Treatment of Humeral Fracture after Shoulder Arthroplasty using Functional Brace: A Case Report

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What to Learn from this Article?
It is acceptable to select functional bracing for periprosthetic humeral fracture after shoulder arthroplasty without stem loosening, especially in cases where surgical treatment is difficult, such as in elderly patients, and individuals with serious complications or osteopenia.

Abstract

Introduction: A periprosthetic humeral fracture is rare after shoulder arthroplasty, and such cases have considerable problems. Patients with this kind of fracture are often complicated by osteopenia, other types of severe disease, or are elderly. Surgical treatment of this fracture type carries some risk, and surgeons may be unsure about the most appropriate approach to adopt.

Case report: The present case occurred in a 78-year-old woman with an osteoporotic humeral bone, and chronic dislocation of shoulder after shoulder arthroplasty. There were many risk factors for revision surgery or osteosynthesis. Therefore, we decided to treat the patient by functional bracing. Fortunately, complete radiographic union was confirmed at 17 weeks. She returned to daily life with good functional activity.

Conclusion: In our opinion, it is acceptable to select functional bracing for periprosthetic humeral fractures after shoulder arthroplasty without stem loosening in elderly patients with an osteoporotic humeral bone.

Keywords: Periprosthetic humeral fracture; functional bracing; osteoporosis; conservative therapy

Introduction
Periprosthetic humeral fracture after shoulder arthroplasty is uncommon, with a prevalence of 1% to 2% [1, 2]. Therefore, such fractures are not encountered often in clinical practice. These fractures are among the most challenging complications of shoulder arthroplasty, and published information about the outcome of treatment is limited. Patients with this fracture are often complicated by osteopenia, other types of severe disease, or are elderly. Surgical treatment of this fracture type carries a certain degree of risk, and surgeons may be unsure about the most appropriate approach to adopt. Essentially, conventional fractures of the humeral diaphysis treated non-surgically have high rate of union with good functional results [3, 4]. However, there have been only a few reports of conservative therapy using functional bracing for periprosthetic humeral fracture after shoulder arthroplasty [5]. The present case occurred in an elderly woman with an osteoporotic humeral bone. Moreover, chronic dislocation had been present after humeral head replacement for a proximal humeral fracture, and there were multiple risk factors for revision surgery or osteosynthesis. Therefore, we decided to treat the patient by functional bracing. Despite the patient’s unfavorable conditions for fracture healing, she achieved bone union, and returned to daily life with good functional activity. We were able to obtain a good clinical outcome with functional bracing for this case of periprosthetic humeral fracture after shoulder arthroplasty.

Case report
A 78-year-old right hand-dominant woman suffered a fall on her right side in a bicycle accident, and presented at our institution on the same day with severe arm pain. Her medical history included internal fixation for a glenoid fracture 7 years ago, and also hemiarthroplasty (bipolar humeral head type) for a proximal
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 Generally, effective treatment is challenging and there have been few reports. Wright et al. reported good clinical results using a functional brace for two cases of periprosthetic humeral fracture after shoulder arthroplasty. However, periprosthetic humeral fracture after arthroplasty is rare, there are a few reports describing conservative therapy. Kim et al. reported that a trial of non-operative treatment may be considered for a well-aligned type B fracture that is associated with a well fixed humeral component [7]. The present fracture showed a well fixed humeral component, but was unstable, and the cortex was thin due to osteopenia. Although, radiography it indicated that the condition was not good enough for fracture healing, bone union was fortunately achieved. Sarmiento reported that the use of functional bracing for fractures of the humeral diaphysis was associated with a high rate of union, particularly when used for closed fractures. The residual angular deformities were usually functionally and aesthetically acceptable [3, 4]. However, periprosthetic humeral fracture after arthroplasty is rare, and many reports on periprosthetic humeral fracture after shoulder arthroplasty with a very poor general condition and poor bone quality. Both cases were type B and unstable [5]. Several authors have also recommended surgical treatment [1, 6, 8]. Other than the shoulder, there have been many reports on periprosthetic femoral fracture, for which there seems to be a consensus on surgical treatment [9, 10]. Periprosthetic fractures located at the tip of the stem differ from conventional fractures due to the presence of an intramedullary stem. Therefore, there is some concern that the fracture site might not receive enough blood flow; furthermore, the degree of bone fragment contact is lower than in a conventional fracture. However, functional bracing for humeral fracture is an established conservative therapy. Moreover, there has been a good clinical outcome for open fracture cases, and also cases of high-energy trauma such as gunshot injury, which are just as unusual as humeral shaft fractures [3]. Therefore, we consider it acceptable to select functional bracing for periprosthetic humeral fracture after shoulder arthroplasty without stem loosening, especially in cases where surgical treatment is difficult, such as in...

