sciendo
ПРИЛОЗИ. Одд. за мед. науки, XLIV 2, 2023 МАНУ
CONTRIBUTIONS. Sec. of Med. Sci., XLIV 2, 2023 MASA

10.2478/prilozi-2023-0028 ISSN 1857-9345

OUR EXPERIENCE WITH POSTERIOR APPROACH FOR POSTERIOR TIBIAL PLATEAU FRACTURES

Andreja Gavrilovski[1], Aleksandra Gavrilovska Dimovska[2], Radmila Mila Mihajlova Ilie[3], Magdalena Petrushevska Gjorikj[1]

[1] University Clinic of Traumatology (TOARILUC), Skopje, RN Macedonia

[2] University Clinic of Neurosurgery, Skopje, RN Macedonia

[3] University Clinic of Emergency Department (TOARILUC), Skopje, RN Macedonia

Corresponding author: Andreja Gavrilovski, University Clinic of Traumatology (TOARILUC), Skopje, RN Macedonia; email: gavrilovskia@yahoo.com

ABSTRACT

Introduction: Posterior tibial plateau fractures are a rare type of fractures. Most surgeons are accustomed to operate in the supine position, however, surgery in the posterior knee region and operating in prone position can be challenging because of the presence of neurovascular structures including the tibial nerve, popliteal artery and vein, common peroneal nerve and, also challenging to achieve effective reduction and fixation, thus, it is less commonly performed.

Materials and methods: Between February and September 2022 four posterior tibial plateau fractures were diagnosed and operated in our clinic within a six months follow-up (2 female and 2 male with mean age of 48.5 years). All were diagnosed with X-rays and CT scans. All of the fractures were on the right leg. Posterior "S shape" approach in prone position was used to reduce the tibial condyle and fix it with a plate. In fracture patterns that include lateral plateau impressions, the posterior "S shape" approach may not be sufficient to perform open reduction and internal fixation of the lateral condyle, so an additional anterolateral approach was made and additional locking plate was placed. Radiographic evaluation included reduction quality and satisfactory alignment of the bone axis.

Results: All fractures healed within 6 months, without secondary displacement. Throughout the follow-up period, there were no incidences of post-traumatic osteoarthritis of the knee. No patient complained of knee instability.

Conclusion: The direct dorsal approach allowed for adequate open reduction and internal fixation, and early clinical results are promising. However, in fracture patterns that include lateral plateau impressions, the posterior "S shape" approach may not be sufficient to perform open reduction and internal fixation of the lateral condyle, so an additional anterolateral approach should be made and additional locking plate to be placed.

Keywords: Posterior tibial plateau fractures, posterior approach, prone position, dual plating

INTRODUCTION

Posterior tibial plateau fractures are a rare type of fractures with an incidence of 28.8% [1]. There are several classifications for tibial plateau fractures but the Schatzker [4] classification is the most widely used, also AO [5] and the Hohl & Moore [6] systems are still in use. However, posterior tibial plateau fracture (PTPF) appears confusing on initial radiographs because of the small displacement, so it is a special injury pattern that is not sufficiently included in any type of the classification systems [2]. Because it is challenging to reduce and stabilize the injury with standard approaches, there are debates concerning surgical approaches and fixation techniques for PTPF.

MATERIALS AND METHODS

Between February and September 2022 four posterior tibial plateau fractures were diagnosed and operated in our clinic within a six months follow-up (2 female and 2 male with mean age of 52 years). All were diagnosed with X-rays (AP and lateral view) and CT scans. All of them were closed fractures. All of the fractures were on the right leg. Two of the patients were treated with posterior approach in prone position to reduce the tibial condyle and fix it with a plate and in two of the patients was combined posterior and anterolateral approach with dual plating.

Injury classification

Hong-Wei Chen, Chang-Qing Chen, and Xian-Hong Yi in their article: Posterior tibial plateau fracture: a new treatment-oriented classification and surgical management proposed a new classification system by classifying PTPFs into 5 categories, which combined Schatzker classification systems [4] with three-column classification based on the x ray, helical CT scanning and MRI 3D reconstruction [3]. According to the direction and form of the fracture line five types were proposed: Type I-split fracture of posteromedial condyle. Type II-split fracture of posterolateral condyle; Type III-collapse fracture of posterolateral condyle; Type IV-split and collapse fracture of posterolateral condyle; and Type V-split fracture of posteromedial condyle and collapse fracture of posterolateral condyle (Figure 1) [3].

