



(CASE REPORT)



TWO-STAGE RECONSTRUCTION OF A FEMORAL METASTASIS FROM PAPILLARY THYROID CARCINOMA USING A CEMENT SPACER AND STRUCTURAL FIBULAR AUTOGRAFT: A CASE REPORT

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ABSTRACT

Introduction and importance: Femoral metastases from differentiated thyroid carcinoma may occur in patients with prolonged survival and create a dual oncological and mechanical challenge. Durable reconstruction after wide resection is therefore particularly relevant in selected patients.

Case presentation: A 54-year-old woman with differentiated thyroid carcinoma and a history of papillary thyroid carcinoma metastasis presented with progressive mechanical pain of the left thigh. Radiographs showed an approximately 7-cm osteolytic lesion at the junction of the middle and distal thirds of the femur without pathological fracture. PET imaging demonstrated a hypermetabolic femoral lesion. Wide en bloc resection was performed with macroscopically safe 3-cm proximal and distal margins. The first-stage reconstruction used an intramedullary nail and a polymethylmethacrylate cement spacer. Histopathology confirmed a femoral metastasis from papillary thyroid carcinoma with clear resection margins. In a second stage, the spacer was removed and biological reconstruction was performed using an ipsilateral structural fibular autograft stabilized with a plate.

Clinical discussion: In patients with an expected prolonged survival, biological reconstruction may provide a durable alternative to purely prosthetic reconstruction. A staged strategy can maintain segmental length and temporary stability before definitive graft-based reconstruction.

Conclusion: Two-stage reconstruction using a cement spacer followed by structural fibular autografting achieved graft integration, radiographic union and satisfactory functional recovery in this patient, with no local recurrence or mechanical or infectious complication at the latest follow-up.

Keywords: Papillary thyroid carcinoma; Femoral metastasis; Bone metastasis; Cement spacer; Fibular autograft; Biological reconstruction

1 INTRODUCTION

Bone metastases are a clinically important complication of differentiated thyroid carcinoma, including papillary thyroid carcinoma. Although differentiated thyroid cancers generally have a favorable prognosis, skeletal dissemination substantially alters the clinical course by increasing the risks of disabling pain, pathological fracture and major functional impairment [1,2]. Long bones, particularly the femur, are clinically relevant sites because of their mechanical loading and the consequences of skeletal failure [3].

Management of femoral metastases must achieve adequate local oncological control while restoring durable mechanical stability and function. Available options include palliative osteosynthesis, intramedullary fixation, tumor endoprosthetic reconstruction and biological reconstruction. Selection depends on lesion extent, expected survival, general condition and the quality of the remaining bone [5,6,8].

In patients expected to survive for a prolonged period, particularly those with differentiated thyroid carcinoma responsive to systemic or adjuvant treatment, durable reconstruction becomes an important objective. Biological reconstruction may therefore be considered in selected cases. We report a femoral metastasis from papillary thyroid carcinoma managed with wide resection followed by a two-stage reconstruction using an intramedullary nail and cement spacer, then an ipsilateral structural fibular autograft with plate fixation.

2 CASE PRESENTATION

A 54-year-old woman was followed for differentiated thyroid carcinoma and was receiving long-term levothyroxine replacement therapy. Her surgical history included a previous left lobectomy and isthmectomy for a thyroid mass, for which the histopathological report was unavailable. Several years later, she underwent resection of a scalp tumor; histopathological examination identified a secondary localization of papillary thyroid carcinoma. A contralateral lobectomy and isthmectomy were subsequently performed, and histological analysis demonstrated an intrathyroidal follicular-variant papillary carcinoma associated with a papillary microcarcinoma, without vascular emboli. She subsequently received several courses of radioiodine therapy. There was no relevant toxic exposure or allergy history.

Four years later, she developed progressive mechanical pain in the middle portion of the left thigh. The pain increased with weight bearing and walking and was associated with a progressive reduction in walking distance. There was no history of trauma or associated infectious syndrome.

Clinical examination showed partial functional impairment of the left lower limb with an antalgic gait. There was no visible swelling or local inflammatory sign. Palpation elicited focal tenderness over the middle third of the left thigh without a superficial palpable mass. Hip and knee ranges of motion were preserved but painful at terminal motion. Distal neurovascular examination was normal.

