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A Long-Term Follow-Up of Post-Operative Periprosthetic Humeral Fracture in Shoulder Arthroplasty

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Abstract

Background: During the last decades, the growing number of shoulder replacement has increased the associated complications. Periprosthetic fractures have a low incidence but can be a severe clinical condition, especially in elderly population. There are still no guidelines to define the best treatment protocol for post-operative periprosthetic humeral fractures. Factors associated to these fractures and consequently the decision-making for the best treatment seem to be patient-related but also correlated with the type of implant. The aim of this study is to analyze the patient's risk factors, fracture pattern, implant type and treatment, evaluating the outcome with a long-term follow-up. **Methods:** A retrospective study was performed on more than 2700 shoulder prostheses implanted over 10 years in two specialized centers, identifying 19 patients who underwent surgery for post-operative periprosthetic fracture. Gender, age, comorbidities, type of prosthetic implant, type of fracture, and cortical index of each patient were evaluated. All patients underwent surgery and were evaluated with a mean follow-up of 5 years with radiographic controls and functional assessment with the Constant–Murley score. **Results:** Complete healing was achieved in 18 of 19 patients. All patients presented a lower Constant–Murley score than the pre-fracture score, there were no significant differences between prosthetic implants, and the cortical index was lower than the threshold level in more than 60% of cases. **Conclusion:** The results of this study showed that a correct preoperative planning is essential to evaluate the type of implant and possible signs of stem mobilization. With a stable stem, it is preferable to maintain it and proceed to a synthesis. The decision process is more complex in periprosthetic fractures with a reduced cortical index, when some radiolucency lines are present in stems with high primary stability, because it is not always indicative of an unstable stem. **Level of Evidence:** Therapeutic III

Keywords
periprosthetic humeral fracture, shoulder arthroplasty, post-operative periprosthetic fracture

Introduction

The number of shoulder replacements in recent years has grown exponentially, especially after the increased utilization of reverse total shoulder arthroplasty (RSA) in the last decade, both in USA and Europe.[1–5]

RSA success and reliability has widened indications, from cuff tear arthropathy to rheumatoid arthritis, complex proximal humerus fractures and their sequelae, failed shoulder arthroplasty, tumors and revisions of primary implants.[6–8]

An increasing number of shoulder implants has also resulted in an increase in the rate of associated complications. Complications that can occur after a shoulder replacement include instability, infection, scapular notching, and periprosthetic fractures.

Periprosthetic shoulder fractures represent an uncommon but severe complication.

The frequency of periprosthetic humeral fractures after shoulder arthroplasty ranges from 1.6 to 2.8% for total replacement and up to 2.3% for hemiarthroplasty.[9–13]

Periprosthetic fractures in reverse shoulder arthroplasty (RSA) are three times more frequent than anatomic arthroplasty and account for approximately 20% of all complications,[14] affecting the humerus, the glenoid, or the acromion.

Depending on the location and morphology of the fracture, different classifications have been proposed; however, best treatment protocols are still debated.[10,15]

Risk factors associated with PHF are represented by a reduced bone stock, female sex, advanced age, higher Deyo-Charlson comorbidity index, and a history of rheumatoid arthritis.[16]

In addition to biological factors, also the characteristics and design of the implants may influence the risk of periprosthetic fracture. For these reasons, further classification has been proposed according to typology of the prosthesis.[17]

This study retrospectively analyzed all the periprosthetic humeral fractures (PHF) occurred in a period of 10 years treated surgically. We classified the different fractures in association with an analysis of risk factors, the radiographical cortical index, and the type of implant used. Analyzing the type of treatment performed, we then evaluated the functional outcomes, the healing rates, and the associated complications, with an average follow-up of 5 years.

Material and Methods

In a 10 years' retrospective study, we enrolled all the post-operative periprosthetic humeral fracture treated surgically from January 2008 to January 2018 in two different institutions.