Surgical technique

As previously mentioned, surgical approaches were chosen according to the fracture type: the "S shaped" incision (Figure 2a) [7] and (Figure 3) for direct posterior approach for posteromedial condylar fracture of tibial plateau for Type I and II [3] and the "S shaped" incision combined with the standard lateral approaches for posterolateral split and depression tibial plateau fractures, Type III and IV [3].

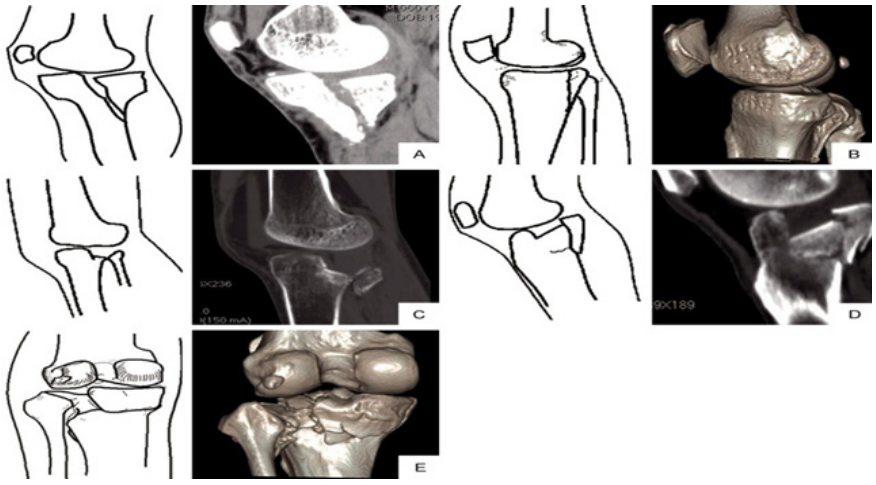


Figure 1. *Diagrammatic sketch showing five fracture patterns of posterior tibial plateau. A. Type I-split fracture of posteromedial condyle; B. Type II-split fracture of posterolateral condyle); C. Type III-collapse fracture of posterolateral condyle; D. Type IV-split and collapse fracture of posterolateral condyle; E. Type V-split fracture of posteromedial condyle and collapse fracture of posterolateral condyle [3]*

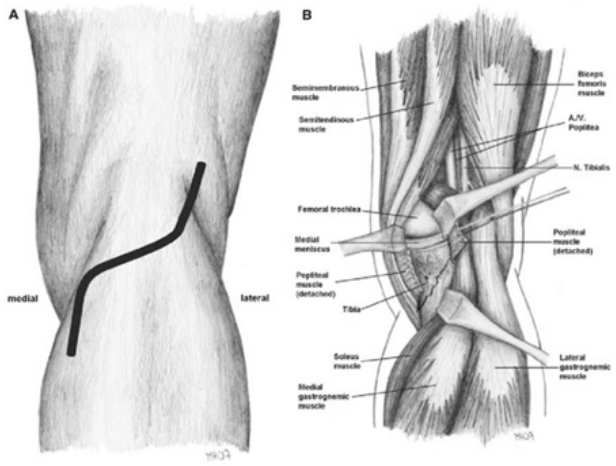


Figure 2. *Direct dorsal approach to the tibia. An S-shaped incision starting over the proximal medial head of the gastrognemic muscle, b direct fracture exposure to the dorsal tibia plateau [7]*



Figure 3. *Postoperative "S shape" incision wound from one of our patients*

Under spinal anesthesia, the patient is prone positioned on a radiolucent table with the knee held slightly flexed. As illustrated in Fig. 1a, an S-shaped incision is made over the gastrognemic muscle's proximal medial head and continues across the popliteal fossa. The medial sural cutaneous nerve and tiny saphenous vein are preserved after the subcutaneous tissue is carefully dissected apart. The gastrognemic muscle's medial head is then mobilized and laterally retracted. The semimembranosus tendon's oblique tendinous extension is detected and retracted medially. The popliteal muscle's superior border is identified, and the muscle is dissected subperiostally until the fracture's posterior-medial spike portion is revealed (Fig 1b). To evaluate the reduction of the articular surface at the level of the primary fracture, an arthrotomy is performed. If the remaining lateral fragment has a posterolateral impression zone, it can be lifted through the fracture using, for example, an elevator. A bone retractor must be used to medialize the medial condyle fragment and enhance flexion in order to gain access to the posterolateral plateau. Before the main posteromedial fragment is reduced under full extension, structural support and reduction maintenance with a k-wire are required.

