Tumors of the head of the fibula

Good function after resection without ligament reconstruction in 6 patients

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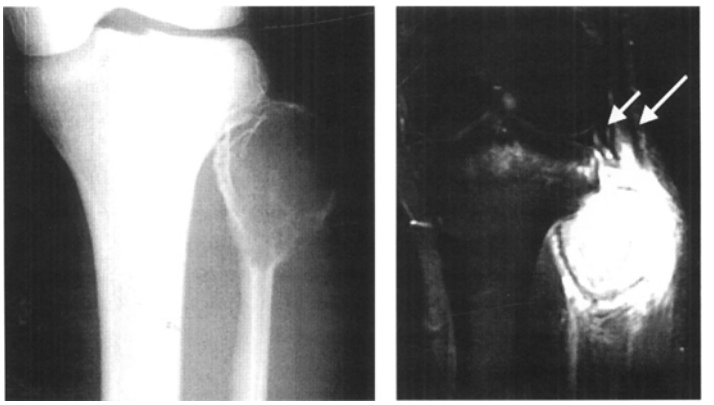
ABSTRACT – Tumors of the proximal fibula are rare. Wide resection includes adjacent knee-stabilizing structures. Unlike treatment of traumatic disruption of the lateral ligamentous structures of the knee, wide resection of the fibular head for a tumor may not require reconstruction. After 1–4 years of follow-up, function was satisfactory in 6 consecutive cases where resection of the fibular head was done without ligamentous reconstruction.

Tumors of the proximal fibula are rare, as shown by Dahlin who reported that only 2.4% of primary bone tumors occur in the fibula (Unni 1996). Depending on the level of malignancy, these may need to be resected, with removal of the adjacent ligamentous structures. When damaged by trauma, these structures are usually reconstructed to restore stability. In patients with a tumor, however, damage to the knee capsule and surrounding ligaments is uncommon apart from the removal of structures in the operative field. In this prospective study, we report 6 consecutive patients with tumors arising from the proximal fibula in whom resection was done without ligamentous reconstruction.

Patients and methods

Between 1997 and 2000, we treated 6 patients at our institution with tumors arising from the proximal fibula (Table). Their average age at presentation was 32 (24–65) years. Investigations included plain radiographs, CT, MRI and bone scans (Figure). The adjacent lateral tibial condyle was not involved in any case. The average size of the tumors on imaging was 5 (3–8) cm. Distant work-up showed no evidence of metastasis on presentation. Fine needle biopsy was done in all except case 5, who had an intralesional excision performed at another institution before referral. 3 patients had tumors arising in bone; the other 3 had soft tissue sarcomas. 50 Gr of preoperative radio-

Case 1.



Lytic, expansile lesion in the proximal fibula with septation, extending to the subarticular region.

T1 weighted, fat suppressed, gadolinium-enhanced MRI showing the lateral collateral ligament (short arrow) and biceps femoris (long arrow).

Summary of patient characteristics, diagnosis, treatment, and function

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	24	M	Giant cell tumor	6	+	–	–	–	+	+	Nil	25	Social soccer	S	S
2	32	F	Giant cell tumor	5	+	–	–	–	+	+	Nil	39	Tennis	S	S
3	27	F	Low grade chondrosarcoma	3	+	–	–	–	+	+	Nil	37	Cable linesman	S	S
4	34	F	Myxofibrosarcoma	4	+	–	–	–	+/–	–	Gastrocnemius	46	Kick boxing	S	1+
5	42	M	Leiomyosarcoma	[a]	–	–	–	–	+	+	Latissimus dorsi	39	Jogging	1+	2+
6	65	M	Malignant fibrous histiocytoma	8	–	–	–	–	+	–	Latissimus dorsi	12	(Died)	1+	2+

[a] Size of primary tumor unknown
No patient reported pain or instability. All knees were clinically stable on anterior drawer, posterior drawer, and on valgus strain (0° and 30° flexion)

A Patient
B Age
C Sex
D Diagnosis
E Size (cm)
F Iliotibial band
+ left intact
– resected
G Biceps femoris tendon
+ left intact
– resected
H Lateral collateral ligament
+ left intact
– resected
I Arcuate ligament
+ left intact
– resected
J Popliteus muscle
+ left intact
– resected
K Lateral head gastrocnemius
+ left intact
– resected
L Soft tissue reconstruction
M Follow-up (months)
N Function
O Joint space opening. Varus strain 0° flexion.
S stable
1+ = <0.5 cm
P Joint space opening. Varus strain 30° flexion
S stable
1+ = <0.5 cm
2+ = 0.5–1 cm

therapy was given for 5 weeks to patients with soft tissue sarcomas.

A wide resection was done in all patients, with the proximal fibula and the attaching lateral collateral ligament, arcuate ligament and biceps femoris tendon removed en bloc. The superior tibiofibular joint was divided intra-articularly. The peroneal nerve and anterior tibial artery were preserved in all cases. The soft tissue sarcomas lay at the tip of the fibular head (cases 4, 6), and anterior to the fibular head (case 5), with the peroneal nerve protected by most of the fibular head and biceps femoris tendon.

