Metastatic proximal femoral fractures treated by segmental allograft replacement

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Abstract

We treated seven metastatic proximal femoral fractures in seven patients. The femoral head, neck, trochanter, and upper shaft were replaced by an allograft. Chemotherapy or radiotherapy for the primary malignancy was continued according to the scheduled regimen. The life span after surgery was seven months (one week-14 months). Notably, all patients could maintain ambulation with aids throughout the residual life.
Introduction

Metastatic bone lesions are not uncommon and the principle of treatment has largely been established [7,13]. Generally, the metastatic area rarely requires surgical treatment and indications for operation include local biopsy, impending or existing fractures [2,6,12].

Although the proximal femur is a common site of metastasis [1,4,7,9], articles reporting total proximal femur involvement are few. Until now, a convincing surgical technique of treatment has not yet been reported. Various operative methods may have individual advantages and disadvantages [9,11]. In this retrospective study, the total proximal femur was replaced by allograft. Postoperatively, chemotherapy or radiotherapy for treating primary malignancy was continued and ambulation with partial weight bearing was permitted. The feasibility of this treatment modality was assessed.

Patients and methods

From May 1994 to June 2001, seven patients with metastatic proximal femoral fractures were treated at our institution. The patients aged from 44 to 72 years (median, 61 years) with a male to female ratio of 4 to 3. Four fractures were in the left while three, in the right. Five primary malignancies came from lung cancer (Table 1). The median period from the diagnosis of the primary malignancy to the pathologic fracture was 5 months (range, 2-9 months). All fractures occurred during admission for treatment of the primary malignancies and were caused by low energy injuries. Concomitantly, none had been surgically treated for the primary malignancy.

Bone scan was performed in all patients to assess metastases in the skeletal system. Metastases were found in several areas in all patients and the femoral head, neck, trochanter, and upper shaft were involved on the fractured side. Therefore, internal fixation with cement augmentation was considered impossible.
The life expectancy and the general condition were evaluated and surgical treatment was arranged. The indications for allograft replacement in this series included: life expectancy of more than 2 months, acceptable general condition and total proximal femoral involvement [7].

Surgical technique:

Under spinal anesthesia, the patient was placed on the operating table in the lateral decubitus position. Direct lateral approach over the proximal femur was used. Fascia lata was retracted and Vastus lateralis was not opened. With a power saw, a transverse osteotomy was performed about 6 cm distal to the fracture site. With the electric cautery, the gluteus medium, the gluteus maximum and the iliopsoas were detached from the femoral insertion. Five mm soft tissue stump was preserved to avoid penetrating into the bone. The capsule of the hip joint was transversely opened at the mid-neck. The proximal femur was pulled up and Ligamentum teres was cut and the proximal femur completely removed.

The local area was massively irrigated with normal saline solution and the bleeding sources were checked. While pulling the distal femur downward, the required length of the allograft was assessed. Generally, a bony segment 1 cm longer was prepared to enforce hip joint stability by increasing muscle tension. The allograft was inserted and the osteotomy site temporarily stabilized with a Lowman bone clamp. The femoral neck was kept in 20° of anteversion and the stability of the hip joint was checked. The femoral marrow canal was reamed to 13 mm and a Grosse-Kemp locked nail (Howmedica, Kiel, Germany) of 12 mm in diameter was inserted. To enforce the rotational stability, staples (Richards, Memphis, TN) or a dynamic compression plate (Synthes, Bettlach, Switzerland) was augmented. No autograft was supplemented. Postoperatively, patients were permitted to ambulate with protected weight bearing. The hip joint was advised to be kept abducted at all times. Treatment of the primary malignancy was continued in the oncological department one week after surgery. Regular follow-up of the femur and was arranged at the Outpatient Department. The walking
aids were advised to be continuously used.

Results

All patients had been regularly followed-up until death (Table 1). The median life span was 7 months (1 week-14 months). There were no surgical complications (Fig.1).

Fig. 1  Case 1. A 44-year-old woman suffered lung cancer for 9 months. A pathologic fracture occurred in the right proximal femur. The total proximal femur was replaced by the segmental allograft and stabilized with a locked nail and one staple. The patient survived 14 months and could ambulate with crutches throughout the whole course.

