A Case Report & Literature Review

Axillary Artery Thrombosis After Humeral Resurfacing Arthroplasty

Robert T. Bents, MD

Abstract

Shoulder arthroplasty is a very successful procedure that places significant technical demands on the surgeon. Complications, such as neural injury and postoperative fracture, have been reported in the literature. In this article, I describe 2 cases of axillary artery thrombosis that occurred after humeral resurfacing arthroplasty.

Case 1 involved a 59-year-old woman who underwent humeral resurfacing arthroplasty. In the immediate postoperative period, a vascular insult was diagnosed by decreased radial pulse and perfusion. Immediate retrograde angiography revealed occlusion of the axillary artery near the level of the prosthesis. Retrograde balloon thrombectomy removed an arterial thrombus and circulation was restored. Case 2 involved a 64-year-old woman with a latent decrease in radial pulse amplitude after humeral resurfacing. Unsuccessful balloon thrombectomy necessitated a reverse saphenous vein bypass graft.

Axillary artery injury that occurs after anterior shoulder dislocation is well documented. Shoulder position during humeral resurfacing reproduces anterior glenohumeral dislocation and may tense the axillary artery against the edge of the pectoralis minor. Elderly patients are predisposed to vascular injury because of loss of arterial elasticity. Meticulous neurovascular examination is crucial throughout the postoperative period, as collateral circulation may conceal perfusion deficits. Prompt recognition of vascular injury may prevent circulatory compromise.

Shoulder arthroplasty is a very successful procedure that places significant technical demands on the surgeon. Complications, such as neural injury and postoperative fracture, have been reported in the literature. There are few reports of vascular injury. In this article, I describe 2 cases of axillary artery thrombosis that occurred after humeral resurfacing arthroplasty. The patients provided written informed consent for print and electronic publication of these case reports.

Dr. Bents is Orthopedic Surgeon, Paragon Orthopedic Center, Grants Pass, Oregon.

Address correspondence to: Robert T. Bents, MD, Paragon Orthopedic Center, 702 SW Ramsey Ave, #112, Grants Pass, OR 97527-5859 (tel, 541-472-0603; fax, 541-472-0609; e-mail, bentsmd@mtashland.net).

Am J Orthop. 2011;40(7):E135-E137.

CASE REPORTS

Case 1

A 59-year-old woman with a history of painful glenohumeral osteoarthritis elected to undergo shoulder arthroplasty. The beach-chair position and a standard deltopectoral approach were used. The axillary nerve was identified and protected throughout the operation. The subscapularis tendon was released 1 cm from the insertion, and the inferior capsule was carefully released to allow full exposure. The arm was placed in adduction, extension, and external rotation to deliver the entire humeral head. The glenoid articular surface was intact. A humeral head resurfacing implant (Global CAP [Conservative Anatomic Prosthesis]; DePuy Orthopaedics, Warsaw, Indiana) was placed. Total operative time was 52 minutes. Initial postoperative neurovascular examination revealed intact bilateral radial pulses with brisk capillary refill. Routine reexamination 30 minutes later showed diminished right radial and ulnar pulses and sluggish capillary refill. The ipsilateral hand appeared mottled and cooler than the contralateral hand. On immediate handheld Doppler ultrasound, the flow in the radial or ulnar artery was indiscernible at the wrist and diminished at the antecubital fossa. Vascular surgery was consulted, and, approximately 70 minutes after arriving in the recovery room, the patient was returned to the operating room.

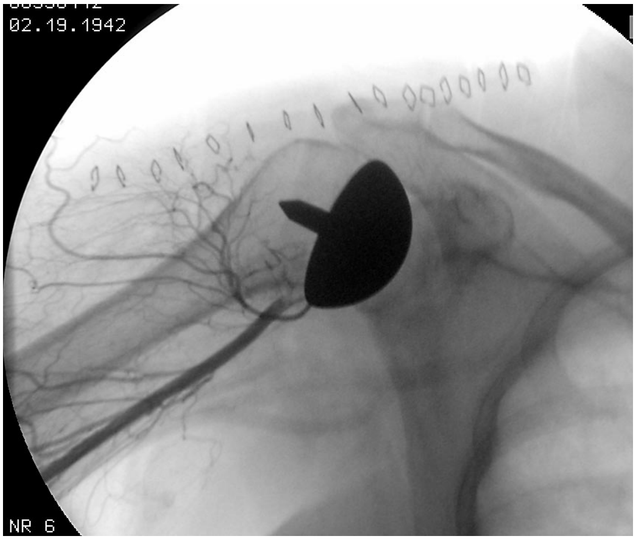

Figure. Intraoperative retrograde angiography reveals lack of flow in third part of axillary artery—consistent with thrombosis.

