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Application effect of arthroscopy combined with external fixation support in the treatment of tibial plateau fracture.

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Abstract

Objective: To investigate the effects of arthroscopy combined with external fixator support for tibial plateau fracture.

Methods: From January 2013 to February 2015, 120 tibial plateau fractures patients in our hospital were selected and divided into observation group and control group according to the treatment methods, 60 cases in each group. All patients were given preoperative routine treatment, while the control group were treated under arthroscope, and observation group accepted external fixation support based on the control group. The prognosis and complications in two groups were observed.

Results: The postoperative 6 months of skin infection, traumatic arthritis, joint stiffness, pain of implants etc. occurred in the observation group were significantly less than those of the control group (χ^2 =8.04, P<0.05). The excellent and good rates of HSS (Hospital for Special Surgery Scores) of the knee joint in the observation group of postoperative 6 months were 93.3%, which was significantly higher than that of 70.0% in the control group (χ^2=16.24, P<0.05). The tibial plateau varus angle (TPA) and posterior tibial plateau angle (PA) values in the observation group of postoperative 6 months were 6.24 ± 0.89 degrees and 6.82 ± 0.49 degrees, which were significantly higher than those immediate postoperation (T=5.73, 4.52, all P<0.05); TPA and PA in the control group were 5.89 ± 1.02 degrees and 7.12 ± 0.55 degrees respectively, which were significantly higher than those immediate postoperation (T=3.41, 2.00, all P<0.05), and the differences of postoperative 6 months showed statistical significance in two group (T=2.00, 3.16, all P<0.05).

Conclusion: The application of arthroscopy combined with external fixation support in tibial plateau fracture can promote the TPA and PA values returning to normal, reduce the incidence of postoperative complications, to improve the function of knee joint, which is of good application values.

Keywords: External fixation support, Tibial plateau fracture, Arthroscopy, Complication.

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Introduction

Tibial plateau fracture is a kind of knee intraarticular fracture, which refers to articular inversion, fracture, step-off and splintered fracture of tibial plateau, mainly accompanied with severe injuries of ligament and surroundings of joint, which mostly due to high energy injury-induced and aggravates the disorder of knee joint function, so it is a serious problem of orthopedic trauma [1,2]. The stability and function of knee joint would be affected if with mismanagement, which may lead to sequela like joint instability, traumatic arthritis etc [3]. The purpose of treatment of tibial plateau fracture is to recover the integrity of articular surface and trans-articular axial alignment, and improve the function of articular activity. With the development of minimally invasive arthroscopy, the prognosis of patients with tibial plateau fracture had great improvement [4,5]. But it is certain that any surgical treatment will do harm to patients to some extent, so the application of external fixation support will be more demanding too [6,7]. While the application of external fixation support allows patients to do weight-bearing exercises or other activities, which help to promote patients recovery [8,9]. This research investigated the effects of arthroscopy combined with external fixator support in the treatment of tibial plateau fracture. The results are as follow.

Objects and Methods

Research objects

Adopting the method of retrospective study, 120 tibial plateau fractures patients in our hospital from January 2013 to February 2015 were selected. Inclusion criteria: patients diagnosed as tibial plateau fracture in intraoperative pathologic and clinically, which are one-side ill and closed fracture [10]; patients with different degree of pain in knee joint, especially

when doing weight-bearing exercises in the morning; patients with poor therapeutic effects by sole conservative treatment and with surgical indications; patients agreed to the research which was approved by the ethic committee of hospital. Exclusion criteria: patients whose tibia plateau were collapse and fracture severely and predicted to have difficulties in reduction and fixation; patients combined with abnormalities of heart, liver and kidney; patients with serious medical diseases; patients underwent surgery of tibia before. According to the different treatment methods, patients were divided into observation group and control group, with 60 cases in each. There is no statistical significance in sex, age, disease location, causes of disease, Schatzker Type and BMI (Body Mass Index) between the two groups (Table 1).

Table 1. Comparison of baseline information.

Group	Cases (n)	Sex (Male/female)	Age (years)	Disease location (Left/ right)	Schatzker type (V/VI)	Causes of disease (high falling/ traffic/ bruised by heavy objects)	BMI (kg/m^2)
Observation group	60	32/28	55.34 ± 2.10	40/20	48/12	32/20/8	22.34 ± 3.15
Control group	60	30/30	55.19 ± 1.98	36/24	44/16	28/19/13	22.19 ± 4.09
t or X^2 value		0.13	0.40	0.57	0.75	1.48	0.23
P value		0.72	0.69	0.45	0.39	0.48	0.83

Method

All patients were received preoperative routine treatment: Elevate the injured limb, treat with dehydration and anti-inflammatory, eliminate the oxygen free radicals to reduce the swelling of injured limbs, do preoperative routine imaging tests to know the situation of fracture and provide objective basis for the formation of surgical plan and choice of approaches.

