Injury, Int. J. Care Injured 47 (2016) 2326–2330

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

A combined approach for the treatment of lateral and posterolateral tibial plateau fractures

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ARTICLE INFO

Keywords:
Tibial plateau fracture
Lateral
Posterolateral
Approach

ABSTRACT

Introduction: The treatment of tibial plateau fractures involving the lateral and posterolateral column is a demanding and fine surgical challenge. The purpose of this study was to evaluate the safety and clinical efficacy of combined approach for the treatment of lateral and posterolateral tibial plateau fractures.
Methods: A prospective study was performed in 17 patients with lateral and posterolateral tibial plateau fractures between January 2009 and December 2012. There were 12 males and 5 females with a mean age of 40 years. All of them received dual-plate fixation through the combined approach, with the patients in a floating position. The combined approaches included a conventional anterolateral approach and an inverted L-shaped posterolateral approach. Operation time, intraoperative blood loss, fracture healing time, Hospital for Special Surgery (HSS) knee score, knee flexion and extension range of motion, and complications were recorded to evaluate treatment effects.
Results: There were no intraoperative complications related to this technology. Mean operation time was 144 min with a mean intraoperative blood loss volume of 233 mL. The mean follow-up was 23 months. All 17 patients had good postoperative fracture healing. Mean union time was 12 weeks. At the final follow-up, the average HSS score was 92.5, with the average knee flexion of 125° and an average knee extension of 2°. Two patients had complications in postoperative incisions with aseptic fat liquefaction. After thorough debridement, second-stage wounds healing were achieved. No neurovascular injury occurred. No collapse of reduced articular surface was detected.
Conclusions: The combined approach with dual-plate offers direct and complete surgical exposure and provide an effective method for the treatment of lateral and posterolateral tibial plateau fractures.

Introduction

Tibial plateau fractures are commonly encountered in clinical practice, whereas posterolateral tibial plateau fracture is rarely reported in the past, with an incidence of 7% [1]. This posterolateral fracture has the following features: the mainly displaced fragment is located at the posterior half of the lateral condyle and/or a fracture line impacts the posterior aspect of the lateral plateau [2]. Most of the current classification systems for tibial plateau fractures are the AO/OTA and Schatzker classifications, which established on the basis of anteroposterior radiographs of the proximal tibia, two-dimensional superimposed images of its coronal plane. This posterolateral fracture is a special fracture pattern that is not well described by the AO/OTA or Schatzker classification systems. With careful review and application of the computed tomography (CT) scan for the evaluation for these fractures, Luo et al. [3] proposed a theory of Three-column classification that the tibial plateau is divided into three columns: the medial, the lateral and the posterior, and the posterior column is subdivided into the posteromedial and posterolateral columns.

Realizing the importance of fixation in posterolateral tibial plateau fractures, various approaches have been explored to achieve reduction and fixation for posterolateral fracture [4–6]. Lobenhoffer et al. [7] described a combined approach for the treatment of posterior tibial plateau fractures, but the fibula neck needed to be osteotomized in his method. More scholars introduced a posterolateral approach without fibular head osteotomy, which favored direct reduction and placement of a posterolateral buttress plate [8–10]. However, these methods all demonstrate a trend toward using posterior approaches for this kind of fractures. Posterior column fractures of tibial plateau, especially those involving the posterolateral section, are quite difficult to manage in clinic. When lateral and posterolateral

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http://dx.doi.org/10.1016/j.injury.2016.07.004
0020-1383/

column fracture were existed simultaneously, it is more difficult to operate for orthopaedic surgeons. Thus, we have tried to use dual-plate fixation through a combined approach for the treatment of lateral and posterolateral tibial plateau fractures, with the patients in a floating position. The combined approaches included a conventional anterolateral approach and an inverted L-shaped posterolateral approach. This study aimed to evaluate the safety and clinical efficacy of this combined approach for lateral and posterolateral tibial plateau fractures.

Material and methods

We obtained institutional review board approval for this study. Between January 2009 and December 2012, 17 patients with lateral and posterolateral tibial plateau fractures were operated via the combined approach with dual-plate fixation. Patients with osteofascial compartment syndrome, pathologic fractures, auto-immune diseases, blood disorder, severe multiple trauma (Injury severity scale, ISS > 16) [11], and surgical contraindications were excluded. Anteroposterior and lateral radiographic views and three-dimensional CT reconstruction images of the tibial plateau were taken in all patients.

The patients consisted of 12 males and 5 females, with a mean age of 40 (26–54) years. The reasons for injury included 7 motor vehicle accidents, 5 falls from a height, and 5 motorcycle crashes. Five patients had associated injuries. None of the patients sustained neurovascular injury (Table 1). Preoperative management included distal bony traction and splint. All operations were performed by the same experienced trauma surgeons after the soft tissue condition was stable, which the striae appeared.

