Acupuncture had been used in one patient who also received low-potency opioids.

Clinical examination showed localised tenderness and swelling of the SC joint. The push-down test which consists of applying downward force on the medial clavicle, the cross-shoulder sign, and resisted arm abduction were the

most reliable clinical methods of reproducing the symptoms. Some patients had limited movement of the neck. Radiography and CT (Fig.1) confirmed hypertrophic arthritis in six patients. A ganglion was present in one patient. In two patients a bone scan showed localised uptake in the region of the SC joint.

Fig. 2

Diagram showing the surgical site of the SC joint. The cross-hatched area indicates the bone to be excised (clav, clavicle; ccl, costoclavicular ligament; icl, interclavicular ligaments; m, manubrium sterni; scm, insertions of the sternocleidomastoid muscle).

Surgery was carried out under general anaesthesia in a semi-sitting position. The joint capsule was incised through a small incision along the medial aspect of the clavicle (Fig. 2). The articular disc was removed and the articular surface with 8 to 10 mm of the medial clavicle were excised, preserving the attachments of the interclavicular, sternoclavicular and costoclavicular ligaments (Figs 3a and 3b). As the intraoperative findings within the joint varied considerably, the direction of the osteotomy and the amount of bone removed also varied. The joint gap after excision measured about 1 cm in all patients. The stability of the joint was assessed by moving the arm and observing that there was no subluxation of the remaining clavicle. Degenerative changes of the disc were confirmed macroscopically in all patients. The medial clavicle was hypertrophied, but there were no osteophytes. The articular cartilage had an ivory appearance (Fig. 3c). The capsule was carefully closed, and much soft tissue was placed in the gap. Postoperatively, the arm was immobilised for two days. Assisted active shoulder exercises started on the third day. Lifting and carrying were allowed after six weeks.

Fig. 3a

Fig. 3b

Fig. 3c

Intraoperative findings. Figure 3a - The clamp is attached to the articular disc. Figure 3b - The articular disc and a slice of approximately 1 cm have been removed from the medial clavicle. Figure 3c - The excised slice of the medial clavicle demonstrates loss of the surface of the cartilage and small inferior bony prominences.

Table II. The scoring system of Constant and Murley¹⁴ for evaluation of outcome at the most recent follow-up after resection arthroplasty for degenerative arthritis of the SC joint in eight women

Category	Points	Case number							
		1	2	3	4	5	6	7	8
Pain	15	15	15	5	10	5	15	15	15
Activities of daily living									
Activity level	10	10	10	0	10	0	6	10	10
Positioning	10	10	10	10	10	10	10	10	10
Abduction/lateral elevation	10	10	8	8	10	10	10	10	10
Flexion/forward elevation	10	10	10	10	10	10	10	10	10
Rotation									
External	10	10	10	10	10	10	10	8	10
Internal	10	8	8	8	10	10	10	8	10
Power	25	14	20	16	12	10	16	15	14
Total score	100	87	91	67	82	65	87	86	89

Results

All patients regained either their preoperative or a full range of movement one week after surgery. There were no complications of surgery. All patients except one reported significant improvement in the pain, movement and strength of the arm, and their ability to work, and considered the outcome a success. The Rockwood score increased from a median of six points preoperatively to 12.5 points postoperatively (Table I). The clinical result was rated excellent in four patients (13 to 15 points), good in three patients (10 to 12 points) and poor in one (<7 points). The median postoperative Constant score was 87 (65 to 91) out of 100 points (Table II). All patients were pleased with the cosmetic result. No patient developed instability or signs of inflammation at the site of the excised joint.

Histological examination of six joints showed perifocal cartilaginous hyperplasia, cartilage clefts, moderate formation of lamellar bone at the medial aspect of the clavicle and moderate degenerative changes with focal stromal siderosis of the articular disc.

