The Knee 22 (2015) 659–663

Contents lists available at ScienceDirect

The Knee

A new technique using mesh for extensor reconstruction after proximal tibial resection

Jiro Ichikawa, Seiichi Matsumoto *, Takashi Shimoji, Keisuke Ae, Taisuke Tanizawa, Tabu Gokita

Department of Orthopaedic Surgery, Cancer Institute Hospital for Japanese Foundation for Cancer Research, Japan

ARTICLE INFO

Article history:
Received 21 October 2013
Received in revised form 27 February 2014
Accepted 1 January 2015

Keywords:
Bone tumor
Proximal tibia
Endoprosthesis
Extensor mechanism
Mesh

ABSTRACT

Background: Proximal tibial reconstruction following wide resection in both malignant and benign tumors presents difficulties mainly due to both patellar tendon reconstruction and high risk of infection. The purpose of this study is to determine the efficacy of a new technique using a mesh for extensor reconstruction.

Methods: We retrospectively reviewed nine consecutive patients who underwent resection of the proximal tibia with prosthetic reconstruction and reconstruction of the extensor using a mesh between 2009 and 2012. The surgical technique included the attachment of the mesh to the tibial component with a band of meshes looped over the patella and a gastrocnemius flap for coverage.

Results: One patient had an above-the-knee amputation due to infection. Eight patients were followed up for 33 months (range, 20–50). In the eight patients, extensor lag had a mean of 5° (range, 0 to 20). Active flexion had a mean of 96.25° (range, 80 to 120) and ISOLS scores had a mean of 21/30 (range, 18 to 26). All patients were able to ambulate without crutches at the latest follow-up.

Conclusion: Extensor lag was significantly less compared to previous reports. No complications were observed in eight patients. Utilization of the mesh for extensor reconstruction after the proximal tibial resection is a simple, reliable and successful method.

Level of evidence: Therapeutic level IV.

1. Introduction

Limb salvage surgery has become the standard of care for primary malignant bone tumors because of advancements in imaging, chemotherapy, and surgical techniques [1]. In addition, a wide resection concept of margins by Enneking et al. [2] has contributed to the improved survival and decreased incidence of local recurrence [3]. The proximal tibia is the second most common site of osteosarcoma and other primary malignant bone tumors [4]. Techniques for limb salvage of the proximal tibia include prosthetic replacement [5], allograft replacement [6], autologous pasteurized replacement [7] and arthrodesis [8]. For prosthetic replacement, Myers et al. [5] reported that the rotating hinge design provides increased long-term prosthetic survival compared to the fixed hinge design On the other hand, Mavrogenis et al. [30] reported that the rotating hinge compared to the fixed hinge had benefit for knee function and gait and no benefit for prosthetic survival.

Two major complications with prosthetic replacement surrounding the knee are extensor lag following resection of the patellar tendon and infection due to the resulting defect of soft tissue and skin [5]. The use of a gastrocnemius flap, a simple method which produces a stable flap, results in lower rates of prosthetic infection [13]. Reconstruction of the extensor mechanism includes reattachment of the patellar tendon to the prosthesis and gastrocnemius flap with or without synthetic materials [10,11,20], fibular transposition [12], reinforcement with an autologous bone graft [7] or allograft reconstruction [6].

Traditionally, polypropylene mesh is applied to inguinal hernias [14] and incisional hernias [15]. In the orthopaedics field, polypropylene mesh is generally applied to chest wall defects after resection of ribs and intercostal muscle [16]. Browne et al. recently reported the use of the mesh to reconstruct patellar tendon disruption after TKA and demonstrated improved results in knee extension [17]. We have used the mesh for knee extension mechanism reconstruction since 2009. Here, we describe a new surgical technique utilizing the mesh for extensor mechanism reconstruction following proximal tibial resection and the associated patient outcomes.

2. Material & methods

Between 2009 and 2012, we followed nine patients who underwent proximal tibial resection and prosthetic replacement by Howmedica Modular Resection System (Stryker Orthopaedics, Limerick, Ireland). There were four male patients and five female patients. The mean age

* Corresponding author at: Department of Orthopaedic Surgery, Cancer Institute Hospital for Japanese Foundation for Cancer Research, 3-8-31 Ariake, Koto-ku, Tokyo 135-8550, Japan. Tel.: +81 3 3520 0111; fax: +81 3 3520 0141.
E-mail address: smatsumoto@jfcr.or.jp (S. Matsumoto).

http://dx.doi.org/10.1016/j.knee.2015.01.001
0968-0160/© 2015 Elsevier B.V. All rights reserved.

Table 1
Patient data.

