Techniques in Shoulder and Elbow Surgery 6(3):150–154, 2005

REVIEW

Clinical Diagnosis of a Superior Glenoid Labrum Cyst with Suprascapular Nerve Entrapment (GLEN Lesion)

Michael Müller, MD and George A. C. Murrell, MD, PhD
Orthopaedic Research Institute
St. George Hospital Campus, University of New South Wales
Sydney, Australia

ABSTRACT

A ganglion cyst arising from the superior labrum with entrapment of the inferior branch of the suprascapular nerve (GLEN lesion) is a rare cause of shoulder pain and weakness. The aim of this study was to determine which clinical findings might predict a GLEN lesion. Twenty-seven clinical signs were assessed on five patients with an MRI-confirmed GLEN lesion and 29 age-matched patients who presented with shoulder pain and no GLEN lesion. The clinical assessment included power for internal rotation, external rotation, supraspinatus and lift-off using a hand-held dynamometer.

The most predictive tests for the diagnosis of a GLEN lesion were a reduction of 33% or more of external rotation power compared with internal rotation power, or a reduction of 33% or more of external rotation power compared with supraspinatus power as assessed by hand-held dynamometry. These tests had a likelihood ratio of 100 and 25 respectively for diagnosing a GLEN lesion.

INTRODUCTION

Entrapment of the suprascapular nerve has been increasingly recognized as a cause of shoulder pain.[1–3] Damage to the nerve can be caused by direct or indirect trauma, fractures, or dislocations[1,2]; entrapment beneath the superior transverse scapular ligament at the suprascapular notch[4]; compression by a malignant tumor[5]; or a ganglion cyst.[1,6–10] A ganglion cyst is a rare cause of nerve entrapment and shoulder pain. Although the cause of the ganglion cyst has not yet been clearly defined, it typically arises from the posterosuperior glenoid; and the underlying pathology seems to be a labral tear or fissure,[1] especially a posterior type II SLAP lesion.[9,11] The ganglion cyst may compress the inferior branch of the suprascapular nerve at the infraspinatus fossa. Entrapment of this nerve branch can lead to posterior shoulder pain and weakness of the infraspinatus muscle.[2] For convenience, we have classified this combined pathology as a GLEN lesion: **G**anglion cyst arising from the superior **L**abrum with **E**ntrapment of the inferior branch of the suprascapular **N**erve.[12] The aim of this study was to determine which clinical findings might predict a GLEN lesion.

Address correspondence and reprint requests to: Professor George A. C. Murrell, Department of Orthopaedic Surgery, St. George Hospital, Level 2, 4-10 South Street, Kogarah NSW 2217, Sydney, Australia (e-mail: admin@ori.org.au).

Supported in part by the St. George Hospital/South Eastern Sydney Area Health Service.

MATERIAL AND METHODS

The clinical assessment of all shoulders included range of movement,[13] impingement signs,[14,15] instability tests,[16] O'Brien sign,[17] apprehension sign,[16] and location of pain and manual muscle tests.[18] The power for internal rotation, external rotation, supraspinatus, and lift off was measured in Newtons by a handheld dynamometer (Modified HFG-45, Hand-Held Force Gauge, Transducer Techniques™, Temecula, CA) as previously described[18] (Fig. 1). In brief, the subject was seated upright on the edge of a treatment table with feet supported on a foot stool. For testing supraspinatus power, the examiner stood to the front of the subject and placed the affected extremity into a position of 90° of elevation (ie, an arm-trunk angle of 90°), 30° in front of the coronal plane (ie, in the scapular plane). The palm of the hand faced downward for this test. The subject was asked to hold this position as the examiner applied a downward resistance through the distal end of the dorsal forearm. The dynamometer was centered on the dorsal aspect of the distal forearm and was kept parallel to the ground throughout the testing procedure. The subject was asked to hold this position as the examiner applied a downward force through the dynamometer. For external rotation, the subject's arm was flexed 90° with their elbow held at their side in neutral rotation. The dynamometer was centered on the dorsal aspect of the distal forearm. The subject

