Glenoid Bone Loss in Anatomic Shoulder Arthroplasty

Literature Review and Surgical Technique

Daisuke Mori, MD[a], Joseph A. Abboud, MD[b,*], Surena Namdari, MD, MSc[b], Gerald R. Williams, MD[b]

KEYWORDS

- C2 glenoid • Steptech • Augmented • All-polyethylene glenoid component
- Severe posterior glenoid bone loss

KEY POINTS

- Despite major advances in total shoulder arthroplasty, management of severe posterior glenoid bone loss remains controversial.
- Several companies have provided alternative treatment options for type C glenoids associated with posterior subluxation of the humeral head.
- Preoperative planning, proper selection of glenoid size, and recognition of the operative pitfalls are crucial for successful outcomes.

INTRODUCTION

With improvements in component design, technology, and surgical technique, total shoulder arthroplasty (TSA) is a highly successful surgical procedure for glenohumeral arthritis. However, lucent lines around the glenoid component and glenoid component loosening remain a major concern. Preoperative recognition of glenoid morphology and proper surgical planning are key factors for successful outcomes after surgical treatment of glenohumeral arthritis.[1–3]

The glenoid classification by Walch and colleagues[4] has been widely accepted for preoperative planning. Walch and colleagues classified glenoid morphology in primary glenohumeral arthritis into 5 types: In type A1, the humeral head is centered and minor glenoid erosion occurs centrally. In type A2, the head is centered and major glenoid erosion occurs centrally. In type B1, the humeral head is subluxated posteriorly without glenoid erosion. In type B2, the humeral head is subluxated posteriorly and the glenoid has posterior erosion with the development of biconcavity. In type C, there is glenoid dysplasia or hypoplasia (retroversion >25°) with or without posterior wear. Among these types, the operative treatment of type B2 and C remains most controversial.[1–3]

The purpose of this article is to address the present operative strategies for B2 and C glenoids and to highlight the surgical technique and its pitfalls.

SURGICAL TREATMENT OF B2 GLENOID

Several treatment strategies have been reported for type B2 glenoids, such as asymmetric reaming,

Disclosures: Dr. Mori has no conflicts to disclose. Dr. Abboud is a consultant and designer for Integra Life Sciences. Dr. Namdari is consultant and receives royalties for product design from Miami Device Solutions and Bulletproof Bone Designs. Dr. Williams is consultant for Depuy, Mitek, and Tornier. He receives royalties for product design from Depuy, IMDS/Cleveland Clinic, and Lippincott.

[a] Department of Orthopaedic Surgery, Kyoto Shimogamo Hospital, 17 Shimogamo Higashimorigamecho, Skyo-ku, Kyoto 606-0866, Japan; [b] Rothman Institute at Thomas Jefferson University, 925 Chestnut Street, Philadelphia, PA 19107, USA

* Corresponding author.

E-mail address: abboudj@gmail.com

Orthop Clin N Am 46 (2015) 389–397

http://dx.doi.org/10.1016/j.ocl.2015.02.007

0030-5898/15/$ – see front matter

bone grafting, augmented components, and reversed TSA.

Asymmetric Reaming and Glenoid Resurfacing

With asymmetric reaming, it can be difficult to re-create normal glenoid version in cases of severe glenoid retroversion without removing substantial anterior bone. Sabesan and colleagues[5] demonstrated that correction of moderate to severe glenoid retroversion by asymmetric reaming cannot always be done with the use of a standard component, and if it is done, it will result in greater medialization of the joint line. In addition, Clavert and colleagues[6] have demonstrated that correction of greater than 15° of retroversion is not possible without violating the anterior subchondral bone or the glenoid vault with the anchoring points. Gillespie and colleagues[7] also have demonstrated that a 15° deformity has only a 50% chance of successful correction by anterior, eccentric reaming in a cadaveric model.

Basic study and clinical results of asymmetric reaming and glenoid implantation have been mixed. Most recently, Walch and colleagues[8] have demonstrated that violation of subchondral bone can lead to early glenoid radiolucency and failure. Study of the use of a standard glenoid component in the setting of a biconcave glenoid demonstrated high rates of complications.[9] Gillespie and colleagues[7] demonstrated that correction of as little as 10° of posterior glenoid wear by preferential anterior glenoid reaming results in significant narrowing of the glenoid anteroposterior distance by their cadaveric study. They also demonstrated that corrective glenoid reaming for wear of greater than 10° results in peg penetration in most glenoids and downsizing of glenoid size for most glenoids. On the other hand, Gerber and colleagues[10] showed that asymmetric reaming resulted in correction of posterior humeral subluxation in 21 of 23 patients (91%). Similarly, Habermeyer and colleagues[11] showed that, with asymmetric reaming and soft tissue balancing, the humeral head was maintained in a recentered position following surgical correction of glenoid morphology.

Ream and Run

"Ream and Run" is a specific procedure in which a humeral arthroplasty is performed for active patients in conjunction with concentric reaming of the glenoid bone to spherical concavity with a diameter of curvature 2 mm greater than that of the prosthetic humeral head. Clinton and colleagues[12] demonstrated that the ream and run can offer similar functional recovery to patients with TSA, although the time to recovery may be longer. Matsen and colleagues[13] presented that the ream and run substantially corrected the glenoid type in conjunction with B2 glenoid on the axial view radiographs. Gilmer and colleagues[14] concluded that the procedure appears to be best suited for older male patients with reasonable preoperative shoulder function without prior shoulder surgery, as an analysis of 176 consecutive cases after the procedure based on patient self-assessment, like the simple shoulder test. They also concluded that the type of glenoid had no significant effect on the outcome, and their patients had no problems with posterior glenohumeral instability, although a substantial number of the glenoids were posteriorly eroded and the humeral head was displaced into the posterior aspect of a biconcavity.

Bone Grafting

Studies of clinical and radiographic results of primary total shoulder replacement with an all-polyethylene glenoid component and autologous humeral head graft augmentation have demonstrated mixed results. Neer and Morrison[15] reported excellent results in 16 patients and satisfactory results in 3 patients, and no revision surgeries. No glenoid loosening or migration had occurred at a minimum follow-up of 2 years (average, 4.4 years). Steinmann and Cofield[16] reported that at a mean of 5 years postoperatively, 23 of 28 (82%) patients had satisfactory results after concomitant bone grafting and TSA. However, 15 patients (54%) demonstrated some degree of radiographic lucency, and 3 glenoids were radiographically loose at an average follow-up of 5.3 years. Hill and Norris[17] reviewed 17 TSAs at a mean of 70 months postoperatively that had undergone concomitant bone grafting to address glenoid erosion. Five (29%) of the grafts failed, resulting in requiring revision as a result of instability (2 patients). Sabesan and colleagues[18] reported that 10 of the 12 patients had graft incorporation without any resorption and 2 patients had minor bone graft resorption. Broken screws occurred in 2 of these 10 cases. Two patients, both of whom required revision surgery, had failure of fixation and of graft incorporation. These studies indicate that posterior subluxation can be corrected with glenoid bone grafting, but that the technique may be difficult to perform, generates inconsistent results, and may result in hardware complications and late graft failure in some cases.

Augmented Polyethylene Glenoid

When posterior bone loss is between 3 and 9 mm on the axial view, an augmented component can