Case	Sex	Age	Diagnosis	Stage	Neoadjuvant	Adjuvant
1	F	15	Osteosarcoma	IIB	+	+
2	F	17	Osteosarcoma	IIB	+	+
3	F	58	MFH of bone	IIB	+	+
4	M	15	Osteosarcoma	IIB	+	+
5	F	15	Osteosarcoma	IIB	+	+
6	M	15	Osteosarcoma	IIB	+	+
7	M	33	Osteosarcoma	IIB	+	+
8	M	19	Osteosarcoma	IIB	+	+
9	F	65	GCT of bone	–	–	–

was 28 years (range, 15–65). The diagnoses of all cases were confirmed by open biopsy. Eight patients have osteosarcoma, stage IIB according to Enneking's surgical classification [2], and one patient had a giant cell tumor of bone (GCT). Standard neoadjuvant chemotherapy and adjuvant chemotherapy (except for the patient with GCT) were administered (Table 1). A follow-up evaluation included both passive and active range of motion (ROM), extensor lag, the International Society of Limb Salvage (ISOLS) score, and complications. All the patients were followed up for greater than one year.

3. Surgical technique

In all cases except the patient with GCT, we planned a resection area consisting of soft tissue and muscle in order to obtain a wide surgical margin. Intraarticular resection and patellar tendon resection were performed in all cases. The proximal tibia was dissected with at least a three centimeter osseous margin based on the preoperative MRI. After the resection of the proximal tibia, the gastrocnemius flap was performed. The femur and tibia were then prepared for the insertion of the endoprosthesis and attachment of the mesh to the tibial component. The mesh was folded in half and wrapped around the tibial component (Fig. 1A) and fixed by a plate and screw to the tibial component (Fig. 1B black arrow). The mesh was reinforced by nonabsorbable sutures in at least three locations. After fixation, the proximal side of the mesh was divided into six rectangular bands (Fig. 1C). The two center meshes were looped over the prosthetic tibial tubercle (Fig. 1C red arrow and Fig. 1D) which was located in the distal portion of the fixation plate. A

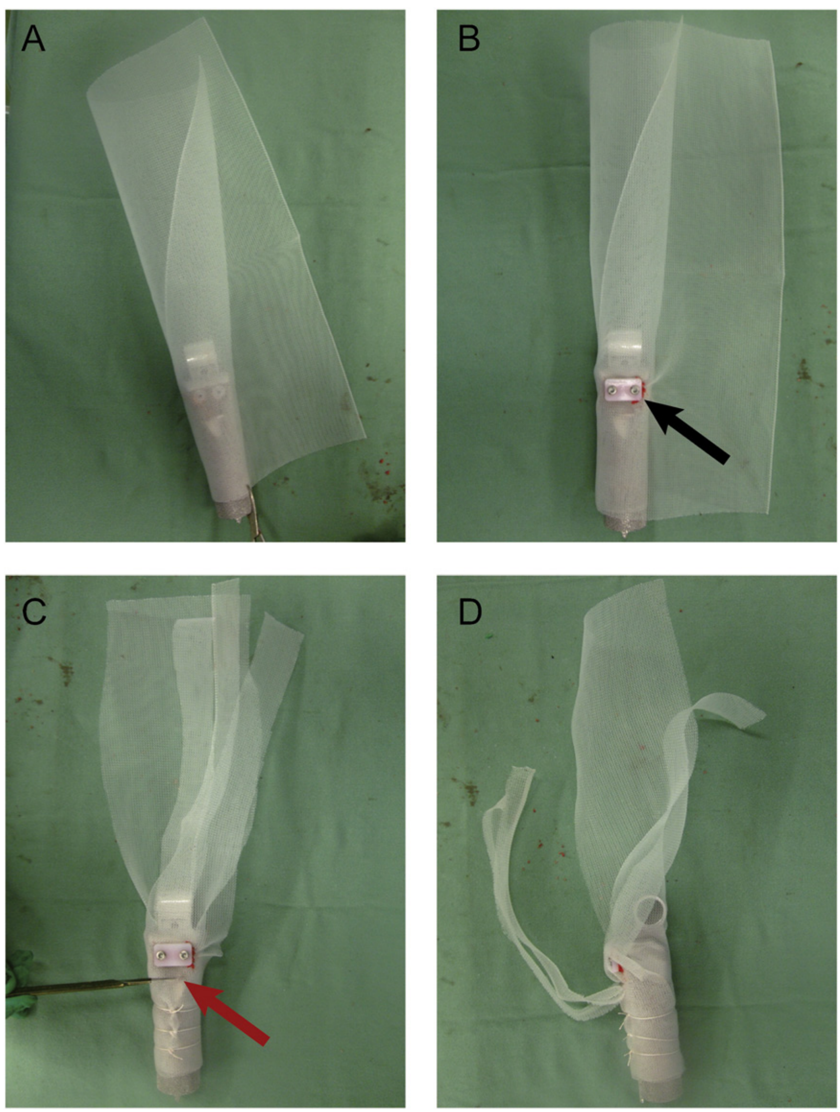

Fig. 1. Attachment of the mesh to the tibial component. (A) The tibial component was wrapped with mesh. (B) The mesh was fixed by a plate and screw (black arrow). (C) Proximal side of the mesh was cut by scissors and separated into six bands. There was a new artificial tibial tubercle (red arrow) in the distal portion of the plate. In addition, the mesh was reinforced by nonabsorbable sutures in at least three locations. (d) Two center meshes were passed through the prosthetic tibial tubercle and were attached to the proximal side.