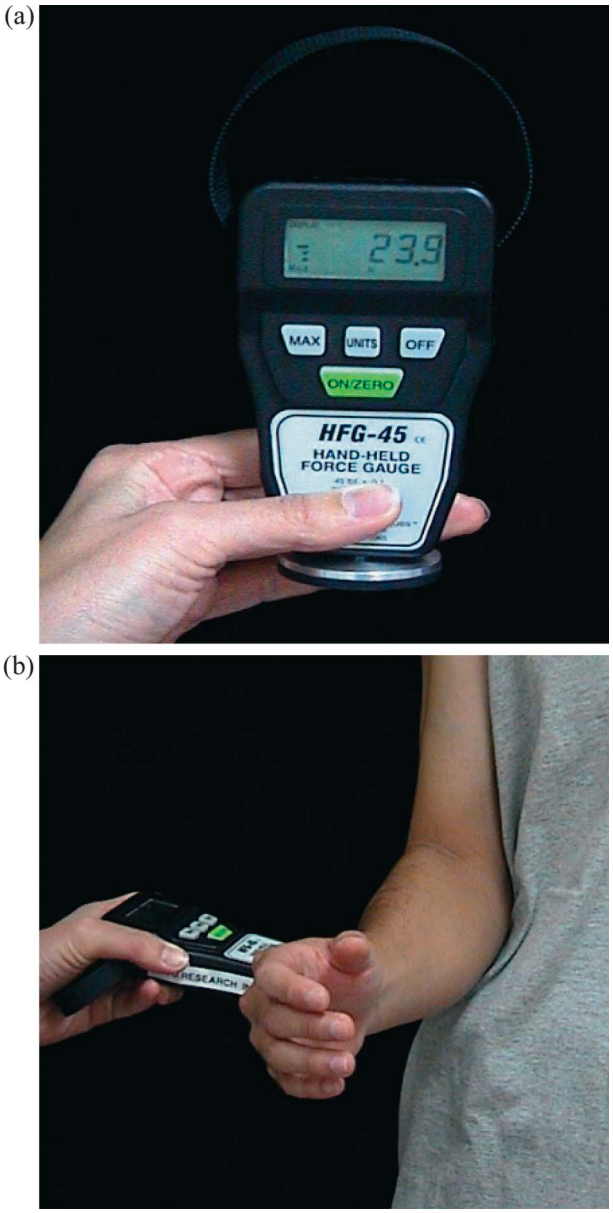

FIGURE 1. Photograph of a handheld dynamometer: (A) close up view, (B) used to test external rotation.

was asked to externally rotate against the dynamometer. For internal rotation the dynamometer was centered on the volar aspect of the distal forearm, and the subject was asked to internally rotate against the dynamometer. For lift off strength, the subject's affected extremity was placed midline behind the back to a reach that was governed by the individual's upper limb flexibility. The dorsal forearm was clear of skin contact. The subject was asked to lift off as the examiner provided an anteriorly directed force through the dynamometer on the volar aspect of the distal forearm.

Further diagnostic tools included a plain X-ray and ultrasound, magnetic resonance imaging (MRI) (Fig. 2),

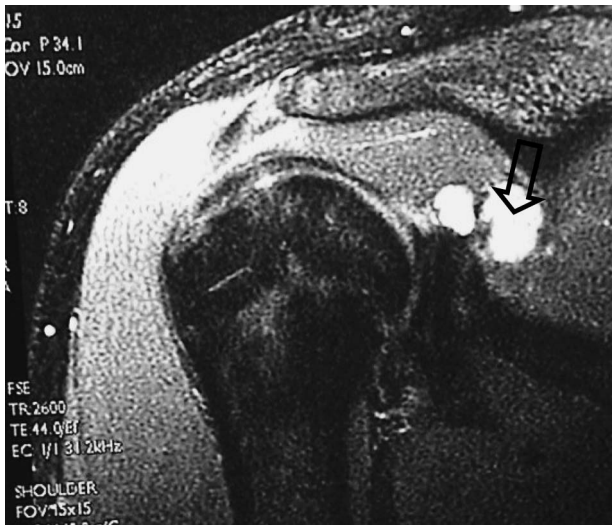

FIGURE 2. Magnetic resonance image (MRI), coronal section, T2 weighted of a patient with a GLEN lesion. Note the ganglion cyst in the spino-glenoid notch (arrow).