Intraoperative retrograde angiography revealed lack of flow in the axillary artery below the level of the prosthesis (Figure). Retrograde catheterization was performed, through the brachial artery, for balloon thrombectomy. A thrombus was dislodged from the axillary artery, and circulation was reestablished. Flow at the antecubital fossa was confirmed, and the radial and ulnar pulses returned. From that point on, recovery was uneventful. At 1-year follow-up, the patient's neurovascular examination was normal, and there was excellent pain relief in the shoulder.

Case 2

A 64-year-old obese woman with painful glenohumeral degenerative joint disease elected shoulder arthroplasty. The beach-chair position and a standard deltopectoral approach were used. Operative findings included an intact concentric glenoid and an intact rotator cuff. Humeral resurfacing was performed as described for case 1. Operative time was 72 minutes. There were no known intraoperative complications, and postoperative radial and ulnar pulses were palpable. The next morning, the patient reported poor sensation in the entire upper extremity. Radial and ulnar pulses were not palpable and not attainable by Doppler ultrasound. The hand appeared cool, and capillary refill was diminished, indicating poor perfusion. Angiography revealed occlusion of the midportion of the axillary artery at the level of the thoracoacromial artery. Vascular surgery was consulted, and the patient was returned to the operating room. A gentle balloon thrombectomy was attempted but could not pass the thrombus. The operative site was explored; there was no external lesion of the axillary artery. Given the concern about possible intimal dissection, the surgeon bypassed the thrombosed region with a reverse saphenous vein graft. There was no external damage to the artery or brachial plexus. The Doppler signal returned to the hand immediately, and there was no further vascular compromise. At 1-year follow-up, the patient had mild weakness in elbow flexion but reported no shoulder problems.

DISCUSSION

Axillary artery injury is rare but potentially devastating. In a comprehensive review of complications after total shoulder arthroplasty, Bohsali and colleagues[1] did not mention vascular injury. An exhaustive review of the English literature revealed only 1 report of vascular injury after shoulder arthroplasty.[2] There have been reports, however, of axillary artery injury after shoulder dislocation,[3-6] after blunt trauma,[7,8] after proximal humeral fracture,[9,10] and in throwing athletes.[11] Most cases involve patients who were older than age 50 and more susceptible to injury because of loss of arterial elasticity. Kelley and colleagues[4] noted that, after shoulder dislocation, classic symptoms and signs of ischemia may develop later than expected because of collateral circulation at the shoulder. Arterial spasm is seldom a sufficient explanation for decreased pulse amplitude.

Anterior shoulder dislocation tenses the axillary artery against the edge of the pectoralis minor. It has been postulated that, during dislocation, the artery is also damaged because of its relative fixation by branches of the circumflex humeral and subscapular arteries.[3] During humeral resurfacing, the arm must be extended and externally rotated to gain exposure of the entire humeral head. This maneuver produces torsional forces to the axillary artery similar to those resulting from traumatic anterior glenohumeral dislocation. This may lead to a propensity toward vascular injury during humeral resurfacing, particularly in the elderly.

Elhassan and colleagues[2] described complete transection of the axillary artery and posterior cord of the brachial plexus after stemmed shoulder hemiarthroplasty. More than 9 months passed before a definitive diagnosis was made. The authors hypothesized that the injury occurred during inferior capsular release or during humeral osteotomy. McFarland and colleagues[12] found the axillary artery 12.7 mm from the anterior glenoid rim with the arm in 90° of abduction—putting the artery at risk from retractors placed behind the anterior glenoid. Because the glenoid is not formally exposed during humeral resurfacing, it is unlikely that deep retractor placement caused arterial injury in the reported cases.

Prompt recognition of arterial injury is crucial to preservation of function. In case 1, prompt recognition of vascular compromise in the recovery room resulted in expeditious return to the operating room and successful thrombectomy. In case 2, there was no decrease in radial pulse amplitude for more than 18 hours. At that point, thrombectomy was not possible, and bypass graft was required. Bypass graft surgery requires significantly more dissection than balloon thrombectomy does, and more dissection may have led to musculocutaneous neuropraxia. In up to 60% of cases, brachial plexus injury is associated with subclavian or axillary artery injury.[4] Formal exploration of the brachial plexus is indicated at time of vascular repair in patients with altered neurologic examinations.