A total of 2704 shoulder prosthesis were implanted, 2143 and 561, respectively, in the two centers. Radiographs and medical records were collected for all the patients that underwent surgery for a periprosthetic humeral fracture. Preoperative radiographs were assessed to understand fracture pattern and the bone mineral density (BMD) of the humerus.

The ratio between the thickness of the cortical and the total diameter of the humeral diaphysis is called cortical index (CI), and it was calculated according the method proposed by Giannotti et al[18] to evaluate the cortical thickness as a predictor of bone mineralization of the patients. Radiographic lucency around the stem and signs of implant loosening has assessed preoperatively with the method described by Sperling and Sanchez-Sotelo,[19,20] for an accurate planning. CT scan was performed in all patients preoperatively. The traumatic event, past medical history, and risk factors

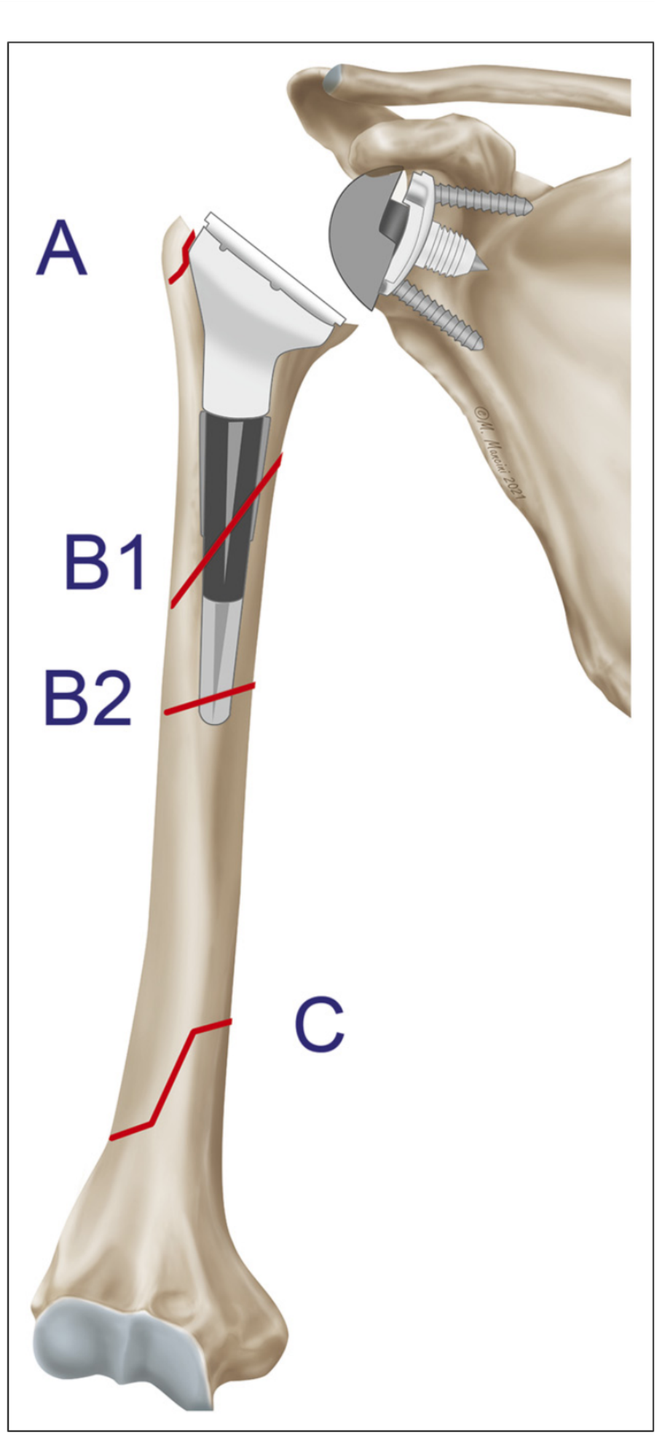

Figure 1. Adaptation of the Worland classification to inverse prostheses.

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