and arthroscopy.[19] Arthroscopy was considered to be positive for a GLEN lesion when there was a labral lesion and when brownish liquid drained intra-articularly after palpation with a probe or shaver through the labroglenoidal gap.

The control group consisted of 29 age-matched patients who presented with shoulder pain and showed no GLEN lesion at arthroscopy.

Treatment of GLEN lesions consisted of arthroscopy in the beach chair position[19] and identification of the labral tear as well as the ganglion cyst. Following drainage, the ganglion cyst was carefully debrided with a shaver through the labral lesion. The glenoid rim was debrided and the labrum reattached in anatomic position using a bioabsorbable tac (Suretac™ II, Acufex®, Smith & Nephew, Inc.).[20] Postoperatively, the shoulder was immobilized for 4 weeks in a sling, followed by an intensive rehabilitation program designed to regain full range of movement and increase muscle power.

Results are reported as mean ± SD. Comparisons were made using 2-tailed paired and un-paired Student *t* tests as appropriate. The statistical significance was set as $P < 0.05$.

RESULTS

Patients with a GLEN lesion were all male and aged 22 to 34 years (mean 28 years). All of them complained of diffuse pain at the posterior shoulder and some weakness. The underlying injury was described as a traction type injury in 2 cases, a road traffic accident in 1 case, a direct

blow to the anterior shoulder, and an overload injury in the gym.

There were no differences in shoulder range of motion when comparing the GLEN lesions (n = 5) with the control group (n = 29). Patients with a GLEN lesion showed no signs of instability, apprehension, or impingement, while these clinical tests were positive in nearly 50% of the control group. O'Brien sign was positive in 3 of 5 cases in the GLEN group (60%), while it was positive in 4 of 29 patients in the control group (14%). All 5 patients in the GLEN group (100%) complained about pain around the posterior aspect of the shoulder when the shoulder was abducted 90° and maximally externally rotated. This sign was positive in 4 of 29 patients in the control group (14%) (Table 1).

The strength tests by handheld dynameter showed an internal rotation power of 86 ± 20 N, external rotation power of 46 ± 12 N, abduction power of 89 ± 25 N, and lift off power of 51 ± 30 N in the GLEN group, while it showed an internal rotation power of 104 ± 39 N, external rotation power of 101 ± 40 N, abduction power of 80 ± 37 N, and lift off power of 87 ± 37 N in the control group (Table 2). The ratio of external rotation power compared with internal rotation power ER/IR was 53 ± 5%, the ER/supraspinatus ratio was 52 ± 3%, and the ER/lift off power ratio was 108 ± 52% for the GLEN group. In the control group external power was similar to internal rotation power with a ER/IR ratio of 98 ± 18%, and external rotation power was increased in comparison to supraspinatus power and lift off power with ER/supraspinatus of 140 ± 59% and ER/lift off power 144 ± 64% (Fig. 3). The strength of external rotation was reduced in comparison with internal rotation ($P < 0.005$) and abduction ($P < 0.05$) in patients with a GLEN lesion, while comparison with lift off showed an insignificant increase in power. The control group showed no significant decrease in power for external rotation in comparison to internal rotation and abduction. When comparing the decreased external rotation power ratio in the GLEN lesion group with external rotation power ratio in the control group, the difference was highly significant, with a $P < 0.001$. Manual muscle tests showed less accurate results. In 3 cases manually tested external rotation power was estimated equal to internal rotation and abduction power, while in 2 cases a slight decrease in external rotation strength was noticed.

