

THE SURGICAL TREATMENT OF TIBIAL PLATEAU FRACTURES: ARTHROSCOPY VERSUS ARTHROTOMY

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Abstract: The purpose of the clinical study is to determine the advantages and disadvantages of the arthroscopic control of reduction, associated with the minimally invasive osteosynthesis in tibial plateau fractures and to compare it with classical osteosynthesis. It was a prospective, randomized study on a group of 45 patients with tibial plateau fractures: group I – in 22 cases, the reduction was made exclusively under arthroscopic control, with the insertion of an elevator through a minimal incision. Osteosynthesis was also performed with screws and washers through minimal incisions and group II – in 23 cases, the approach was the classical one +/- arthrotomy. The reduction was made under visual and radiological control (sometimes, the visualization of the joint surface of the plateau was necessary through arthrotomy +/- meniscectomy due to meniscus injuries or tactic meniscectomy for the visualization of that particular zone), while osteosynthesis was made with the plate and screws and/or screws. The two groups were similar regarding age, sex ratio, BMI, type of fracture, degree of comminution of the fracture, type of professional and sports activity of the patients in the pre-traumatic period. The following parameters were taken into consideration: Lysholm score, mobility, pain, the need for a surgical intervention, the occurrence of degenerative lesions.

Keywords: tibial plateau, fracture, arthroscopy, arthrotomy

Rezumat: Scopul studiului clinic este de a determina avantajele și dezavantajele reducerii sub control artroscopic asociată cu osteosinteza miniinvasivă în fracturile de platou tibial și compararea ei cu osteosinteza clasică. Studiul clinic a fost prospectiv randomizat pe un lot de 45 de pacienți cu fracturi de platou tibial: grup I - în 22 de cazuri, s-a practicat reducerea exclusiv sub control artroscopic, cu introducerea unui elevator printr-o miniincizie și grup II - în 23 de cazuri, calea de abord a fost clasică +/- artrotomie, reducerea a fost realizată sub control vizual și radiologic iar osteosinteza a fost practicată cu placa și șuruburi și/sau șuruburi. Cele 2 grupe au fost similare în ceea ce privește vârsta, sex ratio, BMI, tipul și gradul de cominuție a fracturii, tipul de activitate profesională și sportivă a pacienților în perioada pretraumatică. Au fost urmăriți următorii parametri: scor Lysholm, mobilitate,

durerea, necesitatea unei noi intervenții chirurgicale, apariția leziunilor degenerative.

Cuvinte cheie: platou tibial, fractură, artroscopie, artrotomie

PURPOSE OF THE PAPER

The purpose of the clinical study is to determine the advantages and disadvantages of the arthroscopic control of reduction, associated with the minimally invasive osteosynthesis in tibial plateau fractures and to compare it with classical osteosynthesis (ORIF – open reduction and internal fixation).

MATERIAL AND METHOD

We performed a prospective, randomized study on a group of 45 patients with tibial plateau fractures:

- Group I – in 22 cases, the reduction was made exclusively under arthroscopic control, with the insertion of an elevator through a minimal incision. Osteosynthesis was also performed with screws and washers through minimal incisions. In some cases, a massive cylindrical spongy allograft was inserted through the minimal approach made for the elevator.
- Group II – in 23 cases, the approach was the classical one +/- arthrotomy. The reduction was made under visual and radiological control (sometimes, the visualization of the joint surface of the plateau was necessary through arthrotomy +/- meniscectomy due to meniscus injuries or tactic meniscectomy for the visualization of that particular zone), while osteosynthesis was made with the plate and screws and/or screws.

The first group was named Arthroscopic and the second one – Classic.