After initial fragment fixation utilizing K-wires, reduction is monitored using fluoroscopy in the AP and lateral views. In order to stabilize the fragment at this point, a dorsal 3.5 mm anti-gliding plate is used as a buttress plate, and compression is then provided by inserting compression screws in a posterior-anterior manner.

RESULTS

After surgery, third generation cephalosporin antibiotics were given for the next 7 days and a daily injection of 4,000 IU low molecular heparin was given to prevent deep vein thrombosis for the next 4 weeks. From the 10th postoperative

day on, patients were advised to use a continuous-passive-motion (CPM) device. All patients were mobilized for the next 4 weeks while only bearing 10 kg of weight. As soon as the incisions were healed, the patients started with active-assisted range of motion. Clinical and radiological tests were performed on the 4th week, the 12th week and six months after surgery. All patients were able to be mobilized with full weight bearing after 12 weeks since they all shown satisfactory radiological bone healing. There were no incidents of infection, intraoperative vascular nerve damage, disunion, knee varus/valgus deformity, or fracture re-displacement. Patients self-reports (pain and ability to walk) and clinician examinations were used to measure knee function findings (knee joint range of movements and knee joint stability).

DISCUSSION

Because it is challenging to reduce and stabilize the injury with standard approaches, there are debates concerning surgical approaches and fixation techniques for PTPF. When the femoral condyle strikes the posterior tibial plateau while the knee joint is in semi-flexion or flexion, it can result in posterior tibial plateau fracture (PTPF) [8,9]. Fractures of the anterior and lateral aspect of the tibial plateau and non-ndisplaced posterior fragments can usually be stabilized through a standard anterolateral approach [7,10,11,12]. In contrast, the fracture type presented in this series represents a highly unstable injury with a large posteromedial or posterolateral condyle fragment prone to posterior shearing and the risk of popliteal vessel injury. Surgical treatment of this type of fracture requires direct exposure and posterior stabilization [13,14]. The surgical approach used in this study is based on a technique which was first described by Galla and Lobenhofer [15] in the German literature. Until recently only few case reports [15] about postoperative results after the use of this approach have been published. The widely used dorso-medial technique, as reported by Galla and Lobenhofer [15], may be sufficient to achieve open reduction and internal fixation of the entire condyle fragment in fracture patterns without impressions of the lateral plateau, but two of our cases had lateral plateau impressions, where we used an additional anterolateral approach and dual plating, antiglide buttress plate posteriorly and locking plate on the lateral side. Dual plating with two incisions provided good exposition for the reduction and fixation of complicated tibial plateau fractures.

CONCLUSION

In conclusion, the direct dorsal approach allowed for adequate open reduction and internal fixation, and early clinical results are promising.

The approach presented here is especially useful when the dorsomedial plateau is also depressed. In fracture patterns that do include lateral plateau impressions, the posterior “S shape” approach may not be sufficient to perform open reduction and internal fixation of the lateral condyle so an additional anterolateral approach should be made and additional locking plate to be placed.



Figure 4a. *Case No. 1 – 49 year female preoperative CT scan showing posterior tibial plateau fracture-Type I [3] Shatzker II*



Figure 4b. *Case No. 1 – 49 year female. Postoperative X rays showing posterior fracture reduction and fixation with 3.5 antiglide buttress plate and screws*