The control group were treated with open reduction and internal fixation under arthroscopy. The surgery was supported by lumbar anesthesia, continuous epidural anesthesia or general anesthesia, choose the incision at the criterion of which is easier to do reduction and fixation, usually take the knee joint middle as incision, open the joint capsule limited, reset, repair and restore the smooth of articular surface under direct vision of small incision, fill the bone defect with autogenic cancellous bone or bone allograft, do the fixation of anterior cruciate ligament by using absorbable screws, and retain primary suture for meniscus.

At the basis treatment of the control group, external fixator support were used in the treatment of observation group 1 month before surgery, make the two-thirds of external fixation ring be parallel to the surface of tibia joint, maintain the limb to locate at the centre of ring. Make 2 kirschner wire which are with olive head at one side be parallel to the surface of tibia joint over the surface of neck of fibula, go through from posterolateral proximal tibia to anteromedial side; choose another two kirschner wire at the same time, make them form an angle of 60-70°, tighten the kirschner wire to immobilize the bolt, and adjust the location of ring and limbs to r restore of limb length. Immobilize the unilateral external fixation at the anteromedial site of ring and perpendicular to anteromedial surface of tibial, screw into 2-3 taper pin through tibial median, install column on ring, connect and immobilize the ends of column and taper pin.

All patients received treatment of anti-inflammatory and detumescence, dismantle the external fixation 1 and a half month after surgery, start passive knee function exercise, avoid weight-bearing in three months after surgery, then create a transition from light weight-bearing to full weight-bearing.

Observation index

(1) **Surgical safety:** Observe the success rate of surgery in the two groups, record the inraoperative complication and complication 6 months after the surgery, including skin infection, traumatic arthritis, joint stiffness, pain of implants etc. (2) The HSS (Hospital for Special Surgery Scores) of the knee joint is used to judge, excellent is scores ≥ 85, good is scores ranged 70-84, average is scores ranged 60-69, poor is scores ≤ 59. The good rate=excellent rate + good rate. (3) The TPA and PA right after and 6 months after the surgery were determined and analyzed. All the evaluation and judgment were accomplished by the same research group to ensure the consistency of assessment method.

Statistical analysis

Data were analyzed by using SPSS 22.0 software, all measurements were expressed as mean ± standard deviation ($\overline{x}$ ± SD), analyzed by t-test or SNK-q test; numerical data were expressed as percentage (%), analyzed by χ^2 test. $P<0.05$ indicated the differences showed statistical significance.

Result

Comparison of surgical effect

The surgery was all completed successfully, and there were no serious intraoperative complications, all fractures had reached anatomical reduction, and the incisions were all primary healed. The HSS was judged 6 months after the surgery. The good rate of the observation group and the control group were

93.30% and 70.00% respectively, and the good rate in observation group is significantly higher than that in the control group (P<0.05) (Table 2).

Table 2. Comparison of clinical effect 6 months after surgery (n, %).

Group	Cases (n)	Excellent	Good	Average	Poor	The good rate
Observation group	60	40 (66.67%)	16 (26.67%)	4 (6.67%)	0 (0.00%)	93.3%
Control group	60	22 (36.67%)	20 (33.33%)	10 (16.67%)	8 (13.33%)	70.0%
χ^2 value						16.24
P value						0.00

Comparison between the change of TPA and PA

After the detection, the TPA and PA of the observation group 6 months after the surgery are 6.24 ± 0.89° and 6.82 ± 0.49° respectively, the control group are 5.89 ± 1.02° and 7.12 ± 0.55°, which showed statistical significance both in and between the two groups (Table 3).

Table 3. Comparison between the change of TPA and PA at different time after surgery (x ± SD).

Group	Cases (n)	TPA right after surgery	TPA 6 months after surgery	T	P	PA right after surgery	PA 6 months after surgery	T	P
Observation group	60	5.32 ± 0.87	6.24 ± 0.89	5.73	0.000	7.29 ± 0.64	6.82 ± 0.49	4.52	0.003
Control group	60	5.28 ± 0.94	5.89 ± 1.02	3.41	0.001	7.31 ± 0.49	7.12 ± 0.55	2.00	0.048
T value		0.24	2.00			0.19	3.16		
P value		0.81	0.04			0.85	0.00		

Comparison of the complications

The complications like skin infection, traumatic arthritis, joint stiffness, pain of implants etc. of the observation group is significantly less than those in the control group (P<0.05) (Table 4).

