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# Focal anatomic resurfacing implantation for bilateral humeral and femoral heads' avascular necrosis in a patient with Hodgkin's lymphoma and literature review

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## ABSTRACT

**INTRODUCTION:** The femoral and humeral heads are among the most common sites of osteonecrosis. The aims of this case report was to report three years' results for sequential treatment of bilateral, concomitant involvement of humeral and femoral heads with focal anatomic resurfacing implantation in a single patient with Hodgkin's lymphoma and to review the relevant literature, which is relatively scarce.

**PRESENTATION OF CASE:** We present a 48-year-old male patient with concomitant, bilateral femoral and humeral head avascular necrosis. He was diagnosed as Hodgkin's lymphoma in 1984. He had bilateral groin and shoulder pain, lasting for three years and aggravated by joint motions. Radiological evaluations demonstrated bilateral focal osteonecrosis of femoral heads and humeral heads, respectively. Despite conservative treatment, he did not obtain any symptomatic relief. Following the common decision, he was treated with sequential implantations with the HemiCAP<sup>®</sup> device for both bilateral pathologies, by a single surgeon and standard surgical approaches. Neither intraoperative nor postoperative complication was encountered. After the follow-up period of 36 months after the last surgery, he was symptomless and with normal range of motion for all four joints.

**DISCUSSION:** The bilateral, concomitant involvement of humeral and femoral head in the setting of avascular necrosis is relatively rare. Moreover, the optimal treatment method at earlier stages, in young patients has not been established yet.

**CONCLUSION:** This study is the first report to present the three-years' clinical result of a single, relevant case, who was treated with sequential focal anatomic resurfacing implantations (HemiCAP<sup>®</sup>) in four aforementioned joints.

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## 1. Introduction

The femoral head and humeral head are the first and second most common sites of osteonecrosis in the human body, respectively [1,2]. But, bilateral and concomitant involvement is rare. The risk factors are commonly corticosteroid use and trauma [3].

The management should start with a high index of suspicion in order to diagnose earlier and to prevent further arthritic process. Although there are non-operative and operative options, the optimal treatment method has not been established yet [4,5]. Partial or total resurfacing options have the advantage of preserving the patient's anatomy to a maximum extent, under "joint-preserving" surgeries, which have recently gained importance especially for young and middle-aged, symptomatic patients [6]. There are only

a few studies related with the treatment of osteonecrosis of the femoral or humeral heads with resurfacing [7,8]. To the best of our knowledge, there was no previous report of a case—who had symptomatic, concomitant and bilateral osteonecrosis of femoral head and humeral head—who was treated with the joint-preserving focal anatomic resurfacing implant (HemiCAP<sup>®</sup>) with a three years of follow-up.

The aims of this study was to report a case of a 48-year-old male patient with Hodgkin's lymphoma, who was diagnosed with bilateral femoral head and humeral head osteonecrosis and who was treated successfully with the HemiCAP<sup>®</sup> and to review the relevant literature, which is relatively scarce.

## 2. Presentation of case

A 48-year-old male patient with a history of Hodgkin's lymphoma admitted to our department of adult reconstructive surgery service with complaints of bilateral hip and shoulder pain and limitation in range of motion of all four joints in 2011. He was

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diagnosed as Hodgkin's lymphoma in 1984. He was treated with chemotherapy, corticosteroids and finally cured with bone marrow transplantation in 2007.

The hip pain was localized to bilateral groins, aggravating with joint movements—especially with internal rotation- and during weight bearing. The shoulder pain was getting worse with joint movements, especially with overhead activities. The duration of his complaints was lasting approximately for 3 years, before his admission. There was no history of trauma to both joints. He was treated non-surgically with non-steroidal anti-inflammatory drugs and use of crutches to limit weight bearing, over the last year. But this non-operative management provided very limited symptomatic relief.

The physical examination revealed an antalgic gait without Trendelenburg sign and limp length inequality. The range of motion (ROM) of the right and left hips was painful and limited as follows, respectively: full extension—full extension, 100–90° of flexion, 15–10° of internal rotation, 40–30° of external rotation, 30–30° of abduction and 20–15° of adduction. On physical examination of the shoulder, the range of motion of the right and left sides were painful and limited as follows, respectively: 100–90° of active forward elevation and 30–30° of external rotation.

Magnetic Resonance Imaging (MRI) evaluations of both hips and shoulders demonstrated bilateral focal osteonecrosis of femoral heads (Ficat-Arlet Stage III) and humeral heads (Cruess Stage III), respectively (Fig. 1) [9,10]. The largest anteroposterior and mediolateral sizes (mm) of the lesions measured on MRI were recorded as follows: 19.8–30.3 (right femur), 17.8–29.5 (left femur), 22.8–31.5 (right humerus), 31.7–36.2 (left humerus).

Based on the symptomatology and age of the patient and his unresponsiveness to non-operative management, surgical options were discussed with the patient. The common decision was made to perform initial focal anatomical resurfacing implantation for the relevant joints. Following perioperative antibiotic prophylaxis and sterile preparation of the surgical sites; standard surgical approaches were performed by a single surgeon (O.B.); firstly for both hips with one-month interval and then two months later, sequentially for both shoulders (with two-months interval). Neither intraoperative nor postoperative complication was encountered.

### 2.1. Surgery of the hip

Under spinal anesthesia, safe surgical dislocation was performed according to the technique described by Ganz et al. [11]. After proper debridement of the osteonecrotic lesion, appropriate-sized focal resurfacing implant (HemiCAP®) matching patient's femoral head curvature was impacted securely over the tapered titanium screw. The range of motion and the impingement of the hip joint were checked after relocation of the hip. The intraoperative control of radiography was done routinely in anteroposterior and lateral planes. The osteotomy site and surgical planes were closed accordingly.