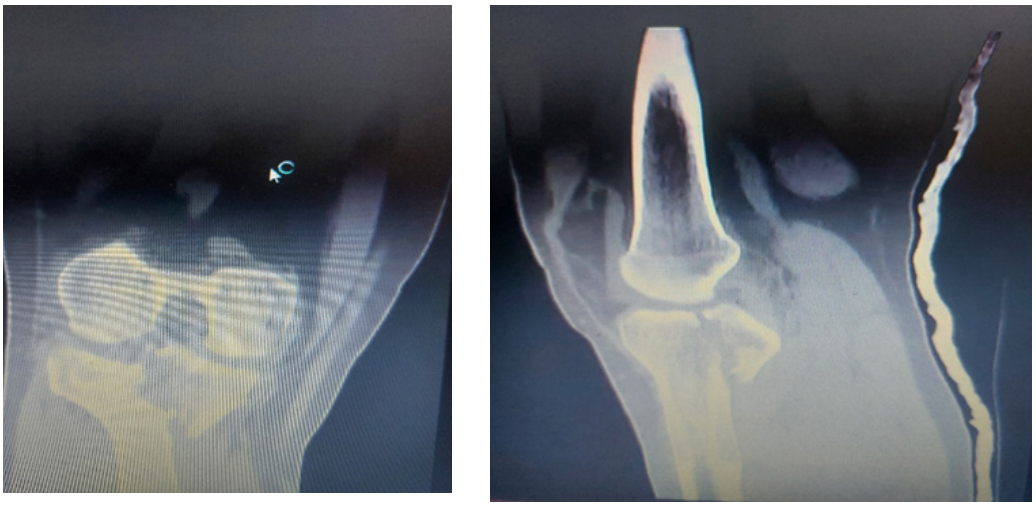


Figure 5a. *Case No. 2 – 31 year male, preoperative CT scan showing posterior tibial plateau fracture, AP and lateral projections. Type II [3], Shatzker IV*

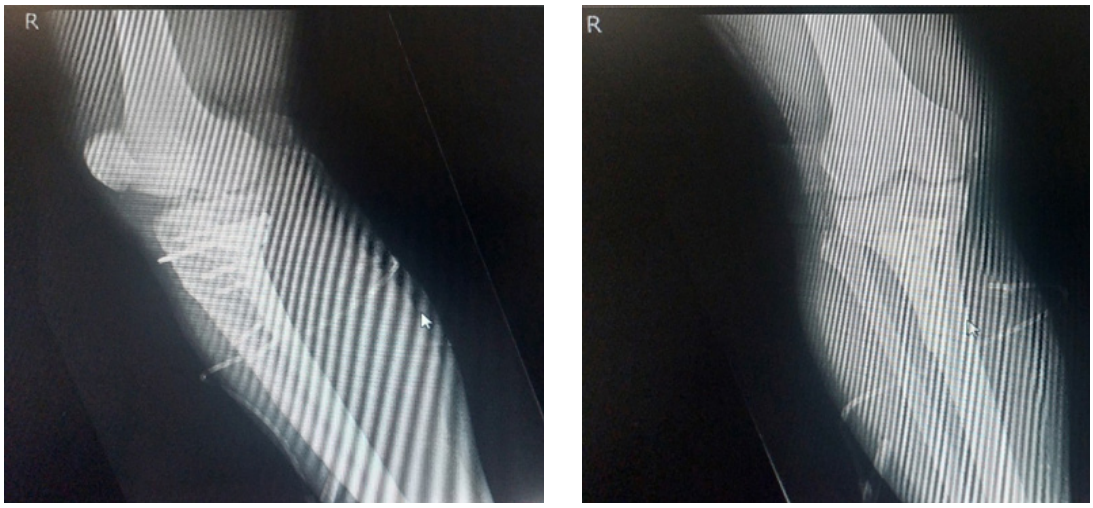


Figure 5b. *Case No. 2 – 31 year old male. Postoperative X-rays showing posterior fracture reduction and fixation with 3.5 antiglide plate and screws*

