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Effect comparison between locking plate and ordinary anatomical type plate internal fixation for the treatment of tibial plateau fracture

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Abstract: **To observe the effect of locking plate and ordinary anatomical type plate internal fixation for the treatment of tibial plateau fracture. 56 cases of tibial plateau fracture were treated with proximal tibial plate from April 2009 to January 2015. 21 cases were treated with locking compression plate and 35 cases were treated with anatomical plate. Operative blood loss,length of hospital stay,fracture time healing ,range of motion, tibial varus angulation, posterior slope angle， HSS score and Rasmussen score were compared after internal fixation for the treatment of tibial plateau fracture between locking compression plate and anatomical plate. All patients were followed up with an average follow-up of 13 months. Locking plate is of no statistically difference in operative blood loss,length of hospital stay,fracture time healing,range of motion, tibial varus angulation, posterior slope angle， HSS score and Rasmussen score. Locking plate is not better than non-locking anatomical plate in treating tibial plateau fractures.**

Keywords: Locking plate; Non-locking anatomical plate; Tibial plateau fracture

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1. Introduction

In recent years, with the continuous development of economy, the incidence of tibial plateau fractures is rising. According to statistics, tibial plateau fractures account for about 1% of total body fractures, mostly due to high energy violence [1]. This type of fracture is usually caused by the axial compression of the platform, which can be combined with varus or valgus stress. The position, direction, size and site of the violence were. The type of fracture is determined by the position, direction, size and site of the violence. According to the principle of treatment of intra-articular fractures, tibial plateau fractures usually require surgical reduction. The tibial plateau fracture is often difficult to restore, because of the involvement of cancellous bone, or with the injury of the joint attachment.

Because of the improvement of CT, MRI and other imaging diagnostic techniques, the diagnosis of this disease is not a problem. Surgery is the most rapid and effective method. The purpose of surgical treatment of tibial plateau fractures is to restore joint function, correct deformity and prevent the occurrence of secondary osteoarthritis [2,3]. The correct internal fixation technique can keep the joint surface smooth. With the development of modern department of orthopedics, internal fixation technology has been widely developed. However, there is no gold standard for the treatment of tibial plateau fractures. Non locking anatomical plate has been widely used in the treatment of tibial plateau fractures because of its good adhesion with the bone surface, good fixation and fixation of the fracture block, and good resistance to shear force, pressure and rotational stress [4,5]; Locking plates are also highly regarded for their greater stability between compression and unstable fractures [6].

The purpose of this study was to compare the surgical outcome of tibial plateau fractures treated with anatomical plate and locking plate (Operative blood loss, length of hospital stay, fracture time healing), postoperative completely weight, range of motion, tibial varus angulation, posterior slope angle, HSS score, Rasmussen score, and explore the advantages and disadvantages of the two in the treatment of tibial plateau fractures.

2. Materials and methods

2.1. Patients

56 patients were treated with tibial plateau fracture in Qingdao municipal hospital from April 2009 to January 2015.Inclusion Criteria: (1) Clinical symptoms, signs, X-ray examination results were consistent with the diagnostic criteria of tibial plateau fractures; (2) Fresh fracture; (3) Age and sex is not restricted; (4) The internal fixation was strong, and the X-ray showed the reduction of the fracture and the reduction of the articular surface. Patients were divided into anatomical plate group and locking plate group. The study had been approved by the ethics committee. Patients had signed the consent form (Table1, 2).

Table 1 The clinical data of the patients

	Patient Number	Average Age	Left: Right	AO classification			Causes of Injury			
				A	B	C	Traffic accident	Fall injury	Tumble injury	Machine injury
Anatomical plate group	35	44.0(21-74)	19:16	15	11	9	25	6	0	3
Locking plate group	21	42.7(28-51)	9:12	4	5	12	13	4	1	3

Table 2 Accompanied injuries

	Ipsilateral meniscus injury	Ipsilateral ACL injury	Ipsilateral collateral ligament injury	Ipsilateral fibular fracture	Ipsilateral common peroneal nerve injury	Ipsilateral femoral fracture	Other fracture
Anatomical plate group	4	2	1	8	2	4	13
Locking plate group	3	1	2	5	3	4	7

2.2. Operative method

Patients with open fractures were treated with debridement and suturing and antiinflammatory. All of the patients were given detumescence treatment, immobilization and raised their affected limb. Patients were administered with combined spinal-epidural anesthesia. We used the anterolateral approach of the knee joint, and the medial and posterior approach was used to expose the fracture. We determined the length of the plate according to the X-ray. We used cancellous bone screws, and the placement should not affect the placement of the subsequent plate. We corrected the deformity of lower limb angulation, rotation and displacement, and restored the alignment of the lower limb. We selected two types of fracture fixation: anatomical plate fixation and locking plate fixation. Treatment of combined injury: fractures, meniscus, medial and lateral collateral ligament were treated at one-stage operation. ACL and PCL injury were treated at two-stage operation.