### 2.2. Surgery of the shoulder

Following interscalene brachial plexus blockage; standard deltopectoral approach was performed in the half-sitting position with the head elevated 45°. After the incision of the subscapularis tendon and the capsule underneath – leaving a cuff tissue on the lesser tuberosity for reattachment –, the humeral head was dislocated anteriorly by externally rotating the arm, with full-exposure of the humeral head. After debridement of the lesion, appropriate-sized implant (HemiCAP®) matching patient's humeral head curvature was impacted securely over the tapered titanium screw. The 35 mm and 40 mm diameter final implants were used for right and left sides, respectively. After relocation of the shoulder, the range of



**Fig. 1.** MRI images. (A) Preoperative T1-weighted MRI scans of both hips demonstrating Ficat-Arlet Stage III avascular necrosis. (B) Right and (C) left shoulders' preoperative T1-weighted MRI scans, demonstrating Cruess Stage III avascular necrosis.



Fig. 2. Full range of motion of patient's both hips and shoulders at 36th months (A–C).

motion was checked for surface congruency. The layers were closed accordingly. The intraoperative control of radiography was done routinely in anteroposterior and lateral planes. A sling was used postoperatively.

On one hand, thromboprophylaxis was used for 6 weeks postoperatively following only the hip surgeries. The patient was mobilized toe-touch weight bearing during the first four weeks in order to allow healing of trochanteric osteotomy and sufficient implant-bone integration. Then the mobilization was progressed to full-weight bearing as tolerated. The osteotomies were healed at postoperative 2nd months. Thereafter, the screws were removed within the first year due to irritation. On the other hand, shoulder joint rehabilitation followed as described in the study by Uribe and Botto-van Bemden [8]. The follow-up period after the last surgery was 36 months. At the end of this period, the patient was without symptom and with normal range of motion for all four joints (Fig. 2A–C). Fig. 3 shows the last radiograph at 36th months since the last surgery.

The patient was informed that data from the case would be submitted for publication, and gave his consent for both surgeries and gave permission for publication of the data from this case, including photographs. Our work has been reported in line the CARE criteria [12].

### 3. Discussion

To the best of our knowledge, this study is the first report to present represents the mid-term successful clinical results of focal,

anatomic resurfacing implantation for the treatment of a middle-aged patient with avascular necrosis of bilateral femur and bilateral humeral heads, firstly in the literature.

The femoral head and humeral head are the two common sites, in which osteonecrosis are encountered. But, their simultaneous, bilateral involvement and their sequential treatment with focal, anatomic resurfacing implants was not reported before. In general, the management of the osteonecrosis, non-operative and operative options are present. The early diagnosis with a high index of suspicion is of utmost importance, in order to have the opportunity to apply a “joint-preserving” treatment modality – especially for a weight bearing joint like hip-, which have regained popularity in the recent years, as stressed by Leuning and Ganz [6].

We think that HemiCAP® implants have offered a variety of advantages since their first launch into the market in 2002. The preoperative planning is much more easier than any total arthroplasty. Moreover, intraoperative diameters and contour shapes allow the surgeon to not only cover the lesion effectively, but also fit the implant to the patient while preserving healthy bone and cartilage [13]. HemiCAP® implant constitutes one of the new alternative options of “joint-preserving” surgeries, while protecting the patients’ anatomy with little bone bony resection [14]. In addition, the implant matches the patient’s anatomy and the related contour of the joint surface. As they are suitable for young and middle-aged patients, the chance for their revision with total hip or total shoulder arthroplasty is always possible, in case of implant failure, fracture or further progression of arthritis, if any.



**Fig. 3.** Final radiograph of all four focal anatomic resurfacing implants (HemiCAP®) in bilateral femoral and humeral heads, at postoperative 36th months since the last surgery.

The longest follow-up periods of patients with its clinical use were 3 years, and 6 years for shoulder [2,8,15–17] and hip [18–21] surgeries, respectively. The clinical experience reported till now was limited with only four case reports and a case series related with the use in hip pathologies of the femoral head [7,18–21].

#### 4. Conclusion

In summary, the alternative focal, anatomic resurfacing implantation with HemiCAP® in this particular case, having bilateral, focal osteonecrosis of the femoral and humeral heads has functioned

well in mid-term. To the best of our knowledge, a single patient with Hodgkin's lymphoma – who was operated by sequential focal, anatomic resurfacing implantation on both femoral and humeral heads due to focal avascular necrosis- was firstly presented in the relevant literature. Although this study demonstrated successful clinical results as an alternative modality for the sequential treatment of avascular necrosis in the relevant joints; in order to make concrete conclusions for the long-term efficacy and the routine use of this implant as an alternative option for the treatment of avascular necrosis of the relevant joints; additional prospective, randomized studies with longer follow-up period and higher number of patients are warranted.

#### Conflict of interest

A.M. has royalties with Arthrosurface. Other authors have no relevant conflicts of interest to declare.

#### Source of funding

The study had no sponsors.

#### Ethical approval

The present study was approved by the local ethical committee of the Konya Necmettin Erbakan University Meram Faculty of Medicine (Reference number: 2014-709).

#### Consent

The patient was informed that data from the case would be submitted for publication, and gave his written and signed consent for all surgeries and gave permission for publication of the data from this case, including photographs.

#### Author contribution

O. Bilge designed the study concept, carried out the surgeries, collected data, analysed data, wrote the paper, revised the manuscript critically, gave approval for the final version. M.N. Doral revised the manuscript critically for content, gave approval for the final version. A. Miniaci revised the manuscript critically, participated in its design and coordination, and gave approval for the final version.

#### Guarantor

The guarantor is O. Bilge.

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