Surgical technique

All patients underwent surgery under spinal anesthesia or general anesthetic, and were operated in a lateral floating position that could facilitate combined posterior and anterior approaches by rotating the lower limb [12]. The knee was maintained in a slightly flexed position. The incision for the inverted L-shaped posterolateral approach was a composite of horizontal and vertical incisions, which was approximately 10 cm to 12 cm in length (Fig. 1). The horizontal incision began at the center of the popliteal fossa. It traversed along the crease to the outside, then turned distally and extended longitudinally along the lateral margin of the lateral head of gastrocnemius muscle. The subcutaneous tissue and popliteal fascia are incised by sharp dissection. Full-thickness

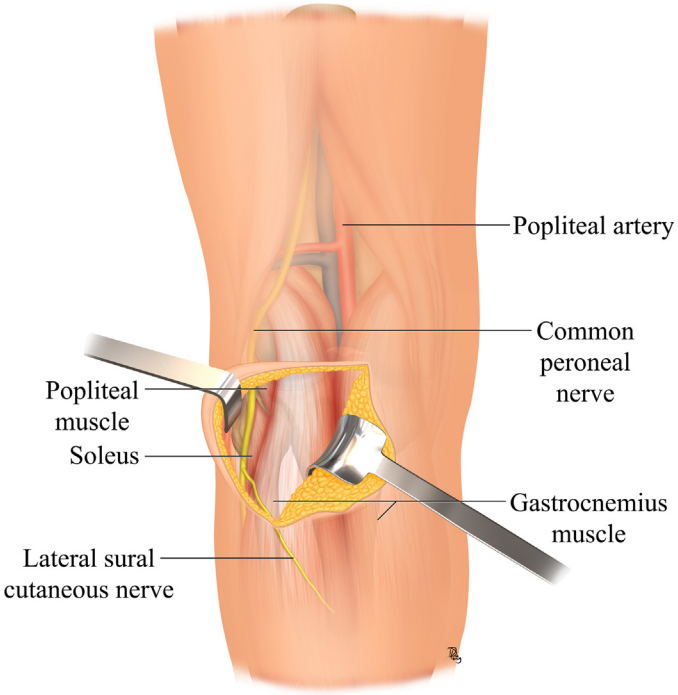

Fig. 1. The surgical approach performed.

fasciocutaneous flaps were elevated, which aimed to protect the lateral sural cutaneous nerves and common peroneal nerve. The lateral head of gastrocnemius muscle and common peroneal nerve was retracted laterally. Then the popliteal neurovascular bundle, which lies medially, were retracted medially by a Langenbeck retractor. Next, we will see the popliteal muscle and soleus. The fibular origin of the soleus is dissected along the medial border of the proximal fibula, and the tibial origin of the soleus is partially divided from lateral to medial. Precautions were taken to protect the anterior tibial vessel in the distal end of the incision. The joint capsule and posterolateral condyles of the tibial plateau were exposed between the popliteal muscle and the soleus muscle. Then the inferior border of the popliteus muscle is dissected and retracted upward, and the inferior lateral genicular vessels on the surface of the popliteus muscle are ligated only if necessary. The posterior joint capsule was incised longitudinally, and the lateral posterior horn of the meniscus was displaced upwards, so that the

Table 1
Patient characteristics.

Patient	Age (y)	Sex	Associated injury	Operation time (min)	Blood loss (mL)	Follow-up (mo)	Healing time (week)	HSS score	Knee flexion (°)	Knee extension (°)	Complications
1	31	M	–	128	220	30	12	94	125	2	–
2	47	M	–	143	180	15	10	96	130	0	–
3	39	F	–	120	150	36	11	94	125	2	–
4	44	M	Head trauma	142	220	21	12	90	120	3	Fat liquefaction
5	47	M	–	160	300	27	14	93	130	5	–
6	28	F	–	157	280	15	15	87	115	0	–
7	34	F	Head trauma	146	250	18	13	96	130	2	–
8	26	M	–	150	220	24	12	94	125	0	–
9	48	M	Humeral fracture	145	190	18	12	90	120	3	–
10	35	M	–	180	200	21	13	96	130	5	Fat liquefaction
11	37	M	–	152	350	24	15	87	115	0	–
12	44	F	Chest injury	160	250	27	11	90	120	3	–
13	42	M	–	147	260	12	10	96	130	0	–
14	54	M	Radius fracture	135	180	24	12	93	125	5	–
15	41	F	–	95	200	33	10	90	120	0	–
16	43	M	–	137	230	24	12	94	130	5	–
17	37	M	–	150	280	21	10	93	130	0	–