

## Clinical outcomes in internal synthesis in the tibial plateau fractures - A clinical study in Tirana

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### Abstract

**Aim:** Our aim was to evaluate the surgical treatment of the tibial plateau fracture. The main objective was to offer statistical proofs whether the chosen treatment is the right one and to test if the use of medicaments in postoperative patients has improved their performance in Albanian patients.

**Methods:** This study included a group of 126 patients operated at the Orthopedic and Trauma University Service in Tirana during 2005-2012. The average follow-up was four years. All patients were operated using screws or plate and screws as synthesis for the fracture. Patients were grouped according to the Schatzker classification and the surgical treatment technique in relation to the classification was investigated. The objective evaluation of the results was performed according to Iowa Knee Score, a clinical evaluation system. A questionnaire was conducted each year for the patients. The outcomes were compared for each patient during four years.

**Results:** The chi-square test used to check the difference in treatment provided the following results:  $\chi^2=7.423$ ,  $df=55$ ,  $P=0.001$ . The use of hyaluronic acid improved the performance of the patients ( $r=0.887$ ,  $P=0.003$ ).

**Conclusions:** Our findings indicate that improving the treatment of tibial plateau fractures through the right diagnosis, the surgical treatment technique and the postoperative period, followed by medical treatment and physiotherapy, is the key-point in getting the best results.

**Keywords:** hyaluronic acid, orthopedic, plate and screws, tibial plateau fractures.

## Introduction

The term “tibial plateau fracture” refers to the interruption of the anatomical entity of the articular surface of proximal tibia. Although these fractures represent only 1% of all fractures worldwide, they are one of the most frequent causes of invalidity (1). These kinds of fractures are diagnosed not only in the active ages, but also in the third age, because of the presence of osteoporosis (1).

This fracture is also widely known as the “bumper fracture”, accusing car accidents as the main cause. It is quite clear for the surgeons that the results following the treatment of this fracture depend on: bone damage (displacement, comminution, depression and collateral damage); quality of reduction; operative technique; quality of osteosynthesis; and rehabilitation.

The objectives of this study were: a) to evaluate whether the way of fixation influences the treatment results of these fractures, and; b) to evaluate whether the postoperative treatment with hyaluronic acid improves the performance of the patients.

## Methods

The frequency of this fracture is estimated at 10 new cases/per 1 million inhabitants in Albania (2). This study includes 126 fractures, operated during 2005-2012 at the Orthopaedic Department in Tirana. The

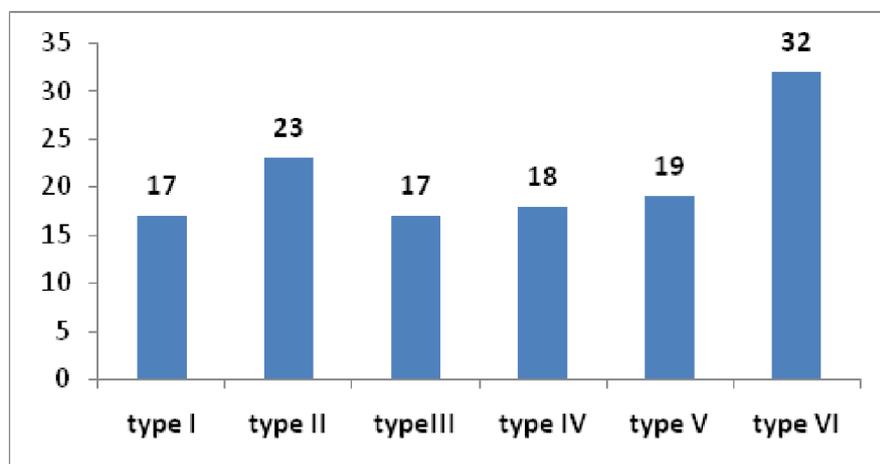
average follow-up was four years, ranging from two to ten years.

Clinical files of the patients were carefully reviewed, and personalised follow-ups and phone calls in selective cases were performed.

The operative treatment is highly recommended for unstable tibial plateau fractures, fractures with displacement and/or depressed fragments, and especially fractures associated with vascular damages or compartment syndrome (3-5). We operated the patients with plateau fractures in our department according to the displacement and depression criteria. If the displacement or depression of the fragments is more than two millimeters in an active patient, or five millimeters in a patient above the age of 60, this is a clear indication for operative treatment. The patients were operated by screw only or plate and screw fixation. The main aim of this study was to find out whether the way of fixation has influenced the results of the treatment. The fractures were divided in groups according to the classification and the way of treatment chosen for each group was studied and then statistical analysis was performed.