Standard radiographs of the left femur demonstrated an approximately 7-cm osteolytic lesion at the junction of the middle and distal thirds, with circumferential cortical thinning and no associated pathological fracture. The radiographic appearance was consistent with a secondary bone lesion at high risk of fracture (Figure 1). Positron emission tomography (PET) demonstrated a hypermetabolic femoral lesion compatible with a dedifferentiated bone metastasis (Figure 2). After multidisciplinary discussion, wide resection with reconstruction was indicated.



Figure 1: Standard radiographs of the left femur showing an approximately 7-cm osteolytic lesion at the junction of the middle and distal thirds, without associated pathological fracture.



Figure 2: Positron emission tomography (PET) images showing a hypermetabolic femoral lesion compatible with a dedifferentiated bone metastasis.

3 SURGICAL TREATMENT

The patient was positioned in right lateral decubitus under general anesthesia. A lateral approach to the thigh centered on the lesion was used. After skin incision and dissection of the subcutaneous planes, the iliotibial tract was opened longitudinally. The vastus lateralis was carefully elevated from the intermuscular septum, with progressive ligation of perforating vessels because of the marked hypervascularity of the tumor.

An approximately 6-cm friable and highly hemorrhagic bone lesion was identified at the junction of the middle and distal thirds of the femur. Wide en bloc excision was performed with macroscopically safe 3-cm proximal and distal margins. Resection was associated with substantial intramedullary bleeding requiring meticulous hemostasis. Initial stabilization consisted of an intramedullary nail combined with a polymethylmethacrylate (PMMA) cement spacer to fill the osseous defect and preserve segmental length (Figures 3–4). The immediate postoperative course was uncomplicated. Histopathological examination confirmed a bone metastasis from papillary thyroid carcinoma with clear resection margins.

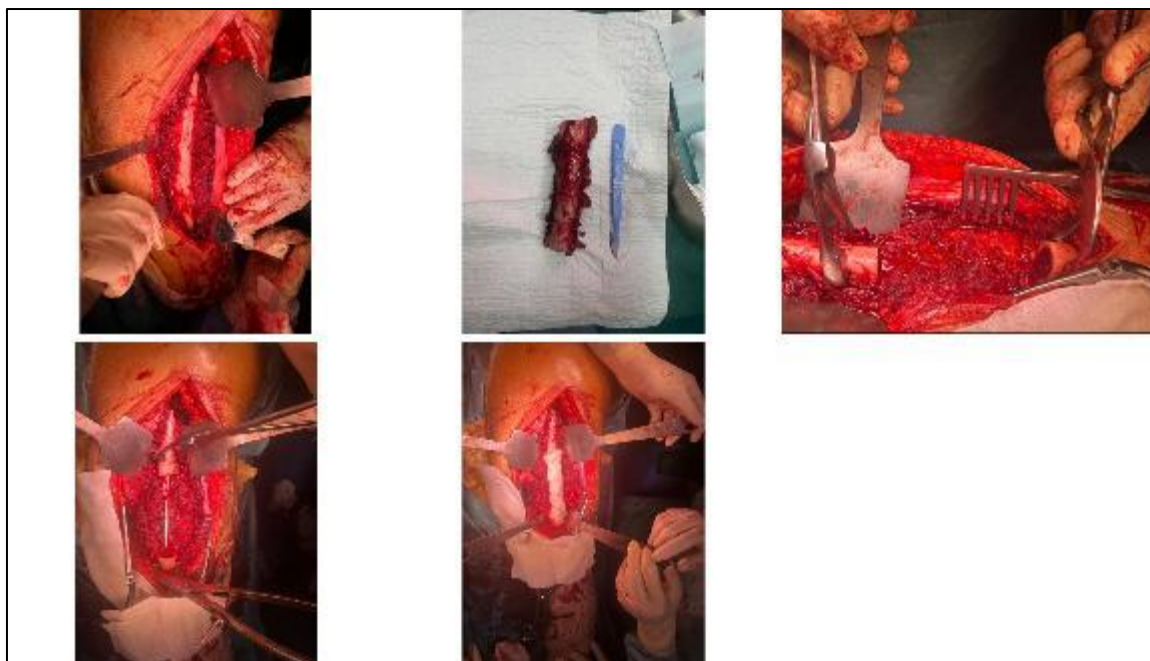


Figure 3: Intraoperative images illustrating the tumor, wide en bloc resection with 3-cm proximal and distal macroscopic margins, and first-stage reconstruction using an intramedullary nail with a PMMA cement spacer.