Discussion

Descriptions of the surgical treatment for pathology of the SC joint mainly consider post-traumatic conditions.^{13,15,16}

There are few reports of the outcome after surgery for degenerative arthritis.^{7,17-19} Bonnin²⁰ described six cases of spontaneous subluxation of the SC joint in a series of 11 patients. These patients were asymptomatic and treatment was therefore not discussed. In one joint, a biopsy showed marked degenerative changes. He speculated that an age-related increase in tissue tension caused the subluxation. Pierce¹⁸ described the surgical exploration of four patients with pain in the SC joint after trauma. In one 28-year-old patient the joint was enlarged and showed degenerative changes; no abnormal pathology was found in the other

three. He described considerable symptomatic improvement four months after excising the articular disc. Rockwood et al¹³ described 15 patients who had surgical treatment for pain in the SC joint secondary to trauma or unsuccessful previous surgery. The patients were predominantly male and younger (mean age 33 years) than the eight women in our study. None of our patients had symptoms of instability such as a grinding or springing sensations in the joint. The stability of the SC joint depends mainly on the costoclavicular ligament and to a less extent on the conformity of the joint and the articular disc.^{3,16,21} The ligamentous structures of the SC joint were preserved in our patients.

Kofoed, Thomsén and Lindenberg,²² and Searle et al²¹ emphasised the need for a thorough clinical assessment and incisional biopsy in patients with degenerative changes in the SC joint, especially in those with a history of or concomitant oropharyngeal malignancy. Swelling of the SC joint has been reported after dissection of the neck and attributed to muscle weakness caused by surgical denervation and radiotherapy.^{23,24} Sclerosis of the medial end of the clavicle may be associated with primary or secondary inflammatory joint disease or overload of the small inferior articular facet.^{12,25,26} It has been reported to produce symptoms in premenopausal women.^{9,12,25} Arlet and Ficat⁹ described 12 women with the spontaneous onset of symptoms arising from the SC joint. Patients between 49 and 66 years of age were successfully treated conservatively, although two aged 30 and 33 years required resection arthroplasty. Both had a good result 18 months after surgery. Only Bremner⁷ has described the long-term results of SC resection arthroplasty. He followed up 12 middle-aged women aged between 34 and 63 years for ten years. Seven underwent surgical treatment. At surgery, there was complete or partial destruction of the articular disc and villous synovitis. Vascularised pannus was seen to cover the articular surfaces, although degenerative or rheumatoid arthritis could not be confirmed. He carried out a synovectomy and excision of the medial 2.5 cm of the clavicle with good results. Kowalik⁸ classified two types of degenerative arthritis of the SC joint. One imitated a tumour of the sternal end of the clavicle, but produced no or only very few symptoms. The second was characterised by minimal enlargement of the joint, but was extremely painful. The symptoms were most severe for a period of one to six months and subsided almost completely after three to four years.

Unlike Bremner,⁷ we found localised synovitis in only two joints, and no osteolysis of the medial aspect of the clavicle. Histological examination which was carried out in six of our eight patients confirmed advanced degenerative arthritis. Excision arthroplasty is a safe and effective treatment for those patients who fail to respond to conservative treatment. Minimal resection and preservation of the stabilising joint structures allow early rehabilitation and provide good clinical and cosmetic results.