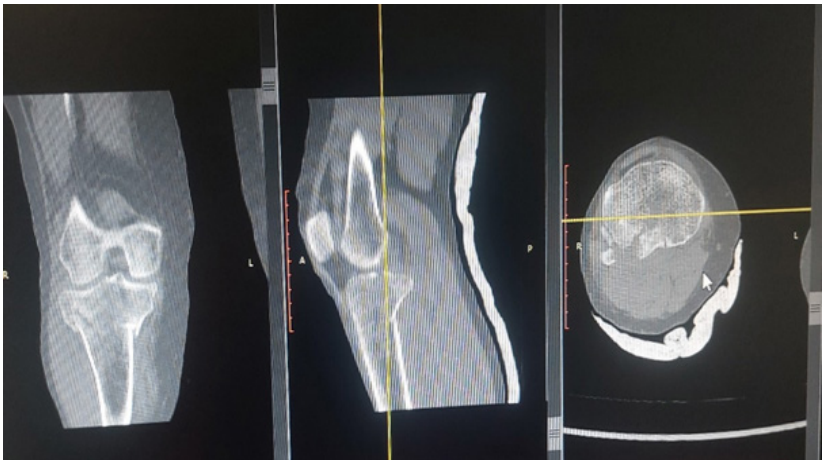


Figure 6a. *Case No. 3 – 54 year old female preoperative CT scan showing Type III[3], Shatzker V posterior tibial plateau fracture, coronal, sagittal and transverse projections*

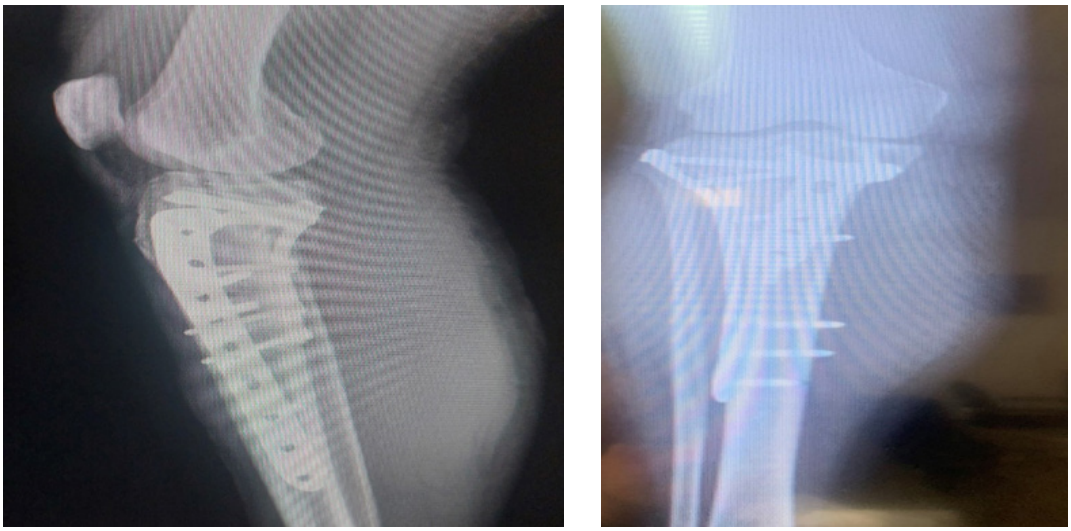


Figure 6b. *Case No 3. 54 year old female postoperative dual plating with additional lateral plate*

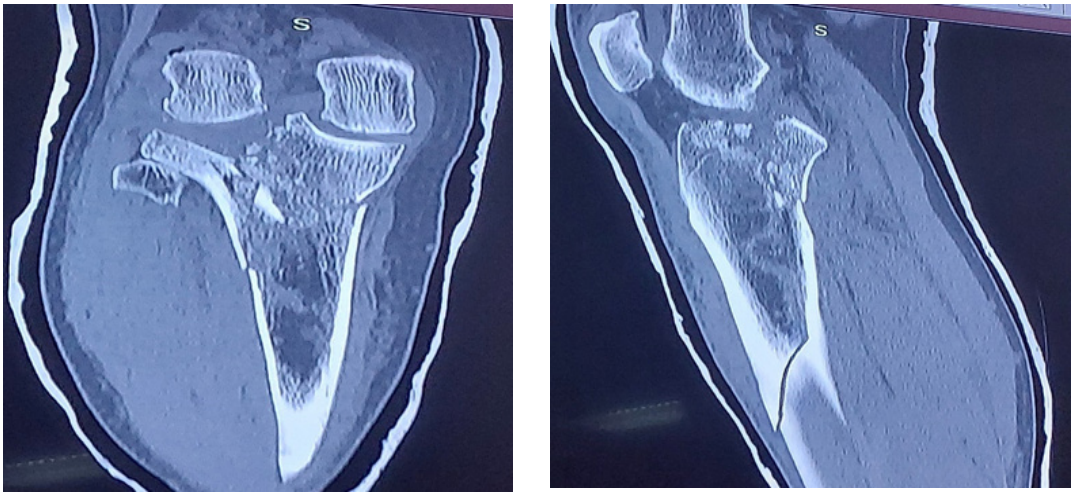


Figure 7a. *Case No 4. 60 year old male CT scan showing posterior plateau fracture with lateral split and depression -Type IV [3], Shatzker VI*