The inclusion criteria were:

- Schatzker type I – IV tibial plateau fractures;
- surgical indication;
- important displacement of the fragments;
- important joint step;
- axial displacement secondary to fracture;
- laxity secondary to fracture;
- lack of degenerative injuries;
- stable knee and without axial displacement before fracture (from the medical history and in comparison

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with the contralateral limb);

- mobility – minimum 90 degrees before the fracture;
- the written consent of the patient to be included in the study;
- the capacity and willingness to fill out the forms of the study upon debut, at 3, 6, and 12, 24, 36, 48, 60 months.

Exclusion criteria consisted of:

- inflammatory joint diseases (rheumatoid arthritis, ankylosing spondylitis etc.), metabolic diseases (gout, chondrocalcinosis etc.) or degenerative diseases (arthrosis);
- autoimmune diseases with joint involvement (systemic lupus erythematosus, scleroderma etc.);
- known pre-existing displacement of the particular inferior limb;
- lower limbs length discrepancy;
- any associated pathology of the ipsilateral limb (i.e., coxarthrosis or hip arthrodesis, malunions of femur or tibia, ankle arthrodesis, foot deformity etc.) or of the contralateral limb, which would abnormally stress the operated knee.
- associated pathology that contraindicates the surgical procedure or can have a significant influence on the evolution of the joint pathology.

The two groups were similar regarding age, sex ratio, BMI, type of fracture, degree of comminution of the fracture, type of professional and sports activity of the patients in the pre-traumatic period. In all cases, antero-posterior and lateral radiographs were made. In some cases, semi-profile Xray views and CTscan or magnetic resonance imaging analysis were added.

The discovery of extended arthrosic changes at the radiological or arthroscopical examination was an exclusion criterion.

The mean age of the whole study group was 43 years (ranging from 22 to 74 years). Group I had a mean age of 41,55 years (limits: 22 – 74) and group II – 38,91 (limits: 23 – 72 years).

In the “Arthroscopic” group, according to the Schatzker classification, the distribution of the fractures was: Schatzker I – 7 cases, Schatzker II – 8 cases, Schatzker III – 5 cases, Schatzker IV – 2 cases. In the “Classic” group, the distribution was: Schatzker – 6 cases, Schatzker II – 8 cases, Schatzker IV – 3 cases.

The following parameters were recorded.

Lysholm Score

For the quantification of the clinical results and for the survey of their evolution, we used the Lysholm score. The lowest value is 0 and the highest is 100 points. A high score indicates an excellent result.

Due to the fact that in most cases of tibial plateau fractures, walking without weight bearing is recommended in the first 3 months, the first determined value of the Lysholm score was the one calculated at the clinical and radiological control 3 months after the surgery, being considered the initial value.

The Lysholm score was calculated every 3, 6, 12 months and then annually.

Mobility

Regarding mobility, several parameters were determined and analyzed:

- The total amplitude of movement;
- The extension deficit;
- The flexion deficit;

Pain

In order to quantify pain, we used a subjective scale from 1 to 10, where 1 meant a light pain, almost imperceptible and 10 meant an unbearable pain. The patients were taught to give a note in order to characterize their pain on every evaluation.

The necessity of a new surgical intervention

It is considered an objective criterion for the evaluation of the results of the initial surgical intervention. These reinterventions may be due to some local post-surgery complications (wound dehiscence, haematoma, suppuration etc.), to some late complications (migration of the osteosynthesis material, pseudoarthrosis, malunion or nonunion, late sepsis, stiffness etc.). The ablation of the osteosynthesis material in standard conditions was not included in the analysis of this parameter.

The occurrence of degenerative injuries

On the periodic radiological examinations, the occurrence of degenerative injuries was monitored. The pre-existence of such injuries was considered an exclusion criterion, thus any such radiological identified injury is “de novo”. We used the Ahlback classification for staging the degenerative injuries.

RESULTS

Initial Lysholm score

The initial score indicated very low values 3 months after the surgery, because during these 3 months, most of the patients moved without weight bearing on the operated lower limb, and thus, they succeeded in achieving only few of the criteria implied by the Lysholm score, which was basically a functional score. There were no statistically significant differences between the two groups of patients.