Figure 4: Postoperative radiographs after first-stage reconstruction showing temporary stabilization with an intramedullary nail and cement spacer.

During the second operative stage, biological reconstruction was performed after removal of the spacer. An ipsilateral fibular autograft was harvested using a standard technique with protection of the neurovascular structures and adapted to the femoral defect as a structural graft. Stabilization was achieved with plate-and-screw fixation, restoring satisfactory alignment and segmental length (Figure 5).



Figure 5: Follow-up radiograph showing definitive femoral reconstruction with an ipsilateral structural fibular autograft stabilized by plate-and-screw fixation.

4 OUTCOME AND FOLLOW-UP

The postoperative course was favorable. Rehabilitation was initiated early with progressive mobilization of the hip and knee. Weight bearing was gradually authorized under clinical and radiological surveillance. Follow-up imaging demonstrated progressive graft integration with union at the proximal and distal interfaces. At the latest follow-up, the patient had satisfactory functional recovery, resolution of pain and independent walking. No infectious or mechanical complication and no local recurrence were observed.

5 DISCUSSION

Bone metastases occur in approximately 2–13% of differentiated thyroid carcinomas and are associated with worse prognosis, reduced overall survival and impaired quality of life [1,2]. Femoral involvement is particularly consequential because of the risk of pathological fracture and loss of ambulation [3].

Treatment of long-bone metastases requires an individualized strategy integrating oncological and functional considerations. Mirels' score remains a useful tool for estimating fracture risk and guiding prophylactic surgical treatment [4]. General principles of metastatic bone disease and musculoskeletal oncological surgery also emphasize the importance of lesion biology, extent and expected survival when selecting the reconstructive strategy [8,9]. In patients with limited life expectancy, palliative fixation or intramedullary stabilization may be appropriate; in those with longer expected survival, wide resection followed by a durable reconstruction can be considered [5,6].

Tumor endoprosthetic reconstruction offers immediate stability and early weight bearing, but long-term complications such as deep infection, aseptic loosening and revision surgery remain relevant, particularly in patients with prolonged survival [6,7]. These limitations support consideration of biological reconstruction in carefully selected patients.

Structural fibular grafting aims to restore bone continuity while permitting biological incorporation. Bone grafting has a long reconstructive history [10], and contemporary reviews of femoral metastatic disease and biological reconstruction support the concept of durable biological options in selected patients with favorable survival profiles [11,12].

The two-stage strategy used in this case - temporary intramedullary stabilization with a cement spacer followed by definitive structural fibular autografting - is less commonly described for femoral metastases from thyroid carcinoma. The spacer preserved segmental length and temporary stability after tumor resection, while the second stage provided a biological reconstruction. In this patient, the strategy resulted in radiographic union and satisfactory functional recovery without local recurrence or mechanical or infectious complication at the available follow-up.

This approach nevertheless has limitations. It requires two operations, entails a longer period before definitive biological union and exposes the patient to donor-site morbidity. Furthermore, evidence specifically addressing staged biological reconstruction for thyroid carcinoma metastases of the femur remains limited. This case therefore supports feasibility rather than superiority over endoprosthetic reconstruction.

6 CONCLUSION

Femoral metastasis from differentiated thyroid carcinoma requires a treatment strategy that balances oncological control with durable mechanical and functional reconstruction. In a selected patient with an expected prolonged survival, wide tumor resection followed by staged reconstruction using a cement spacer and structural fibular autograft provided satisfactory biological union and functional recovery. This technique may represent an alternative to prosthetic reconstruction in carefully selected cases, although broader evidence is required to define its indications.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

Disclosure of conflict of interest

The authors declare no competing interests.

Statement of ethical approval

This case report is exempt from formal ethical approval at our institution.

Statement of informed consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

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