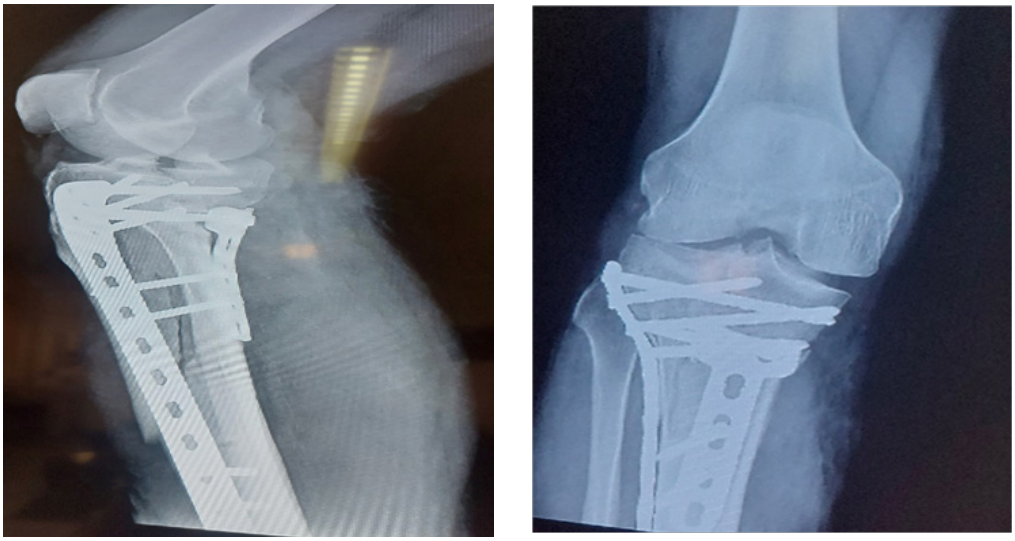


Figure 7b. *Case No 4, 60 year old male. Postoperative X ray showing dual plating with additional lateral plate*

REFERENCES

1. Bhattacharyya T, McCarty LP 3rd, Harris MB, Morrison SM, Wixted JJ, Vrahas MS, Smith RM. The posterior shearing tibial plateau fracture: treatment and results via a posterior approach. J Orthop Trauma. 2005;19:305–310.
2. Maripuri SN, Rao P, Manoj-Thomas A, Mohanty K. The classification systems for tibial plateau fractures: how reliable are they? Injury. 2008;39:1216–1221.
3. Hong-Wei Chen, Chang-Qing Chen, and Xian-Hong Yi . Posterior tibial plateau fracture: a new treatment-oriented classification and surgical management. Int J Clin Exp Med. 2015; 8(1): 472–479.
4. Schatzker J, McBroom R, Bruce D. The tibial plateau fracture. The Toronto experience 1968--1975. Clin Orthop Relat Res. 1979:94–104.
5. https://surgeryreference.aofoundation.org/orthopedic-trauma/adult-trauma/proximal-tibia
6. Alexander Brunner, Monika Horisberger, Benjamin Ulmar, Alexander Florian Hoffmann, Reto Hansjörg Babst :Classification systems for tibial plateau fractures Does computed tomography scanning improve their reliability? Injury 41(2):173 -8 DOI:10.1016/j.injury.2009.08.016
7. Alexander Brunner, Monika Horisberger, Benjamin Ulmar, Alexander Florian Hoffmann, Reto Hansjörg Babst : Open reduction and fixation of medial Moore type II fractures of the tibial plateau by a direct dorsal approach. Archives of Orthopaedic and Trauma Surgery 129(9):1233-8 DOI:10.1007/s00402-009-0841-9
8. Chang SM, Zheng HP, Li HF, Jia YW, Huang YG, Wang X, Yu GR. Treatment of isolated posterior coronal fracture of the lateral tibial plateau through posterolateral approach for direct exposure and buttress plate fixation. Arch Orthop Trauma Surg. 2009;129:955–962.
9. Tao J, Hang DH, Wang QG, Gao W, Zhu LB, Wu XF, Gao KD. The posterolateral shearing tibial plateau fracture: treatment and results via a modified posterolateral approach. Knee. 2008;15:473–479.
10. Moore TM (1981) Fracture-dislocation of the knee. Clin Orthop Relat Res 156:128–140
11. Fernandez DL (1988) Anterior approach to the knee with osteotomy of the tibial tubercle for bicondylar tibial fractures. J Bone Joint Surg Am 70(2):208–219
12. Schatzker J (1988) Fractures of the tibial plateau, vol 1. Lippincott, Philadelphia, pp 421–434
13. Bhattacharyya T, McCarty LP 3rd, Harris MB, Morrison SM,Wixted JJ, Vrahas MS, Smith RM (2005) The posterior shearing tibial plateau fracture: treatment and results via a posterior approach. J Orthop Trauma 19(5):305–310
14. De Boeck H, Opdecam P (1995) Posteromedial tibial plateau fractures. Operative treatment by posterior approach. Clin Orthop Relat Res 320:125–128
15. Galla M, LobenhoVer P (2003) The direct, dorsal approach to the treatment of unstable tibial posteromedial fracture-dislocations. Unfallchirurg 106(3):241–247.

