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## ORIGINAL ARTICLE

# Arthroscopic arthrodesis of the shoulder in brachial plexus palsy

Hubert Lenoir, MD<sup>a,\*</sup>, Thomas Williams, MD<sup>b</sup>, Aude Griffart, MD<sup>b</sup>, Cyril Lazerges, MD<sup>c</sup>, Michel Chammas, PhD<sup>c</sup>, Bertrand Coulet, PhD<sup>c</sup>, Dominique Le Nen, PhD<sup>c</sup>

<sup>a</sup>Centre Ostéo-Articulaire des Cèdres, Échirolles, France

<sup>b</sup>Hand Surgery Unit, Orthopedic Surgery Department, CHU La Cavale Blanche, Brest, France

<sup>c</sup>Hand and Upper Extremity Surgery Unit, CHU Lapeyronie, Montpellier, France

**Background:** Shoulder arthroscopic arthrodesis is an uncommon and non-standardized procedure. Results are poorly evaluated. We describe the findings in 8 patients who underwent shoulder arthroscopic arthrodesis for brachial plexus injury.

**Methods:** The humeral head and glenoid were excised through standard arthroscopic portals. A Hoffmann external fixator and cannulated screws were used to stabilize the shoulder. Standard clinical assessment and radiographic evaluation were performed each month until bony fusion occurred. With a mean follow-up of 28 months, functional evaluation included pain level (on a 0- to 10-mm visual analog scale); American Shoulder and Elbow Surgeons index; Disabilities of the Arm, Shoulder and Hand score; and Simple Shoulder Test score. Mobility was systematically investigated. Blood loss was assessed by measuring hematocrit proportion.

**Results:** Glenohumeral fusion was achieved in all 8 patients. The mean time to arthrodesis was 3 months (range, 2-8 months). At last follow-up, the mean pain level was 1 (range, 0-4); the mean American Shoulder and Elbow Surgeons score was 69; the mean Disabilities of the Arm, Shoulder and Hand score was 36; and the mean Simple Shoulder Test score was 4. Mean active flexion and abduction were 80° (range, 60°-90°) and 59° (range, 40°-80°), respectively. Mean blood loss during the perioperative period was 432 mL (range, 246-792 mL). We observed one superficial wound infection and one migration of an acromioclavicular screw. These complications did not compromise the final results.

**Conclusions:** Arthroscopic arthrodesis of the shoulder can be a reliable procedure and associated with a low rate of complications.

**Level of evidence:** Level IV; Case Series; Treatment Study

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**Keywords:** Arthroscopy; arthrodesis; shoulder; glenohumeral fusion; brachial plexus palsy; external fixator

This is research involving the collection of existing data and documents. We asked the Ethical Committee to give an opinion: This work does not require institutional review board approval. The information is recorded in such a manner that subjects cannot be identified directly or through identifiers linked to the subjects. The name of the approval-giving authority is Comité de Protection des Personnes Sud Méditerranée IV, and the study number is Q-2016-05-03.

\*Reprint requests: Hubert Lenoir, MD, Centre Ostéo-Articulaire des Cèdres, 5 rue des Tropiques, F-38130 Échirolles, France.

E-mail address: [hubert.lenoir@laposte.net](mailto:hubert.lenoir@laposte.net) (H. Lenoir).

Glenohumeral arthrodesis, commonly called *shoulder arthrodesis*, was considered a salvage procedure during the past century. The indications are now limited because of advances in shoulder arthroplasty.<sup>3</sup> Current indications concern mainly severe traction injuries to the supraclavicular brachial plexus with a flail shoulder.<sup>2,16</sup> Therefore, the objectives of shoulder arthrodesis are to provide a stable and strong

shoulder with no pain and to allow active elevation of the shoulder through scapulothoracic motion.

Despite the advantages of the procedure, shoulder arthrodesis has been associated with high rates of complications, including nonunion and soft-tissue problems with infection.<sup>3,17</sup> To reduce morbidity, arthroscopic techniques have been developed. Nevertheless, only 5 cases of shoulder arthroscopic arthrodesis have been reported.<sup>6,8,12,18</sup> Recently, Porcellini et al<sup>15</sup> reported good results with mini-open arthroscopy-assisted arthrodesis.

Arthroscopic arthrodesis of the shoulder without any surgical approach may be a reliable and safe procedure. The purpose of this study was to report the results of 8 patients with brachial plexus palsies treated with arthroscopic arthrodesis of the shoulder. We hypothesized that the results of arthroscopic arthrodesis of the shoulder would be as good as historical reports.