Lysholm score 6 months after the surgery

A statistically significant difference occurred between the mean Lysholm scores in the two groups of patients, 6 months after the surgery. The differences between the two techniques could not be identified 3 months after the surgery because of the impossibility of achieving the Score’s criteria in none of the groups, due to the lack of weight bearing for a longer period of time. The results in the arthroscopic treated group were labelled as “satisfactory”, while in the classic treated group were considered “unsatisfactory”.

In both groups, the difference between the scores at 3 months and those at 6 months is extremely statistically significant with a $p < 0,0001$. This is due to the actual functional rehabilitation of the knee in this period of time. It is well understood that in the first 3 months, the patients followed a rehabilitation programme: kinetotherapy, continuous passive motion (CPM) on

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Kinetec type machines, building muscle tone, but the score implies what exactly the patient can do with that particular knee: running, jumping, changing direction, climbing up stairs – activities that are hard to be undertaken (some of them even impossible) 3 months after the surgery, but which became more than possible in the meantime.

Mention must be made of the fact that the highest score registered at 6 months in the “classical” treated group was 75 (in 2 cases), while in the arthroscopic treated group, the scores reached even 78 points (3 cases) and 77 (2 cases). In the “classic” group, the lowest score was 45, while in the second, it was 47.

Lysholm score 6 months after the surgery related to the Body Mass Index

The variation analysis of the Lysholm Score, 6 months after the surgery, related to the Body Mass Index, indicated the fact that the values of the score decreased quite steeply below a certain index value. This happens below a value of approximate 25 (the optimal weight limit) in the “Classic” group and much closer to 30 (the limit between overweight and obesity) in the “Arthroscopic” group. Above a certain body weight, it is normal that the score has low values, because the patients have a limited capacity to undertake some of the activities implied by the Score. But the difference between the two groups is significant and we can issue a hypothesis that the superior qualitative reduction, practiced under arthroscopic control determines an improvement of the Lysholm score in the overweight patients.

The cost of this improvement relies on the difficulties to undergo minimal invasive surgery in an overweight or obese patient.

Lysholm scores, 12 months after the surgery

The differences between the mean scores registered 12 months after the surgery also remained statistically significant ($p = 0,0019$), the “arthroscopic” group recording better clinical results – in this group, there were two 98 values – a very good score, that characterized an almost normal knee. In the “Classical” treated group, the highest score was 92 and it was registered only in one case. The mean score in the “Classic” group was $81,65 \pm 5,087$, while in the “arthroscopic” group was $87,36 \pm 6,426$.

The statistic comparative analysis of the values of the clinical scores related to the type of fractures according to the Schatzker classification, indicated that the best clinical results are those from type I and III fractures in both groups, while the results of the “arthroscopic” group were constantly higher. The best results were recorded for the type I and III arthroscopic treated fractures, while the weakest were recorded in the type IV classically treated fractures.

Total mobility

Regarding the total mobility, 6 months after the surgery, the mobility was slightly better in the arthroscopic treated group, without a statistically significant difference; the 6-month results remained valid in time but still, 4 years after, there could be observed a

discrete involution regarding the situation observed 12 months after surgery.

Pain

Statistically significant differences were recorded between the two groups, one week after the surgery. The “Arthroscopic” group had significant lower scores, sustained by the minimal invasive approach way and by the minimal surgical trauma. The pain evolution was favourable in time in both groups; the “Arthroscopic” study group permanently kept a slightly ascending trend, but still remaining insignificant. Very few cases still evoked slight pain 6 months after the surgery.

The necessity of a new surgical intervention

In the first group, 3 additional surgical interventions were recorded during the follow-up period:

- The ablation of a migrated screw;
- The suture of a dehiscent injury;
- Arthroscopy with partial arthroscopic meniscectomy for blocking and persistent episodes of post-fracture hydrarthrosis without any other trauma induced symptoms.