The fractures were classified according to Schatzker (6). The 126 fractures were grouped as indicated in Figure 1.

**Figure 1. Fracture classification according to Schatzker**



To evaluate the results, two kinds of reference systems were build up. The “subjective” tool was based on the answers to an annual questionnaire completed by all the patients about the performance of their knee. Every year the patients were asked the same questions concerning mainly the performance of their knee and the ability to go back to their previous activity. Their responses are presented in a result-subjective table.

The “objective” one, based on the Iowa Knee Score, was structured on our own data. Using this method we could estimate: the range of motion, axis failure, pain at effort or at rest, and arthrotic changes in the knee.

Within the big group of 126 patients, we conducted a sub-study by establishing two groups of 27 and 29 patients respectively with similar conditions regarding age, sex, type of fracture, operation technique (operated by the same surgeon).

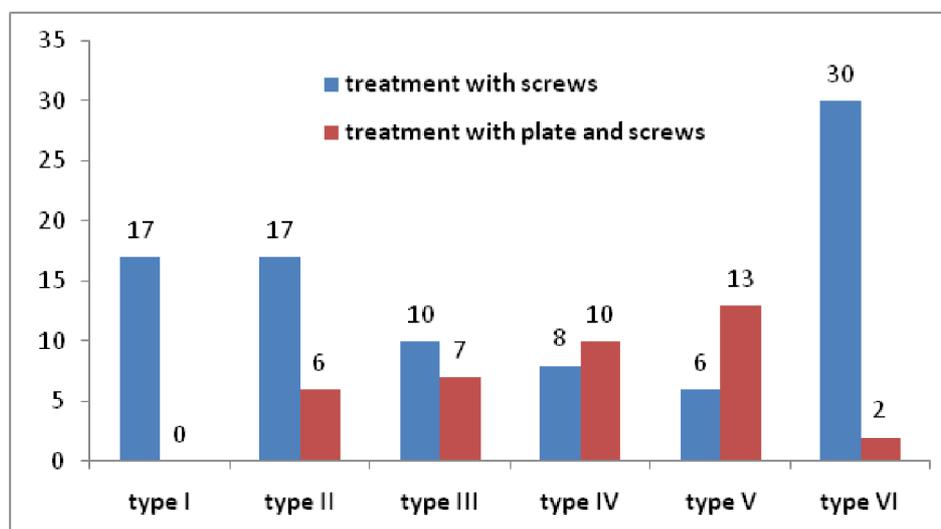
Hyaluronic acid as local injection and glucosamine & chondroitin per os, were used in the first group (study group), whereas the second group was used as a control group. Even in this sub-study, the same method of study was employed: objective and subjective. The results were statistically elaborated, in order to evaluate whether the use of these medicines influences the long-term performance of the patients.

To assess the correlations between the variables, Kendall’s correlation coefficient was used, while the differences between the categorical variables were analysed using the chi-square test. The statistical package SPSS 11.5 was used to analyse the data.

## Results

The way of treatment of the fractures according to the selected classification is shown in Figure 2.

**Figure 2. The way of treatment of the fractures according to the selected classification**



As observed in Figure 2, the higher the number of the fracture type, the more does the use of plates and screws become the rule. In the 17 patients diagnosed with fracture type I, only screws were used. In 32 patients with type VI fracture, 30 of them were fixed with plate and screws, and two

of them with screws only.

Various complications were noticed treating this kind of fracture. Surgical site infection was diagnosed in 15 patients (12% of the cases). One of the patients had to be operated after two months in order to remove the synthesis material, due to a

deep infection. According to an international study, the average rate of infection of the surgical site is reported at 8.5% of the patients (7).