TABLE 1. *Comparison of clinical tests (number and percentage of patients with positive tests)*

	GLEN lesion (n = 5)	*Control group (n = 29)*
Instability	0 (0%)	14 (48%)
Apprehension	0 (0%)	11 (38%)
Impingement	0 (0%)	15 (52%)
O'Brien[18]	3 (60%)	4 (14%)
Pain in 90° abduction and external rotation	5 (100%)	4 (14%)

TABLE 2. *Muscle strength in N measured by handheld dynamometry (mean ± standard deviation)*

	GLEN lesion (n = 5)	*Control group (n = 29)*
Internal rotation	86 ± 20	104 ± 39
External rotation	46 ± 12	101 ± 40
Abduction	89 ± 25	80 ± 37
Lift off	51 ± 30	87 ± 37

In this study handheld dynamometry showed a sensitivity of 100% for the diagnosis of GLEN lesions when there was a 33% or greater reduction of external rotation power compared with internal rotation and abduction power. The specificity for GLEN lesions diagnosed by handheld dynamometry using this criterion was 96%. The likelihood ratio (LR) for GLEN lesions diagnosed by handheld dynamometry was 100 when there was a 33% or greater reduction of external rotation power as compared with internal rotation power and was 25 when there was a 33% or greater reduction of external rotation power as compared with abduction power.

Following arthroscopic treatment no patient complained of posterior shoulder pain after 3 months. External rotation power was improved from 46 ± 12 N preoperatively to 91 ± 36 N after 6 months ($P < 0.01$). The external rotation power as compared with internal rotation power improved from ER/IR 53 ± 5% preoperatively to 91 ± 16%. The ratio of ER/supraspinatus improved from 52 ± 3% preoperatively to 108 ± 13% 6 months

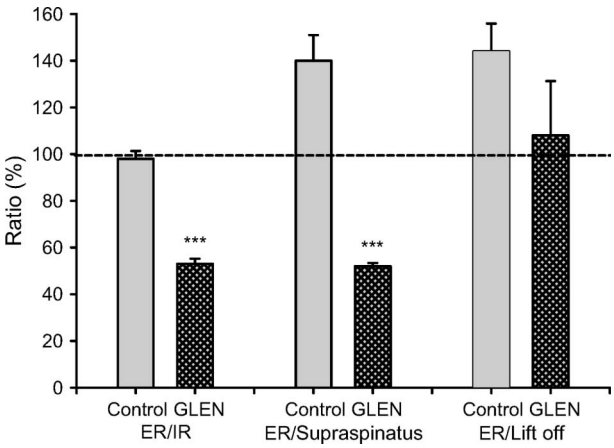

FIGURE 3. Muscle strength of patients with a ganglion cyst arising from the superior labrum with entrapment of the inferior branch of the suprascapular nerve (GLEN lesion, n = 5) compared with patients without a GLEN lesion (control, n = 29). Data is expressed as mean ± SEM external rotation (E/R)/internal rotation (IR), supraspinatus, or lift off power. *** = $P < 0.001$ using unpaired 2-tailed Student *t* tests.