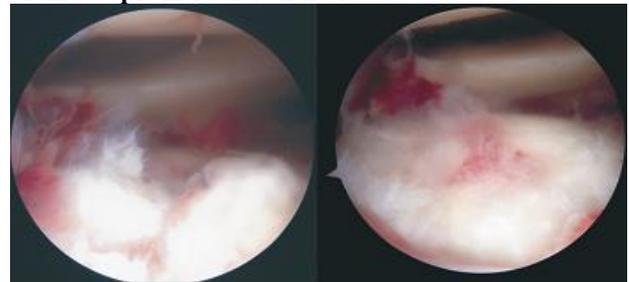
A single intervention was necessary in the “Arthroscopic” group – the ablation of a screw in an extremely underweight patient, where the screw head was close to damaging the skin.

The appearance of degenerative injuries

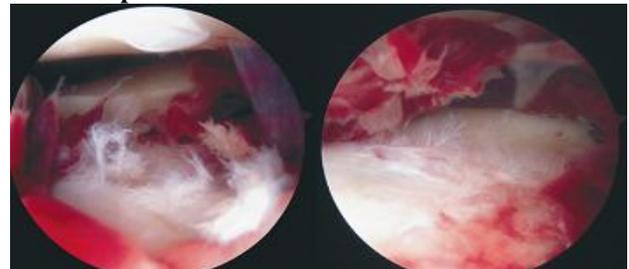
In the “Arthroscopic” group, 4 years after, Ahlback I injuries were present in 3 cases.

In the “Classic” group, 4 years after, Ahlback I injuries were recorded in 4 cases.

Picture no. 1 – Fracture before and after reduction – arthroscopic intraarticular views



Picture no. 2 – Fracture before and after reduction – arthroscopic intraarticular views



CONCLUSIONS

1. The reduction under arthroscopic control is superior to that under visual +/- radiological control.
2. The proposed technique follows the minimal invasive

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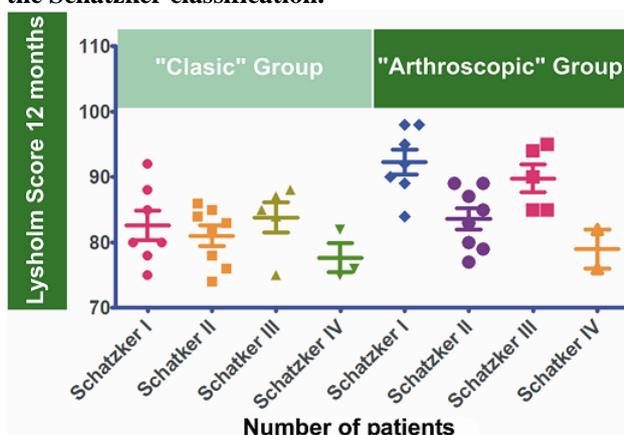
surgery principles. The post-surgery pain is significantly reduced.

3. The joint mobility is superior to that obtained by the "classical" technique. The arthroscopic technique allows a faster and better quality functional rehabilitation.
4. It has superior functional results regarding the classical techniques in all temporal segments. The clinical scores have significant statistical higher values.
5. It enables the diagnosis and treatment of associated injuries – partial meniscectomy for meniscal injuries, removal of meniscus enclaved in the fracture, removal of free osteocartilaginous bodies from the joint.

Picture no. 3 – Bilateral fractures of tibial plateau and diaphyseal fracture of the right tibia. The fracture of the tibial plateau did not allow osteosynthesis with centromedullary nail and a plate osteosynthesis was performed. In order to avoid an intraarticular lengthening of the approach, a miniinvasive reduction under arthroscopic control with minimal invasive osteosynthesis was performed. The contralateral tibial plateau fracture underwent open reduction and osteosynthesis with plate and screws under fluoroscopic control.



Picture no. 4 – Lysholm score 12 months after the surgery, according to the type of fracture regarding the Schatzker classification.



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