The 3 patients with soft tissue sarcomas required a more extensive resection. In 2 cases, resection included the iliotibial band, and in 2 others, the lateral head of the gastrocnemius. In 1 case, the popliteus muscle was partially removed. These 3 patients required a soft tissue reconstructive procedure. 2 received latissimus dorsi vascularized free flaps, and 1 a gastrocnemius rotation flap.

Postoperatively, a hinged knee brace was worn when ambulant for up to 3 months. Physical therapy was prescribed to strengthen the quadriceps and hamstring muscles.

The patients were followed for mean 33 (12–46) months. Case 6 was assessed at 12 months and later died of metastatic disease. Subjective evaluation of knee function was based on a history of instability and the ability to return to prediagnosis activities. Clinical examination concerned the stability of the knee with varus and valgus strain applied at 0 and 30 degrees of flexion. Instability was graded on a 1+ to 3+ scale (Rockwood and Green 1984). Anterior and posterior drawer tests were also done (Table).

Results

All 6 resection specimens had negative margins with no patient requiring secondary resection or amputation. At the last review, no patient had

evidence of a local recurrence. Case 6 died of disseminated disease at 12 months.

None of the patients complained of pain, episodes of giving-way, or instability. The 5 surviving patients returned to their prediagnosis activities, which included: soccer, tennis, kickboxing, jogging and working as a cable linesman. Clinical assessment showed lateral joint opening in 3 patients at 30° of flexion, of whom 1 was stable in full extension. In the other tests, we found no instability (Table).

Discussion

The lateral collateral ligament, arcuate ligament and biceps femoris tendon all insert into the fibular head. The peroneal nerve lies adjacent to the neck of the fibula. The anterior tibial artery passes above the superior border of the interosseous membrane, lying closer to the fibula than the tibia. The iliotibial band passes just anterior to the fibular head, attaching to the anterior surface of the lateral condyle of the tibia.

Resection of malignant tumors frequently necessitates wide surgical margins. Resection of the proximal fibula detaches the collateral ligament, arcuate ligament and biceps femoris attachments. The iliotibial band may also have to be included. In similar case series, the peroneal nerve, lateral tibia and terminal branches of the popliteal artery have also been resected (Malawer 1984, Draganich et al. 1991, Lushiku and Gebhart 1997). These lateral structures help to stabilize the knee. The lateral collateral ligament is the main resistor of varus loading in a partially flexed knee (Grood et al. 1981). The biceps femoris imparts a posteriorly-directed force to the proximal tibia and the iliotibial band giving anterior stability, reducing the strain on the anterior cruciate ligament (Draganich and Vahey 1990). The iliotibial band helps to control both the anterior and mediolateral motions of the knee (Butler et al. 1980).

Damage to the lateral collateral ligament by trauma requires reconstruction to prevent instability of the knee. Hughston et al. (1976) and Trickey (1980) reported that injury to the lateral side of the knee generally is associated with injuries to the anterior cruciate or posterior cruciate ligament. The posterolateral corner can also be injured.

Surgical excision of the proximal fibula spares structures such as the popliteus muscle, the lateral head of the gastrocnemius, the posterolateral joint capsule, patellar retinacula and the cruciate ligaments, all of which promote stability. The iliotibial band, if spared, can produce a marked increase in lateral restraining moment when placed under tension (Grood et al. 1981).

To our knowledge only 3 studies have assessed the stability and function of the knee after proximal fibula resection for tumors. Draganich et al. (1991) reviewed 6 patients who underwent unilateral marginal resection of the proximal fibula for resection of a benign bone tumor or for use as an autogenous graft. Using the Genucom knee-analysis system, they found substantial differences in knee stability as compared to the contralateral side. They recommend that insertions of the lateral collateral ligament and biceps femoris be meticulously repaired. Lushiku and Gebhart (1997) performed wide en bloc resection for osteosarcoma of the proximal fibula in 3 patients. Their resection included the lateral wall of the tibia along with the anterior tibial artery. In all cases, the lateral collateral ligament was reconstructed using a band of fascia lata, and clinical stability was achieved. Malawer (1984) reported 10 patients with proximal fibula tumors treated with marginal or wide intracompartmental resection, depending on the type of tumor. In both groups, the lateral collateral ligament was reconstructed, with no subjective complaints of knee instability or varus opening on examination.

Unlike these studies, our results support the view that no formal reconstruction of the lateral collateral ligament is needed to achieve good function. Despite clinical evidence of knee instability in 3 of our 6 patients, they perceived no functional deficit and could return to prediagnosis activities. In the 3 patients with demonstrable lateral joint opening on examination, the iliotibial band had been included in the resection.

We conclude that the knee remains functionally stable after resection of the proximal fibula for tumor, without reconstruction of the lateral collateral ligament. This is probably due to the sparing of other stabilizing structures, including the cruciate ligaments. Postoperative scarring, and the scarring after radiotherapy would also contribute

to lateral tissue tension-resisting valgus forces. The iliotibial band is required for clinical stability on varus loading, but after resection for a tumor of the proximal fibula, it is not essential to function.

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