Резиме

НАШЕТО ИСКУСТВО СО ЗАДЕН ПРИСТАП ЗА ФРАКТУРИ НА ЗАДНОТО ТИБИЈАЛНО ПЛАТО

Андреја Гавриловски[1], Александра Гавриловска Димовска[2], Радмила Мила Михајлова Илие[3], Магдалена Петрушевска Ѓориќ[1]

[1] Универзитетска клиника за трауматологија (ТОАРИЛУЦ), Скопје, РС Македонија

[2] Универзитетска клиника за неврохирургија, Скопје, РСа Македонија

[3] Универзитетска клиника (ТОАРИЛУЦ) – Ургентен центар, Скопје, РС Македонија

Вовед: Фрактурите на задното тибијално плато се редок тип фрактури. Повеќето хирурзи се навикнати да оперираат во супинациска положба, меѓутоа, операцијата во задниот дел на коленото и работењето во пронациска положба може да биде предизвик поради присуството на невроваскуларни структури, вклучувајќи го тибијалниот нерв, поплитеалната артерија и вена, заедничкиот перонеален нерв, а, исто така, предизвикувачки е да се постигне и ефективна репозиција и фиксација, па затоа поретко се изведува.

Материјали и методи: Помеѓу февруари и септември 2022 година беа дијагностицирани и оперирани четири случаи на фрактури на задното тибијално плато на нашата клиника и беше спроведено шестмесечно постоперативно следење (2 жени и 2 мажи со просечна возраст од 48,5 години). Сите беа дијагностицирани со рендген и КТ-скенови. Сите скршеници беа на десната нога. Беше користен заден пристап со „S-форма“ во пронациска положба за да се репонира тибијалниот кондил и да се фиксира со плочка. Кај фрактурите што вклучуваат латерална депресија на платото, задниот пристап со „S форма“ можеби не е доволен за да се изврши отворена репозиција и внатрешна фиксација на латералниот кондил, па затоа беше направен дополнителен антеролатерален пристап и беше поставена дополнителна заклучувачка плочка. Радиографската евалуација вклучува квалитет на репозиција и задоволителен правец на коскената оска.

Резултати: Сите фрактури зараснаа во рок од 6 месеци, без секундарно изместување. Во текот на целиот период на следење немаше случаи на посттрауматски остеоартритис на коленото. Ниту еден пациент не се пожали на нестабилност на коленото.

Заклучок: Директниот дорзален пристап овозможи адекватна отворена репозиција и внатрешна фиксација, а раните клинички резултати се ветувачки. Меѓутоа, кај фрактурите што вклучуваат латерална депресија на платото, задниот пристап со „S форма“ може да не е доволен за да се изврши отворена репозиција и внатрешна фиксација на латералниот кондил, па затоа треба да се направи дополнителен антеролатерален пристап и да се постави дополнителна заклучувачка плочка.

Клучни зборови: фрактури на задно тибијално плато, заден пристап, пронациска положба, двојна фиксација со плочки