## Materials and methods

### Patients

From February 2012 to August 2014, 9 patients (all men) underwent arthroscopic arthrodesis of the shoulder for brachial plexus injury. One patient was lost to follow-up.

The average age of the 8 remaining patients was 33 years (range, 26-58 years). All injuries were due to motorcycle accidents. The mean time after injury was 46 months (range, 21-93 months), and the mean follow-up period was 28 months (range, 12-40 months). Of the 8 patients, 4 were affected on the dominant side. **Table 1** summarizes the type of brachial plexus injury, associated lesions, and previous procedures performed. All direct transfers of the inferior branch of the spinal accessory nerve to the suprascapular nerve had

failed with muscle power of British Medical Research Council (BMRC) grade 2 or less. In all cases, examination of the shoulder before surgery showed muscle power of BMRC grade 4 or 5 for the superior trapezius and serratus anterior.

### Surgical technique

The patients were placed in the beach-chair position. Before the surgical procedure began, the fluoroscopy position was controlled to allow for anteroposterior and Bernageau profile views of the glenoid,<sup>1</sup> so the patient had to be positioned sufficiently on the table edge.

First, 3 pins of the external fixator were introduced percutaneously in the scapular spine and 3 others in the humeral shaft. Then, a standard arthroscopic posterior and anterior approach was performed. Initially, the glenohumeral ligament-labrum complex was entirely removed by the use of radiofrequency energy. The hyaline cartilage and the subchondral bone of the glenoid surface were excised with a 5-mm arthroscopic reamer. On the humeral head, the area to denude was determined in accordance with the future position of arthrodesis (ie, 30° of forward flexion, 30° of abduction, and 30° of internal rotation) (**Fig. 1**). This area was exposed by positioning the shoulder in flexion and external rotation. In case of difficulties in achieving humeral milling, an assistant can perform rotational movements while leaving the burr in place. In this way, the humeral head passes under the burr without any movement with the shaver.

Then, the Hoffmann external fixator (Stryker, Kalamazoo, MI, USA) was assembled (**Fig. 2**). Shoulder reduction was performed under fluoroscopic views by the surgeon. While maintaining the position, the assistant locked the external fixator. The position was checked by positioning the patient's hand at the forehead and the ipsilateral buttock.

Two parallel guidewires were placed percutaneously through the humeral head. Their positions were controlled with anteroposterior and Bernageau lateral fluoroscopic views. Cannulated cancellous

**Table 1** Preoperative conditions before arthrodesis

Case No.	Age, y	Type of lesion	Associated lesions	Previous procedures
1	26	C5-C6	—	Partial ulnar nerve transfer to musculocutaneous nerve
2	31	C5-T1	<ul style="list-style-type: none"> <li>• Ipsilateral both-bone forearm fractures</li> <li>• Ipsilateral scaphoid fracture</li> <li>• Ipsilateral trapezoid dislocation</li> <li>• Ipsilateral multiple carpometacarpal fracture-dislocations</li> </ul>	<ul style="list-style-type: none"> <li>• Direct transfer of inferior branch of spinal accessory nerve to suprascapular nerve</li> <li>• Intercostal transfer to musculocutaneous nerve</li> </ul>
3	25	C5-C6	—	Partial ulnar nerve transfer to musculocutaneous nerve
4	58	C5-C7	Ipsilateral both-bone forearm fractures	<ul style="list-style-type: none"> <li>• Combined transfer of pectoralis major and pectoralis minor muscles</li> <li>• Tendon transfer for finger and wrist extension restoration</li> </ul>
5	26	C5-C7	Head trauma with ipsilateral spastic hemiparesis	Partial ulnar nerve transfer to musculocutaneous nerve
6	38	C5-T1	—	<ul style="list-style-type: none"> <li>• Direct transfer of inferior branch of spinal accessory nerve to suprascapular nerve</li> <li>• Intercostal transfer to musculocutaneous nerve</li> </ul>
7	33	C5-T1	—	<ul style="list-style-type: none"> <li>• Direct transfer of inferior branch of spinal accessory nerve to suprascapular nerve</li> <li>• Intercostal transfer to musculocutaneous nerve</li> </ul>
8	28	C5-C7	—	<ul style="list-style-type: none"> <li>• Direct transfer of inferior branch of spinal accessory nerve to suprascapular nerve</li> <li>• Intercostal transfer to musculocutaneous nerve</li> <li>• Triceps to biceps transfer</li> <li>• Tendon transfer for finger and wrist extension restoration</li> </ul>

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