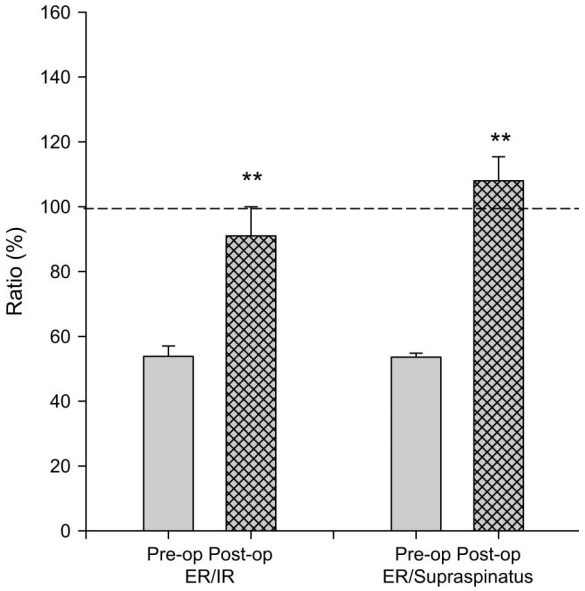

FIGURE 4. Muscle strength of patients with a ganglion cyst arising from the superior labrum with entrapment of the inferior branch of the suprascapular nerve (GLEN lesion), pre and 3 months post surgical decompression. Mean ± SEM, n = 4. ER = external rotation, IR = internal rotation. ** = $P < 0.01$ using paired 2-tailed Student *t* tests.

postoperatively ($P < 0.01$, Fig. 4). Full strength was regained in all but 1 case after 6 months. This patient showed even after 9 months of intensive physiotherapy just an improvement of 65% for his external rotation power.

DISCUSSION

A ganglion cyst with nerve compression is a rare cause of shoulder pain.[1,2,6,7,9] Although the etiology of the ganglion cyst is not clearly defined in the literature, the underlying pathology seems to be a labral tear located at the superoposterior glenoid.[1,9] It is likely that intraarticular fluid escapes out of the shoulder joint through the valve-like labral lesion and forms a ganglion cyst at the infraspinatus fossa. This ganglion formation can cause compression of the inferior branch of the suprascapular nerve, followed by pain and weakness of the infraspinatus muscle. This so-called GLEN lesion can be easily diagnosed by clinical examination and muscle strength measurement with a handheld dynamometer. Common complaints of the patients were some shoulder weakness and a diffuse posterior shoulder pain. A useful clinical test is to determine if there was posterior shoulder pain when the arm was 90° abducted and maximally externally rotated.[11] We found the most predictive tests for the diagnosis of a GLEN lesion were a reduction of 33% or more of external rotation power, as assessed by a handheld dynamometer, compared with internal rotation power, or were a reduction of 33% or more of external rotation power compared with supraspinatus power. The likelihood ratio for GLEN lesions diagnosed by handheld dynameter was 100 when there was a 33% or greater reduction in external rotation power as compared with internal rotation power and 25 when there was a 33% or greater reduction in external rotation power as compared with supraspinatus abduction power in the same shoulder. A clinical test is considered useful if the likelihood ratio is greater than 10.[21]

Ultrasound[22] and MRI[2,9] are further tools to visualize the ganglion cyst. The advantage of an MRI investigation is that it may also be able to confirm the labral tear.[23,24] Costs and loss of time are the major disadvantages of these procedures, especially when using MRI. Handheld dynamometry offers an easy and reproducible tool to identify weakness of external rotation. We found this technique to be more accurate and sensitive than manual muscle tests.

Although our postoperative results are preliminary, we did find an improvement of external rotation power as assessed by handheld dynamometry after arthroscopic treatment. Arthroscopic debridement and reattachment of the labrum for GLEN lesions shows promising short term results, but long term follow ups will be necessary to confirm these early results.

In summary, while compression of the inferior branch of the suprascapular nerve via a ganglion cyst is an uncommon lesion, this study showed that a handheld dynamometer was particularly effective at identifying these lesions when external rotation power was reduced by one third or more, when compared with internal rotation or supraspinatus power.

ACKNOWLEDGMENTS

We are grateful to the patients who participated in the study and to Dr. David Manohar and Dr. James Linklater.

REFERENCES

1. Antoniou J, Tae SK, Williams GR, et al. Suprascapular neuropathy. Variability in the diagnosis, treatment and outcome. *Clin Orthop*. 2001;131–138.
2. Chochole MH, Senker W, Meznik C, et al. Glenoid-labral cyst entrapping the suprascapular nerve: Dissolution after arthroscopic debridement of an extended SLAP lesion. *Arthroscopy*. 1999;13:753–755.
3. Connell DA, Potter HG, Wickiewicz TL, et al. Noncontrast magnetic resonance imaging of superior labral lesions. *Am J Sports Med*. 1999;27:208–213.
4. Cummins CA, Messer TM, Nuber GW. Suprascapular nerve entrapment. *J Bone Joint Surg Am*. 2000;82:415–424.