Humeral surface replacement arthroplasty, which provides excellent pain relief in patients with osteonecrosis of the humeral head or shoulder osteoarthritis,[13-16] is an attractive bone-preserving implant for patients with minimal glenoid wear. Resurfacing arthroplasty avoids humeral osteotomy, which minimizes errors in version, offset, and head height.[16] Although dissection and bone resection are usually less with resurfacing than with traditional stemmed implants, surgeons must remain vigilant when protecting neurovascular structures. Significant proximal vascular damage may go underrecognized because of collateral flow. Any alteration in postoperative vascular status mandates immediate investigation and appropriate treatment.

AUTHOR'S DISCLOSURE STATEMENT

The author reports no actual or potential conflict of interest in relation to this article.

REFERENCES

1. Bohsali KI, Wirth MA, Rockwood CA Jr. Complications of total shoulder arthroplasty. *J Bone Joint Surg Am.* 2006;88(10):2279-2282.
2. Elhassan B, Shin A, Bishop A, Spinner R. Neurovascular injury after shoulder hemiarthroplasty: a case report and review of the literature. *J Shoulder Elbow Surg.* 2008;17(3):e1-e5.
3. Milton GW. The circumflex nerve and dislocation of the shoulder. *Br J Phys Med*. 1954;17(6):136-138.
4. Kelley SP, Hinsche AF, Hossain JF. Axillary artery transection following anterior shoulder dislocation: classical presentation and current concepts. *Injury.* 2004;35(11):1128-1132.
5. Gates JD, Knox JB. Axillary artery injuries secondary to anterior dislocation of the shoulder. *J Trauma.* 1995;39(3):581-583.
6. Drury JK, Scullion JE. Vascular complications of anterior dislocation of the shoulder. *Br J Surg*. 1980;67(8):579-581.
7. Murata K, Maeda M, Yoshida A, Yajima H, Okuchi K. Axillary artery injury combined with delayed brachial plexus palsy due to compressive hematoma in a young patient: a case report. *J Brachial Plex Peripher Nerve Inj.* 2008;3:9.
8. Adovasio R, Visintin E, Sgarbi G. Arterial injury of the axilla: an unusual case after blunt trauma of the shoulder. *J Trauma.* 1996;41(4):754-756.
9. Matheï J, Depuydt P, Parmentier L, Olivie F, Harake R, Janssen A. Injury of the axillary artery after a proximal humerus fracture: a case report and overview of the literature. *Acta Chir Belg.* 2008;108(5):625-627.
10. Veraldi GF, De Manzoni G, Tasselli S, et al. Iatrogenic axillary artery injury from humeral neck fracture repair. A rare and unusual event in which an aggressive strategy was mandatory to save a child limb. *Chir Ital.* 2006;58(2):247-251.
11. Reeser JC. Diagnosis and management of vascular injuries in the shoulder girdle of the overhead athlete. *Curr Sports Med Rep.* 2007;6(5):322-327.
12. McFarland EG, Caicedo JC, Guitterez MI, Sherbondy PS, Kim TK. The anatomic relationship of the brachial plexus and axillary artery to the glenoid. Implications for anterior shoulder surgery. *Am J Sports Med.* 2001;29(6):729-733.
13. Bailie DS, Llinas PJ, Ellenbecker TS. Cementless humeral resurfacing arthroplasty in active patients less than fifty-five years of age. *J Bone Joint Surg Am.* 2008;90(1):110-117.
14. Levy O, Copeland SA. Cementless surface replacement arthroplasty (Copeland CSRA) for osteoarthritis of the shoulder. *J Shoulder Elbow Surg.* 2004;13(3):266-271.
15. Thomas SR, Wilson AJ, Chambler A, Harding I, Thomas M. Outcome of Copeland surface replacement shoulder arthroplasty. *J Shoulder Elbow Surg.* 2005;14(5):485-491.
16. Jensen KL. Humeral resurfacing arthroplasty: rationale, indications, technique, and results. *Am J Orthop.* 2007;36(12 suppl):4-8.

This paper will be judged for the Resident Writer's Award.