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REVIEW ARTICLE

Shoulder arthroplasty options in young (< 50 years old) patients: review of current concepts

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Background: Prosthetic shoulder arthroplasty provides excellent pain relief and functional restoration for patients with glenohumeral arthritis, but concerns of survivorship have limited its use in younger patients.
Discussion: Despite general reports of high long-term survivorship, implant failure and functional deterioration after total shoulder arthroplasty are major concerns in the management of younger patients. In addition to having a longer life expectancy, younger patients also tend to be more active and can be expected to place greater demands on their shoulder arthroplasty.
Conclusion: Alternative strategies have been developed and used for shoulder arthroplasty in younger patients. This manuscript reviews current concepts of shoulder arthroplasty in young patients.
Level of evidence: Narrative Review.

Keywords: Shoulder; arthroplasty; young; hemiarthroplasty; humeral resurfacing; biologic; glenoid

Shoulder arthroplasty has been a treatment option for patients with glenohumeral arthritis since the first anatomic design by Krueger in the 1950s.[25] Decades of development and pioneering by Neer and others have made shoulder arthroplasty a successful treatment option today. Several studies describing patients of all ages show good survivorship and clinical improvements in patients with glenohumeral arthritis.[14,17,39] Shoulder arthroplasty is now considered the ''gold standard'' for surgical management of advanced glenohumeral arthritis in older patients.

Despite the published clinical effectiveness of total shoulder arthroplasty, later failure and outcome deterioration with time are major concerns with shoulder arthroplasty, especially for younger patients. Young, in terms of shoulder arthroplasty, has been arbitrarily defined as younger than 55 years in most studies.[49] Whereas chronologic age is not always a predictor of remaining life expectancy, previous studies have shown that age does correlate with activity level and increased expectations after joint replacement surgery.[29]

Similar to those in older patients, the goals of arthroplasty in younger patients are pain relief and functional restoration. Younger patients, however, tend to have greater functional demands. Schumann et al[44] reported on increased participation in sports for younger patients after anatomic total shoulder arthroplasty. Younger patients are more likely to be laborers and to participate in sports and other physically demanding recreational activities and, consequently, expect to return to a high level of activity after surgery. McCarty et al[34] reported that 64% of patients

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had a shoulder arthroplasty to continue to be able to participate in sports or recreation. Zarkadas et al[54] found that 89% of total shoulder arthroplasty patients and 77% of humeral head replacement patients participated in medium- to high-demand activities. Henn et al[21] showed that a younger age was the only independent predictor of having an increased amount of expectations, including the ability to exercise and to participate in sports, that were considered ''very important'' to a patient. Understanding the expected physical demands of the patient is an important consideration in choosing among shoulder arthroplasty options.

Thus, the shoulder surgeon must not only consider the challenge of shoulder replacement surgery in a patient with more years of life remaining but also anticipate that these patients will have greater expectations for activity and functional outcome from their shoulder replacement, which are likely to increase stress and wear on the prosthetic components.

Longer term studies have shown evidence of implant loosening and deterioration of function with use of anatomic total shoulder arthroplasty in young patients.[3,46,47] Sperling et al[46] reported unsatisfactory outcomes in 48% of 25 total shoulder arthroplasty patients younger than 55 years with a minimum of 10 years of follow-up. In that same study, 76% of total shoulder arthroplasty patients had radiographic evidence of glenoid component loosening and 60% had humeral head subluxation. At the same institution, Bartelt et al[3] described 46 patients with a mean follow-up of 9.3 years after total shoulder arthroplasty and found that 15% had moderate or severe pain, and 13% of those patients felt unsatisfied with the procedure.

Because younger patients with shoulder arthroplasty are likely to experience implant failure in their lifetime, the primary focus of alternative treatment has been to avoid the use of prosthetic glenoid implants, to preserve glenoid bone stock, and to use humeral implants that facilitate revision surgery.

Diagnostic considerations

Whereas older patients treated with shoulder arthroplasty tend to have a diagnosis of primary glenohumeral osteoarthritis or rotator cuff arthropathy, younger patients present with a variety of other pathologic processes, including primary osteoarthritis, post-traumatic arthritis, capsulorrhaphy arthropathy, inflammatory arthritis, osteonecrosis, chondrolysis, and glenoid dysplasia. Each of these causes of glenohumeral arthritis is associated with specific pathologic findings that have an impact on the surgical management.

Primary glenohumeral osteoarthritis affects a broad age range and is associated with progressive internal rotation contracture and posterior glenoid wear, but it is rarely accompanied by significant rotator cuff tearing. In contrast, rotator cuff tear arthropathy, by definition, is associated with large and chronic rotator cuff tears, typically in older patients.[12] Rotator cuff tear arthropathy is characterized by superior migration of the humeral head, decrease in acromiohumeral distance, superior wear of the glenoid, acetabularization of the coracoacromial arch, and rounding of the greater tuberosity.

Proximal humerus fractures can result in nonunion, malunion, osteonecrosis, and cartilage degeneration secondary to articular injury and incongruity. Malunion of the humeral head or tuberosities is a common problem encountered in patients undergoing arthroplasty for treatment of post-traumatic sequelae.[10] The results of arthroplasty for fracture sequelae tend be less satisfactory and are limited by soft tissue contracture, deltoid scarring, rotator cuff disease, and tuberosity healing.[31] Results tend to be inferior particularly when a greater tuberosity osteotomy is needed.[4]

Capsulorrhaphy arthropathy is thought to occur because of altered joint mechanics due to internal rotation contracture after anterior instability surgery, such as Putti-Platt, Magnuson-Stack, and overly tight Bankart repairs.[19] The anterior contracture causes eccentric loading of the posterior glenoid that results in posterior glenoid wear and posterior humeral subluxation.[50] Glenohumeral arthritis can also develop in patients with untreated anterior instability.

Inflammatory arthropathies, such as rheumatoid arthritis, are progressive diseases and affect all of the periarticular tissue. They are associated with osteopenia, glenoid and humeral erosion, and bone loss as well as with rotator cuff degeneration.[37,41]

Glenohumeral chondrolysis is an uncommon but devastating condition that has recently been reported in younger postarthroscopy patients (Fig. 1). It results in symmetric articular loss and periarticular osteopenia and causes deep shoulder pain with progressive loss of motion.[53] It has been clearly linked to intra-articular local anesthetics.[33] Bioabsorbable anchors and thermal capsulorrhaphy have also been reported in the literature as potential causes of postarthroscopic glenohumeral chondrolysis.[53]

Although humeral head osteonecrosis is most commonly the result of systemic corticosteroid use, it can also be the result of trauma, alcoholism, Caisson disease, Gaucher disease, sickle cell anemia, and use of human immunodeficiency virus infection retroviral drugs and other pharmaceuticals.[20] A varying degree of humeral head collapse occurs and can result in severe soft tissue contracture that can make exposure and implant placement difficult. In severe cases, the peripheral edges of the glenoid erode, creating a convex glenoid as the collapsing humeral head envelops it.

Glenoid dysplasia, a relatively uncommon developmental anomaly resulting from abnormal ossification and fusion of the 2 ossification centers within the glenoid, often