J Shoulder Elbow Surg (2017) ■■, ■■–■■

ELSEVIER

Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

ORIGINAL ARTICLE

Neurologic complications of shoulder joint replacement

Craig M. Ball, FRACS*

Department of Orthopaedic Surgery, Auckland City Hospital, Auckland, New Zealand

Background: Little attention has been given to neurologic complications after shoulder joint replacement (SJR). Previously thought to occur infrequently, it is likely that many are not clinically recognized, and they can result in postoperative morbidity and impair the patient's recovery. The purpose of this study was to document the prevalence of nerve complications after SJR, to identify the nerves involved, and to define patient outcomes.

Methods: This was a retrospective review of 211 SJRs in 202 patients during a 5-year period were included, with 89 male and 122 female patients at an average age of 70 years. All patients underwent a comprehensive analysis of any postoperative nerve complication, including onset, duration, investigation, treatment, and symptom resolution.

Results: Of the 211 SJR procedures, 44 were identified as having sustained a nerve complication (20.9%), with 36 female (81.8%) and 8 male patients (18.2%). Reverse SJR was associated with the highest number of nerve complications. The median nerve (25 patients) and musculocutaneous nerve (8 patients) were most commonly involved. Most nerve complications were transient and resolved within 6 months. Permanent sequelae and injuries that required secondary surgical intervention were rare.

Conclusion: The occurrence of nerve complications after SJR is common, but almost all will fully recover. Most are transient neurapraxias involving the lateral cord of the brachial plexus. Women are more likely to be affected, as are patients who have undergone prior surgery to the affected shoulder. Most are likely to be the result of excessive traction or direct injury to the nerves during glenoid exposure.

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

Keywords: Nerve dysfunction; shoulder joint replacement; reverse shoulder replacement; complication; median nerve; nerve recovery

Nerve dysfunction is a well-recognized but uncommonly reported complication after shoulder joint replacement (SJR). Previous literature has suggested that neurologic injuries occurred infrequently and generally resulted in little if any morbidity.[2,18] However, it is likely that many nerve complications are not clinically recognized. This is because the patient may not be aware that any nerve symptoms being experienced are abnormal, neurologic examination of the postoperative shoulder is often limited by pain and poor function, and transient nerve dysfunction may resolve before it is clinically identified. Therefore, the true incidence of nerve dysfunction is likely to be much higher, especially if examination for such complications is purposefully done.

Nerve complications can occur after any type of SJR.[3,32] Causes are multifactorial and include direct nerve damage

This study was deemed exempt from review by the New Zealand Health and Disability Ethics Committee.

*Reprint requests: Craig M. Ball, FRACS, Auckland Bone and Joint Surgery, PO Box 99405, Newmarket, Auckland 1149, New Zealand.

E-mail address: cm_km_ball@hotmail.com (C.M. Ball).

1058-2746/$ - see front matter © 2017 Journal of Shoulder and Elbow Surgery Board of Trustees. All rights reserved.
http://dx.doi.org/10.1016/j.jse.2017.04.016

during surgical dissection, excessive traction due to arm positioning during exposure, compression secondary to retractors, cement extrusion, postoperative hematoma formation, and use of interscalene nerve blocks.[9,21,28,29] The use of reverse SJR may lead to an increased risk of nerve injury, primarily because of its nonanatomic design.[14] Idiopathic brachial neuritis has also been reported after SJR.[18]

Most previous reports of nerve injury after SJR have suggested that these complications are for the most part transient neurapraxias. However, they can still be responsible for significant postoperative morbidity and may impair the patient's recovery and rehabilitation after the procedure. The purpose of this study was to document the prevalence of all nerve complications after SJR, to identify the spectrum of nerves involved, and to define patient outcomes.

Materials and methods

After Ethics Committee approval was obtained, a retrospective review of prospectively collected data was undertaken of all patients who had undergone an SJR procedure by the author during the 5-year period between 2000 and 2014. Patients with preexisting neurologic symptoms or known cervical radiculopathy or peripheral neuropathy were excluded. A total of 211 shoulders in 202 patients were included in the study, which included 65 anatomic SJRs, 118 reverse SJRs, 11 hemiarthroplasties, and 17 revision SJR procedures (Table I). Surgery was performed on the right shoulder in 109 patients and on the left shoulder in 102 patients.