Discussion

Periprosthetic fracture of the humerus after shoulder arthroplasty is rare, with a reported prevalence between 1.6% [1] and 2.4% [2]. Generally, effective treatment is challenging and difficult, and there have been few reports. Wright et al. classified the pattern of such periprosthetic humeral fractures according to their relationship with the distal tip of the implant stem: type A, centered at the tip and extending proximally for more than one-third of the stem length; type B, also centered at the stem tip, but with less proximal extension; type C, involving the humeral shaft distal to the prosthesis tip and extending into the distal humeral metaphysis [6]. Accordingly, the present fracture, which was short and oblique, being located at the stem tip, was type B by this classification. Previous studies have suggested that type C fractures respond favorably to non-operative treatment [2, 6, 7], whereas type A and type B fractures do not. This is because fractures centered at the tip of the prosthesis stem (types A and B) behave in a manner very different from the usual course of a humeral fracture [1, 2, 8]. Conversely, Wright et al. recommended non-operative treatment with a coaptation splint, followed by a plastic orthosis, for type B fractures that have a long oblique or spiral pattern [6]. Kumar et al. reported that a trial of non-operative treatment may be considered for a well-aligned type B fracture that is associated with a well fixed humeral component [7]. The present fracture showed a well fixed humeral component, but was unstable, and the cortex was thin due to osteopenia. Although, radiography it indicated that the condition was not good enough for fracture healing, bone union was fortunately achieved. Sarmiento reported that the use of functional bracing for fractures of the humeral diaphysis was associated with a high rate of union, particularly when used for closed fractures. The residual angular deformities were usually functionally and aesthetically acceptable [3, 4]. However, periprosthetic humeral fracture after arthroplasty is rare, there are a few reports describing conservative therapy. Kim et al. reported good clinical results using a functional brace for two cases of periprosthetic humeral fracture after shoulder arthroplasty with a very poor general condition and poor bone quality. Both cases were type B and unstable [5]. Several authors have also recommended surgical treatment [1, 6, 8]. Other than the shoulder, there have been many reports on periprosthetic femoral fracture, for which there seems to be a consensus on surgical treatment [9, 10]. Periprosthetic fractures located at the tip of the stem differ from conventional fractures due to the presence of an intramedullary stem. Therefore, there is some concern that the fracture site might not receive enough blood flow; furthermore, the degree of bone fragment contact is lower than in a conventional fracture. However, functional bracing for humeral fracture is an established conservative therapy. Moreover, there has been a good clinical outcome for open fracture cases, and also cases of high-energy trauma such as gunshot injury, which are just as unusual as humeral shaft fractures [3]. Therefore, we consider it acceptable to select functional bracing for periprosthetic humeral fracture after shoulder arthroplasty without stem loosening, especially in cases where surgical treatment is difficult, such as in...
elderly patients, and individuals with serious complications or osteopenia. Sarmiento considered that manipulation of fractures of the humeral diaphysis is not necessary when functional bracing is employed. They reported that the triceps, brachialis, and biceps muscle show coiling of their fibers as the bone fragments rotate after injury, whereas they recoil as the muscles contract during activity. This recoiling appears to align the fragments in a parallel direction, thus correcting any malrotation [3]. As our patient had suffered chronic dislocation of the shoulder and undergone a post-coracoid tip transfer procedure, we were seriously concerned about non-functional recoiling. However, although some anterior angulation deformity remained, the fracture healed. We speculate that the anterior angulation deformity might have been due to a change in biceps muscle function resulting from chronic dislocation and the coracoid tip transfer procedure.

Conclusion
Periprosthetic humeral fracture is rare, and among the most challenging complications of shoulder arthroplasty. Surgical treatment is especially difficult for elderly and frail patients with osteopenia. However, a few previous reports have suggested the use of conservative therapy [5, 6]. Although our patient was considered a poor candidate for fracture healing, bone union was successful with conservative therapy using a functional brace with careful follow-up.

Clinical Message
Periprosthetic humeral fracture may need a surgical procedure. However, some cases amongst these are elderly and frail patients. Therefore, in our opinion it is acceptable to select functional bracing for periprosthetic humeral fractures occurring after shoulder arthroplasty without stem loosening.

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