The median operation time was 110 minutes (range, 90-150 minutes) and the median bleeding amount was 800 ml (range, 400-2,000 ml). The fracture site in the patient with hepatoma (case 4) bled easily. Therefore, it had the longest operation time (150 minutes) and the
maximal bleeding amount (2,000 ml).

Postoperatively, all patients could walk with aids by partial weight bearing. Local pain had vanished. All except one patient had a life span of more than 4 months. The special case (case 6) was due to bleeding from a gastric cancer (Fig.2).

Fig. 2 Case 6. A 61-year-old man suffered gastric cancer for 2 months. A pathologic fracture occurred in the left proximal femur. The total proximal femur was replaced by the segmental allograft and stabilized with a locked nail and two staples. Unfortunately, massive bleeding from gastric cancer occurred and the patient died at one week.

Postoperatively, the patient was permitted to ambulate using a walker at 3 days. At one week an upper gastrointestinal bleeding occurred. Although endoscopic hemostasis was performed the patient died from a hemorrhagic shock.
Discussion

Techniques to treat impending or existing fractures caused by metastases are various and each has individual merits and defects [7,9,11]. Non-operative treatment will hinder the treatment regimen for the primary malignancy. Moreover, in proximal femoral fractures, patients’ care becomes more complicated [1,2]. Therefore, surgical treatment to make patients early ambulate is always preferred.

Table 1
Clinical data for seven patients with metastatic proximal femoral fractures

<table>
<thead>
<tr>
<th>Case number</th>
<th>Sex</th>
<th>Age (yr)</th>
<th>Primary malignancy</th>
<th>Period from diagnosis of malignancy to fracture (mo)</th>
<th>Stabilization devices</th>
<th>Life span (mo)</th>
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<td>K</td>
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<td>L+S</td>
<td>14</td>
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<td>K</td>
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<td>L+P</td>
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<td>K</td>
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<td>48</td>
<td>H</td>
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<tr>
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<td>54</td>
<td>K</td>
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<td>L+S</td>
<td>4</td>
</tr>
</tbody>
</table>

F: Female; G: Gastric cancer; H: Hepatoma; K: Lung cancer; L: Locked nail; M: Male; P: Plate; S: Staple

In the literature, internal fixation with or without cement augmentation has achieved much support [1,2,5,8,11]. However, once the total proximal femur is involved, such a method will fail. A custom-made proximal prosthesis may be used [9,11,13]. However, its high cost and being not short-term available will greatly restrict its use. In this series, segment allograft replacement can provide an excellent function. The allograft may be stabilized with various
devices. However, a locked nail may be more ideal. In principle, the allograft is not predicted to be able to fuse with the distal bony segment. It is only used temporarily to support the lower extremity. Therefore, the autograft can be spared. A sliding compression screw has an inferior mechanical strength in the subtrochanteric use [10,14]. A gamma nail requires an image intensifier to aid to insert a lag screw and the nail length may be insufficient [5]. A traditional Küntscher nail has a lower rotational resistance. In this series, a dynamic locked nail with staple or plate augmentation is proven to be sufficient to provide stability for early ambulation.

Bone scan is a useful tool to evaluate the boundary of involvement [3,11]. It may affect the decision to use different treatment methods. Theoretically, magnetic resonance imaging (MRI) may also be used to detect the boundary of involvement. However, its higher cost and being unable to detect systemic involvement will descend its clinical value.

With preserving the acetabular labrum, when the allograft femoral head was reduced into the acetabular cavity, a suction effect was observed. The stability of the hip joint was maintained. Furthermore, the over-lengthening in this technique further enforced the joint stability. We saw no dislocation and all patients could ambulate with aids.

In this series, surgical treatment was for an existing pathologic fracture. In the literature, surgical treatment may be indicated for impending fractures [2,13]. However, for terminal–stage patients with proximal femur involvement, preventive surgery may be inadequate. Patients may die before a pathologic fracture occurs. Allograft replacement has been proven very effective once a pathologic fracture occurs. Delayed treatment does not induce a more complicated course.

In the literature, the median survival time was 4.7-14.5 months after pathologic fractures occurred [7,9,13]. In this series, a median survival time was 7 months. All except one patients had survived more than 4 months.
In conclusion, segmental allograft replacement is an alternate feasible method to treat metastatic proximal femoral fractures where internal fixation is unsuitable. The technique is not complex and the effect can be very satisfactory.

References