2.3. Postoperative treatment and follow-up

Patients raised their affected limb with ice compress after the operation. Isometric quadriceps exercises and knee range of motion was encouraged from 3rd day depending on patient tolerance to pain. The knee's range of motion reached 0-90° on the 14 days after operation. We suggested patients review at 1, 3, 6 months after operation, then once every six months. Patients did not weight bearing crutch walking for at least 12 weeks with partial weight bearing after that and full weight bearing allowed only after radiological healing of the fracture. Bony union was defined radiolographically when at least three cortices united. We Evaluate the following indicators: Operative blood loss, length of hospital stay, fracture time healing ,range of motion, tibial varus angulation, posterior slope angle, hospital for special surgery knee score (HSS) and Rasmussen score.

2.4. Statistical methods

The statistical analysis was performed using software SPSS 20.0 to analyze the data. The quantitative data were expressed as mean±standard deviation ($X \pm S$), and the last follow-up data was analyzed by one-way analysis of variance. P values below 0.05 were considered as statistically significant.

3. Results

3.1. General situation of follow-up

The patients were followed up for 6-24 months with an average of 13 months. An acute infection of the wound was observed in the anatomical plate group. All fractures were healed without internal fixation failure.

3.2. Comparison of indicators related

There was no significant difference between the 2 groups in operative blood loss, length of hospital stay, fracture time healing (Table 3).

3.3. Range of motion, tibial varus angulation, posterior slope angle，HSS score, Rasmussen score

There was no significant difference between the 2 groups in range of motion, tibial varus angulation,posterior slope angle, HSS score and Rasmussen score (Table 4).

Table 3 Comparison of indicators related

Group	Operation time(min)	Operative blood loss(ml)	Length of hospital stay(d)	Fracture time healing(w)
Anatomical plate group	115.8±15.8	113.6±12.4	19.6±5.6	14.6±3.8
Locking plate group	116.2±16.1	114.3±12.6	19.3±5.3	15.1±3.5
P value	0.928	0.840	0.841	0.618

Table 4 ROM, tibial varus angulation,posterior slope angle, HSS score and Rasmussen score at the last follow-up

	ROM	tibial varus angulation	posterior slope angle	HSS score	Rasmussen score
Anatomical plate group	115.9±32.0	85.2±1.8	7.8±1.5	92.1±7.9	28.3±15
Locking plate group	112.6±39.1	86.1±2.5	8.5±1.9	89.3±8.1	28.9±0.7
P value	0.71	0.124	0.132	0.208	0.09

4. Discussion

With the update of the concept of fracture treatment and the continuous development of new fixation materials, the surgical treatment's effect of various fractures has been improved significantly [7]. Locking compression plate has been chosen as the first choice for the treatment of tibial plateau fractures due to its better fracture stability and soft tissue blood supply. In order to investigate the normal anatomical plate internal fixation with locking plate fixation in clinical effect in patients with fracture of tibial plateau, we analyzed retrospectively 56 patients, compared with locking plate fixation with common anatomical plate fixation. The results show that there were no significant differences between the locking plate group and the anatomical plate in operative blood loss, length of hospital stay, fracture time healing ,postoperative completely weight, range of motion, tibial varus angulation, posterior slope angle, HSS score and Rasmussen score. In other words, patients will get the same clinical manifestations in the surgical anatomy and functional reconstruction by using locking plate and anatomical plate.

Previous studies of anatomical plate and locking plate are rare [8,9]. With a long term follow-up of 41 patients with tibial plateau fractures, Tahririan [10] considered locking plate can reconstruct the function of the knee joint, reduce pain, increase knee activity better than anatomic plate. Jiang R found that the locking plate (LISS) had no advantage compared with the traditional anatomical plate by studing 84 patients with double platform fractures. Locking plate can only be used as an alternative for the treatment of tibial plateau fracture with anatomical plate, but it cannot replace the latter [11]. The American Association of Department of orthopedics physicians (AAOS) experts agree that locking plates cannot provide better outcomes than non locking plates [12]. We consider that the results of this study differed from those of Tahririan is. All the operations in this study were performed by a senior physician. He controlled the AO principle mastery. Previous studies were done by several groups of doctors. There were simple fracture and complex fracture in this study, but Tahririan's was mostly complicated fractures. This study's evaluating indicator is different from previous studies'. Tahririan did not perform an ITT analysis for patients lost to follow up.

There are several deficiencies in this study certainly. Only 56 patients with tibial plateau fractures were included in this study. Sample capacity needs to be increased. The whole process of bone remodeling was not observed, and the effects of the two kinds of plants on the incidence of long-term secondary osteoarthritis were also not observed because the average follow-up time was 13 months. The study could not allocate the patients randomly due to the high price of the locking plate. This increases the error of the study.

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