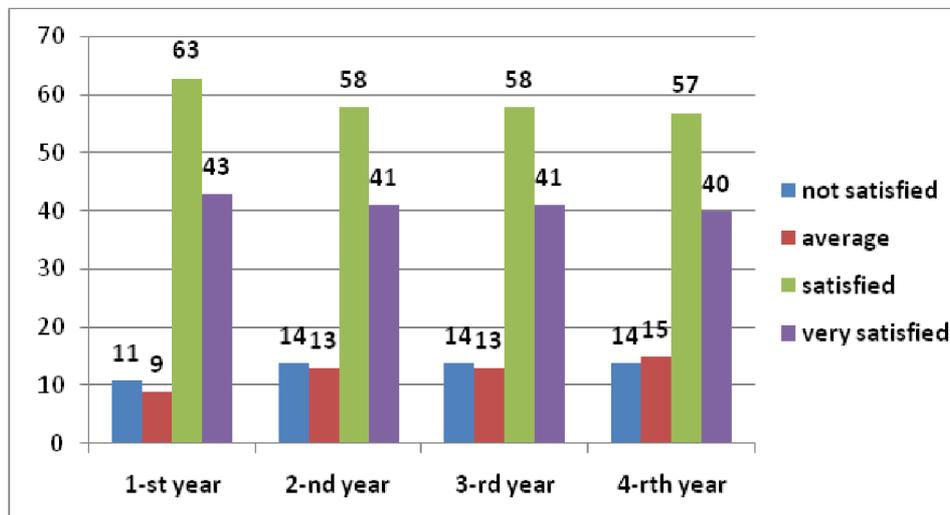
The following data was collected by the “subjective” evaluation of the patients: out of the 126 patients included in the study, eleven of them were “not satisfied” at the end of the first year. At the end of the second year, three more patients joined the “not satisfied” group, while the number remained the same in the third and in the fourth year.

Nine patients defined their result as “average” at

the end of the first year. These patients defined their everyday activity as “limited”. This number grew with four more patients at the end of the second year and with further two patients at the end of the fourth year.

At the end of the first year, 63 patients defined themselves as “satisfied”. This number decreased to 58 at the end of the second year. While 43 patients were “very satisfied” at the end of the first year, this number decreased at 41 by the end of the second year.

**Figure 3. “Subjective” results collected by the patients’ annual questionnaire**



Out of all the patients included in the study, 71 of them were back to their normal previous routine activity, and 25 of them were even engaged in hard labor (construction, mining, long term stand-up, and the like).

Regarding the Iowa Knee Score, each one of the patients was monitored within a period ranging from two to ten years. The result for each patient was expressed in points. The evaluation was made employing the IKS criteria. The maximum points were assigned to the patients with maximum flexion of the knee (140°), preserving of the axis, the absence of pain and other minor criteria. The score range was from of minimum of 20 points to a maximum of 100.

In the objective evaluation, it was noticed that at the end of the second year, 99 patients showed no arthrotic changes in the X-ray, four patients showed arthrosis of the third degree, and in 25 patients progressive arthrotic changes were noticed. Based on the chi-square test we noticed the difference in treatment between the treatment of the same fracture with plates and screws and screws only ( $\chi^2=7.423$ ,  $df=55$ ,  $P=0.001$ ).

Such a result with a highly significant p-value indicates that the use of screws alone in fractures which need to be treated with plate and screws has a strong negative impact on the outcome of the treatment.

In our statistics we find treatment with screws

only, even in the highly comminuted fractures, while according to the international literature treatment with screws only is exclusively reserved for the non-displaced fractures.

In order to improve the results of the surgical treatment, hyaluronic acid (five local shots every

week) and pills of glucosamine & chondroitin for three months were used. The results of this sub-study are taken 18 months after the surgery. The selected patients were carefully chosen, preserving a correct distribution by fracture classification, age and especially the way of treatment.

**Table 1. Patients treated with hyaluronic acid according to fracture type**

Hyaluronic acid	Fracture type						Total
	I	II	III	IV	V	VI	
Yes	3	5	3	4	6	6	27
No	4	8	4	4	3	6	29
<b>Total</b>	7	13	7	8	9	12	56

By means of the chi-square test we noticed the difference in evaluation with points according to the fracture type ( $\chi^2 = 73.162$ ,  $df = 55$ ,  $P=0.05$ ).

By means of Kendall's correlation coefficient we noticed a correlation between the use of hyaluronic acid and the point-evaluation of the fractures ( $r=0.887$ ,  $P=0.003$ ). These data helped us to address the hypothesis on whether the use of hyaluronic acid at the postoperative phase is justified or not.