Patient demographics including age, gender, and handedness were recorded, as were the indication for the surgical procedure and whether the patient had undergone prior surgery to the affected shoulder. All patients had undergone a detailed preoperative clinical assessment including active and passive range of motion, strength assessment, and neurologic examination of the involved upper extremity. All patients had completed a preoperative functional assessment using the American Shoulder and Elbow Surgeons shoulder assessment form.[25] Postoperatively, all patients followed the author's standard SJR rehabilitation protocol.

There were 89 male and 122 female patients with an average age of 70 years (range, 36-92 years). The average age of patients undergoing anatomic SJR was 62 years, and the average age of patients undergoing reverse SJR was 73 years. For the first 3 years of the study, all anatomic and reverse SJR procedures were undertaken using either the DePuy Global AP anatomic (60) or DePuy Delta Xtend reverse (81) prostheses (DePuy Synthes Joint Reconstruction, Warsaw, IN, USA). For the last 2 years of the study, all anatomic and reverse SJR procedures were undertaken using the Tornier Ascend Flex anatomic (17) and reverse (53) prostheses (Tornier Inc, Warsaw, IN, USA). All but 1 of the hemiarthroplasties was undertaken for acute fracture.

Table I Breakdown of SJR procedures performed during study period and number of nerve complications per procedure

Procedure	No.	%	Nerve complications	%
Anatomic SJR	65	30.8	13	20.0
Reverse SJR	118	55.9	27	22.9
Hemiarthroplasty	11	5.2	1	9.1
Revision SJR	17	8.1	3	17.6

SJR, shoulder joint replacement.

All patients received interscalene regional anesthesia as part of their anesthetic. In 56 patients, this involved the use of a continuous ambulatory interscalene catheter; in the remainder, a single-shot nerve block was administered. All patients underwent surgery through a deltopectoral approach in the beach chair positon with use of a specific shoulder positioning table attachment (T-MAX Shoulder Positioner; TENET Medical Engineering, Smith & Nephew, Memphis, TN, USA).

In all patients, a comprehensive analysis of all postoperative neurologic complications had been undertaken, including onset, duration, investigation, treatment, and resolution of neurologic symptoms. The diagnosis was established at the time by subjective complaints of the patient and careful clinical assessment of the upper extremity. In 19 cases, when the nerve dysfunction appeared more clinically significant, nerve conduction studies had been undertaken to assist in the diagnosis and management of the patient. No other complications occurred in the immediate postoperative period (dislocation, humeral shaft fracture, infection) that could have influenced the occurrence of nerve dysfunction.

The following data on any nerve dysfunction were recorded: operative procedure, intraoperative complications, symptoms of nerve dysfunction, location of nerve dysfunction based on clinical examination with (in 19 cases) or without nerve conduction studies, time to identification of nerve dysfunction, presence of neuropathic pain, management of nerve dysfunction, time to resolution of nerve dysfunction, and presence of persistent nerve symptoms or clinical signs of nerve injury. All patients had been observed until maximal improvement in their nerve dysfunction had been reached. No patients were lost to follow-up.

Statistical analysis

The baseline demographic and clinical features potentially related to the development of a nerve complication were summarized using means and standard deviations or frequencies and percentages as appropriate. These measures were compared between those who developed a nerve complication and those who did not using independent *t*-tests and χ^2 tests. A P value $< .05$ was considered statistically significant.

Results

Distribution of nerve complications

Of the 211 SJR procedures performed, 44 were identified as having some postoperative nerve dysfunction (20.9%). The number of nerve complications per procedure performed is identified in Table I. Of the 44 patients with nerve dysfunction, only 38 of these were directly related to the SJR procedure (18.0%); the remainder were confirmed as occurring at a site outside of the brachial plexus (Table II). Overall, reverse SJR was associated with the highest number of postoperative nerve complications (22.9%) and hemiarthroplasty with the least (9.1%). Of the 44 patients identified as having some nerve dysfunction, 36 were female (81.8%) and 8 were male (18.2%). This difference was highly statistically significant ($P < .001$).