Table 4. Comparison of the postoperative complications of the two groups (n, %).

Group	Cases (n)	Skin infection	Traumatic arthritis	Joint stiffness	Pain of implants	Total
Observation group	60	4	2	2	2	10 (16.7%)
Control group	60	8	6	8	6	24 (46.7%)
χ^2 value						8.04
P value						0.01

Discussion

Tibial plateau is composed of cavernous bone and articular cartilage, which were easily split and collapsed when there is external force or strike so as to be fractured and it is commonly seen in ectocondyle [11]. The Schatzker type V/VI of tibial plateau fracture refer to the collapse of articular surface of tibial platform, fracture of tibial metaphysic which were comminuted fracture combined with displacement, usually associated with serious injuries of intra/outra-articular soft tissue, which would badly influence the knee joint function of patients [12].

The satisfied prognosis in treatment of tibial plateau fracture depends on non-weight-bearing exercise at early stage, stable internal fixation, full bone graft after reduction of collapsed part, good anatomical reduction of articular surface. Now commonly used surgical options are to incise in two sides, so as to meet exposure, do anatomical reduction at fracture ends, or get it fixed by steel plate etc. The application of arthroscopy can reduce the injuries of patients, but some situation like skin infection, traumatic arthritis, joint stiffness, pain of implants etc. seemed to appear easily after surgery [13,14]. The research showed that all the patients came through the surgery successfully and there were no serious intraoperative complications, all fractures had reached anatomical reduction, and the incisions were all primary healed. The HSS was detected 6 months after the surgery, the good rate of the observation group and the control group were 93.30% and

70.00% respectively, which the good rate in observation group is significantly higher than that in the control group (P<0.05). It shows safety and success of the application of external fixation support, especially because the fixed ring of external fixation support link to bone through kirschner wire where the interface friction between them acquires multi-directional support, so as to improve patients' recovery. It mainly because that there is an adjustable fixed angle after the application of external fixation support, so we can make it different angle for joint which needed long-time fixation, which adjust the effect of reduction and keep proper joint space and promote the recovery of joint function [15]. At the same time, there is no need to dissect the soft tissue widely in its application, which is positive for wound protection, treatment and observation, and is beneficial to healing and shaping of cartilago articularis, and make it more possible to allow early function rehabilitation of joint [16,17]. When external fixation assist reduction surgery is taken, the surgical injuries can be reduced, and also secondary injuries of soft tissue around knee joint can be minimized to the full extent. And the triangular structure will be formed in external fixation, which reduced failure deformation of external fixator structure greatly, and enhanced the axial rigidity [18].

There are complications after surgery of tibial plateau fracture, with the improvement of minimally invasive treatments on tibial plateau fracture, the clinical effect is improving gradually, but some complications are still comment [18]. The research showed that complications in observation group 6 months after surgery are significantly less than that in the control group (P<0.05), which mainly because external fixation support can stabilize fracture firmly, have less influence in blood supply to fracture ends, leave no foreign matter at incision, which is beneficial for infection control [19]. Also, external fixation support relieved postoperative swelling, has little influence on fracture wound, which maintained the blood support of fracture sites and facilitated its healing. In the process of complication prevention, sludged blood and fragments of meniscus in the joint space should be clean timely, implant the defect site by using modified autogeneic-iliac bone, be careful to adjust the position of steel plate to ensure the stability of fracture fragments which maintain the articular surface, and guide patients to take exercise in limb function when is possible.

The greatest advantage of tibial plateau fracture treatment under arthroscope lies in that under direct vision, the dislocated end can be met anatomical reduction more possibly, which significantly reduced the influence caused by the change of anatomical structure. But the irregularity of the anatomical structure of tibial plateau, complexity and diversity of fracture, make it a higher requirement for treatment after the surgery [19-22]. The research showed that the TPA and PA in observation group 6 months after surgery are 6.24 ± 0.89° and 6.82 ± 0.49° respectively, the control group are 5.89 ± 1.02° and 7.12 ± 0.55°, which showed statistical significance both in and between the two groups. It indicated the application of external fixation support can promote the regain of TPA and PA. But because the follow-up time is short, the long-term curative effect remains further study.

In conclusion, the application of arthroscopy combined with external fixation support in tibial plateau fracture can promote the TPA and PA values returning to normal, reduce the incidence of postoperative complications, so as to improve the function of knee joint, which is of great application values.

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