## Discussion

Operative indication in tibial plateau fracture depends on the type of fracture (according to the classification), age, physical activity, accompanying pathology. In our clinics, a plateau fracture is operated if the displaced or depressed fragments are more than two millimeters in young and active patients, if the fracture is unstable and in polytrauma patients (2).

Almost all the plateau fractures, as far as they are intrarticular fractures, are subject of surgery, be it endoscopic or open air surgery (8).

Improvement of the surgical technique and technology have led the surgeons toward endoscopic assisted intervention and the progress of the osteosynthesis materials have led to even better

results in treatment of these fractures. The qualitative reduction of the fragments, stable osteosynthesis and of course a clever postoperative treatment with the right physiotherapy are the necessary steps to achieve the best result. In a considerable number of patients, we found minimal and non appropriate synthesis used to keep the reduction. This often leads to second collapse or loss of reduction and surely to bad result. The discussion is focused not only on the solid synthesis and preserving of the soft tissues as well, but on the establishment of the right protocols in the postoperative treatment as well.

Physiotherapy takes place during the postoperative phase, medicines like hyaluronic acid and glucosamine & chondroitin are recommended to be used.

The use of such medicines is not new in the arthrotic and degenerative diagnosis. We try to use them in trauma, in order to prevent the degeneration of the joint. There is a scientific explanation to this: the hyaluronic acid inhibits up to 19 destructive enzymes present in the intraarticular joint fluid. Trauma is a preferred predecessor of the degeneration diagnosis due to activation of the destructive enzymes, thus the use of hyaluronic acid is an interesting medicine to ease the healing

process and the performance of the knee (2).

The discussion on patients' surgical site infection is heatedly debated. Any infection within the first year is considered as postoperative (9). Taking the preoperative necessary precautions is the best way to prevent an infection (9). The postoperative antibiotherapy should be no longer than 24 hours following the surgery (10).

The success in surgical treatment of the tibial plateau fracture is a result of the coordination of the three following steps: (i) a complete diagnosis, taking into consideration the advances in technology in order to have a clear view of the fracture, and leaving no surprises to the surgery; (ii) the right treatment for such fractures, that means: a good pre-operation

plan, a perfect reduction and the right osteosynthesis according to the grade of the fractures. The use of inappropriate osteosynthesis is the main cause of failure or bad results. Use of technological advantages such as endoscopy, modern osteosynthesis tools and the use of image intensifier systems in the operation theater, leads to the desired success, and; (iii) the postoperative phase is completed with a proper protocol of physiotherapy with early passive movement and possibly no immobilization.

In conclusion, the use of medicines such as hyaluronic acid and glucosamine & chondroitin is statistically supported and clinically recommended in order to reach a better performance of the patients.

**Conflicts of interest:** None declared.

## References

1. Duparc J, Ficat P. Fractures articulaires de l'extrémité supérieure du tibia [in French]. *Rev Chir Orthop* 1960; 46:399-486.
2. Todhe D, Caushi Gj, Hasho S. Tibial plateau fracture and their internal fixation. *European Journal of Trauma* 2006; 32:S1.
3. Duwelius PJ, Rangitch MR, Colville MR, Woll ST. Treatment of tibial plateau fractures by limited internal fixation. *Clin Orthop Relat Res* 1997;339:47-57.
4. Honkonen SE. Indications for surgical treatment of tibial condyle fractures. *Clin Orthop Relat Res* 1994;302:199-205.
5. Lobenhoffer P, Krettek C, Tscherne H. Complex knee trauma. *Orthopade* 1997;26:1037-45.
6. Schatzker J, McBroom R, Bruce D. The tibial plateau fractures: The Toronto experience 1968-1975. *Clin Orthop Relat Res* 1979;138:94-104.
7. Mckee MD, Pirani SP, Stephen DJ. The Canadian Orthopedic Trauma Society, Open reduction and internal fixation compared with circular fixator application for bicondylar tibial plateau fractures. Results of a multicenter, prospective, randomized clinical trial. *J Bone Joint Surg Am* 2006;88:2613-23.
8. Young MJ, Barrack RL. Complications of internal fixation of Tibial Plateau fractures. *Orthop Rev* 1994;23:149-54.
9. Gjata A. Infeksioni kirurgjikal, monografi [in Albanian]. Tirana, 2005:35-48:53-83.
10. Gjata A. Infeksioni kirurgjikal, monografi [in Albanian]. Tirana, 2005:179-80.