5. Fehrman DA, Orwin JF, Jennings RM. Suprascapular nerve entrapment by ganglion cysts: A report of six cases with arthroscopic findings and review of the literature. *Arthroscopy.* 1995;11:727–734.
6. Fritz RC, Helms CA, Steinbach LS, et al. Suprascapular nerve entrapment: Evaluation with MR imaging. *Radiology.* 1992;182:437–444.
7. Garcia G, McQueen D. Bilateral suprascapular-nerve entrapment syndrome. Case report and review of the literature. *J Bone Joint Surg Am.* 1981;63:491–492.
8. Hashimoto BE, Hayes AS, Ager JD. Sonographic diagnosis and treatment of ganglion cysts causing suprascapular nerve entrapment. *J Ultrasound Med.* 1994;13:671–674.
9. Hawkins RJ, Kennedy JC. Impingement syndrome in athletes. *Am J Sports Med.* 1980;8:151–158.
10. Hayes K, Walton J, Szomor ZL, et al. Reliability of five methods for assessing shoulder range of motion. *Aust J Physiother.* 2001;47:293–298.
11. Hayes K, Walton J, Szomor ZL, et al. Reliability of 3 methods for assessing shoulder strength. *J Shoulder Elbow Surg.* 2002;11:33–39.
12. Iannotti JP, Ramsey ML. Arthroscopic decompression of a ganglion cyst causing suprascapular nerve compression. *Arthroscopy.* 1996;12:739–745.
13. Moore TP, Fritts HM, Quick DC, et al. Suprascapular nerve entrapment caused by supraglenoid cyst compression. *J Shoulder Elbow Surg.* 1997;6:455–462.
14. Morgan CD, Burkhart SS, Palmeri M, et al. Type II SLAP lesions: Three subtypes and their relationships to superior instability and rotator cuff tears. *Arthroscopy.* 1998;14:553–565.
15. Muller M, Murrell GAC. Clinical diagnosis of a superior glenoid labrum cyst with suprascapular nerve entrapment (GLEN lesion). At the Australian Conference of Science and Medicine in Sport, Melbourne, 2002.
16. Murrell GAC, Warren RF. The surgical treatment of posterior shoulder instability. *Clin Sports Med.* 1995;14:903–916.
17. Neer CS. Anterior acromioplasty for the chronic impingement syndrome in the shoulder: A preliminary report. *J Bone Joint Surg Am.* 1972;54:41–50.
18. O'Brien SJ, Pagnani MJ, Fealy S, et al. The active compression test: A new and effective test for diagnosing labral tears and acromioclavicular joint abnormality. *Am J Sports Med.* 1999;2:610–643.
19. Paxinos A, Walton J, Tzannes A, et al. Advances in the management of traumatic anterior and atraumatic multidirectional shoulder instability. *Sports Med.* 2001;31:819–828.
20. Post M. Diagnosis and treatment of suprascapular nerve entrapment. *Clin Orthop Relat Res.* 1999;368:92–100.
21. Sackett DL. A primer on the precision and accuracy of the clinical examination. *JAMA.* 1992;267:2638–2644.
22. Skirving AP, Kozak TK, Davis SJ. Infraspinatus paralysis due to spinoglenoid notch ganglion. *J Bone Joint Surg Br.* 1994;76:588–591.
23. Tzannes A, Murrell GAC. Clinical examination of the unstable shoulder. *Sports Med.* 2002;32:1–11.
24. Yoneda M, Izawa K, Hirooka A, et al. Indicators of superior glenoid labral detachment on magnetic resonance imaging and computed tomography arthrography. *J Shoulder Elbow Surg.* 1998;7:2–12.