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References

1. **Fick R.** *Handbuch der Anatomie*. Jena: Fischer; 1911.
2. **Rathcke L.** Beitrag zur normalen und pathologischen Anatomie des Sternoclaviculargelenkes. *Deutsche Ztschr Chir* 1937;249:162-9.
3. **DePalma AF.** Surgical anatomy of acromioclavicular and sternoclavicular joints. *Surg Clin North Am* 1963;43:1541-50.
4. **Kalliomäki JL, Viitanen S-M, Virtama P.** Radiological findings of sternoclavicular joints in rheumatoid arthritis. *Acta Rheumatol Scand* 1968;14:233-40.
5. **Langen P.** Untersuchungen über die Altersveränderungen und Abnutzungserscheinungen am Sternoclaviculargelenk. *Virchows Arch Pathol Anat* 1934;293:381-408.
6. **Silberberg M, Frank EL, Jarrett SR, Silberberg R.** Aging and osteoarthritis of the human sternoclavicular joint. *Am J Pathol* 1959;35:851-65.
7. **Bremner RA.** Monarticular, non-infective subacute arthritis of the sterno-clavicular joint. *J Bone Joint Surg [Br]* 1959;41-B:749-53.
8. **Kowallik B.** die Arthrosis deformans des Brustbein-Schlüsselbeingelenkes. *Zblchir* 1951;10:672-5.
9. **Arlet J, Ficat P.** Osteoarthritis of the sterno-clavicular joint. *Ann Rheum Dis* 1958;17:97-100.
10. **Hamilton-Wood C, Hollingworth P, Dieppe P, Ackroyd C, Watt I.** The painful swollen sterno-clavicular joint. *Br J Radiol* 1985;58:941-5.
11. **Westermann HH.** Die Erkrankungen der Sternoklavikulargelenke mit besonderer Berücksichtigung der Arthrosis deformans. *Arch Klin Chir* 1942;203:19-42.
12. **Brower AC, Sweet DE, Keats TE.** Condensing osteitis of the clavicle: a new entity. *Am J Roentgenol* 1974;121:17-21.
13. **Rockwood CA Jr, Groh GI, Wirth MA, Grassi FA.** Resection arthroplasty of the sternoclavicular joint. *J Bone Joint Surg [Am]* 1997;79-A:387-93.
14. **Constant CR, Murley AHG.** A clinical method of functional assessment of the shoulder. *Clin Orthop* 1987;214:160-4.
15. **Waskowitz WJ.** Disruption of the sternoclavicular joint: an analysis and review. *Am J Orthop* 1961;3:176-9.
16. **Rockwood CA Jr, Wirth MA.** Disorders of the sternoclavicular joint. In: Rockwood CA Jr, Matsen FA III, eds. *The Shoulder*. Vol.1. 2nd ed. Philadelphia: W. B. Saunders; 1998:555-609.
17. **Abbott LC, Lucas DB.** The function of the clavicle. Its surgical significance. *Ann Surg* 1954;140:583-99.
18. **Pierce RO Jr.** Internal derangement of the sternoclavicular joint. *Clin Orthop* 1979;141:247-50.
19. **Turowski B, Dresing K, Sievers KW.** Swelling of the sternoclavicular joint. *Unfallchirurg* 1995;98:427-31.
20. **Bonnin JG.** Spontaneous subluxation of the sternoclavicular joint. *Br Med J* 1960 (II):274-5.
21. **Searle AE, Gluckman P, Sanders R, Breach NM.** Sternoclavicular joint swellings: diagnosis and management. *Br J Plast Surg* 1991;44:403-5.
22. **Kofoed H, Thomsen P, Lindenberg S.** Serous synovitis of the sternoclavicular joint. *Scan J Rheumatol* 1985;14:61-4.
23. **Gorman JB, Stone RT, Keats TE.** Changes in the sternoclavicular joint following radical neck dissection. *Am J Roentgenol Radium Ther Nucl Med* 1971;111:584-7.
24. **Cantlon GE, Gluckman JL.** Sternoclavicular joint hypertrophy following radical neck dissection. *Head Neck Surg* 1983;5:218-21.
25. **Cone RO, Resnik D, Goergen TG et al.** Condensing osteitis of the clavicle. *Am J Roentgenol* 1983;141:387-8.
26. **Vierboom MA, Steinberg JD, Mooyaart EL, van Rijswijk MH.** Condensing osteitis of the clavicle: magnetic resonance imaging as an adjunct method for differential diagnosis. *Ann Rheum Dis* 1992;51:539-41.