Aspect Regarding Plastic Deformations in Tibial Plateau Fractures

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Our purpose was to study tibial plateau fractures considering the rise of their incidence, their potential immediate seriousness or late complications and their complexity. We realized a clinical-statistical study concerning the incidence of tibial plateau fractures taking in account critaeria like age, sex, mechanism of injury, fracture type and correlations between these. The study involves 126 patients, 98 (77.77%) being treated surgically and 28 (22.22%) conservatory between 2008–2016 in the I-st Clinic of Orthopaedics and Traumatology Timisoara. Approximately 2/3 of cases are of Schatzker type I, II and III. Type VI Schatzker occured in 5.78% of all, the mechanism of injury being split almost equal between road accidents and falls from height. Road accidents prevale as a causing circumstance of tibial plateau fractures. 2/3 of the tibial plateau fractures associate with other significant regional lesions. Bone lesions are not rarely underestimated by plain radiographs. Therefore evacuation of haemarthrosis (showing lipohaemarthrosis) and high performance imaging (CT, MRI) are often needed. In comparison to other fracture sites, imperfect reduction of tibial plateau fractures results more frequently in long term sequellae. Being frequently complex, comminuted fractures with associated regional lesions tibial plateau fractures raise the complexity of the medical act from establishing a complete diagnosis to the final therapeutic measures. For a correct and complete preoperatory diagnosis frequently high performance imaging is needed. Tibial plateau fractures significantly affect patients, the healthcare and social-economic system, the healing and rehabilitation.

Keywords: tibial plateau fractures, associated lesions, imaging

Tibial plateau fractures have always been and continue to be, to great extent, a real challenge for orthopeadic surgeons, due to regional anatomical features and frequent damage of the joint surface in a bear-weighting limb. Furthermore, the great variety of anatomical pathology of these fractures also urged us to conduct this study [1, 2,].

Treatment challenges are linked to the spongy and brittle characteristic of the proximal tibia, especially when the fracture lines are multiple and when they cause a local compression of the subchondral bone. The frequent compression of the articular cartilage / subchondral bone, tears of the meniscus and of the joint ligaments all endanger the perfect anatomical reduction, and can lead to early osteoarthritis and joint laxity, sometimes even after a primary correct surgical treatment [3-6].

For best results compression fractures should be elevated and the remaining free space filled with autologous bone grafts [7- 10].

Tibial plateau fractures are often underestimated by plain radiographs, but they can be confirmed by evacuation of haemarthrosis (showing lipohaemarthrosis) and high performance imaging (CT, MRI) [11-13].

Objective

Our purpose was to study tibial plateau fractures considering the rise of their incidence, their potential immediate seriousness or late complications and their complexity. Most of these fractures are intraarticular, thereby generating most of the treatement challenges, as well as major medical and social costs.

Experimental part

Patients and methods

We realized a clinical-statistical study concerning the incidence of tibial plateau fractures taking in account critaeria like age, sex, mechanism of injury, fracture type and correlations between these.

The study involves 126 patients, 98 (77.77%) being treated surgically and 28 (22.22%) conservatory between 2008-2016 in the I-st Clinic of Orthopaedics and Traumatology Timisoara (fig. 1) [14- 16].

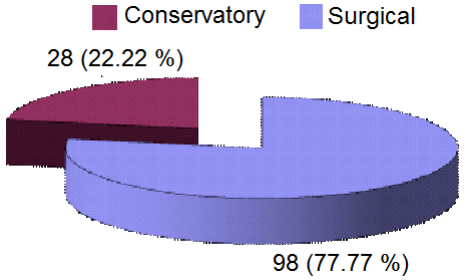

Fig. 1. Distribution of patients by treatment choice

Results and discussions

Of the 126 patients, 68 (53.96 %) were male, and the rest of 58 (46.03%) were female.

Out of the lot included in the study, 121 of the fractures occured in adulthood, and 5 cases were of patients in the growth period -epiphysiolysis.

We observed these fractures to prevale in men up to 50 years of age, and in women over this age. This finding is associated especially with a more impetuous lifestyle in men of younger ages, and a more intense decrease in bone density in menopausal women (fig. 2).

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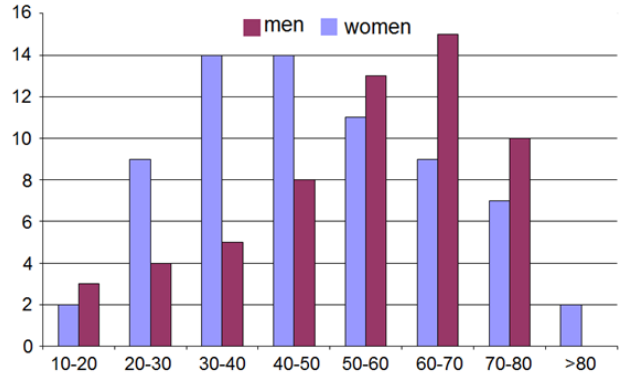

Fig. 2. Distribution of age groups and sex

Considering the mechanisms of injury, we observed road accidents to be the leading cause of tibial plateau fractures, whether betweens cars, between cars-pedestrians, or accidents involving two-wheel vehicles [1, 17- 19].

The second cause was the fall from low height or same-level height, especially in elderly patients (14.28%). This was closely followed by the third cause, falls from height (12.69%), which occured mostly in young or middle-aged patients and happened as accidental falls in the home, in the workplace and even voluntary jump in the attempt to escape aggression (table 1) [15, 17].

Table 1

CIRCUMSTANCES OF FRACTURES

Circumstances of fractures	Number	Percent (%)
Road accidents	72	57.14
Falls from same height: stairs, sliding, torsion	18	14.28
Falls from height	16	12.69
Direct injury (work accident, aggression)	8	6.34
Sports injuries	6	4.76
Other causes	6	4.76
Total	**126**	**100**

Considering the distribution of fracture types, we observed that Schatzker type I, II and III made up approximately 2/3 of cases. Type VI Schatzker occured in 5.78 % of all, the mechanism of injury being split almost equal between road accidents and falls from height (table 2) [19].

Schatzker type I, II and III, observed in approximately 2/3 of cases, affected the external tibial plateau [18, 20]. This is linked to the physiological valgus of the knee (especially in women) and the external plateau being more exposed in case of accidents of all types, including road accidents. Other important factors are the lower bone density of the external plateau, its weaker trabecular structure, and the instinctive tendency to fall with the lower limbs slightly abducted.

Table 2

OCCURENCE OF TIBIAL PLATEAU FRACTURES (SCHATZKER CLASSIFICATION)

Fracture type	Number	Percent (%)
Schatzker I	23	19
Schatzker II	35	28.92
Schatzker III	21	17.35
Schatzker IV	13	10.74
Schatzker V	22	18.18
Schatzker VI	7	5.78
Total	**121**	**100**

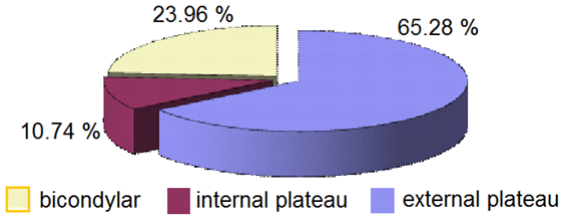

Fig. 3. Distribution of fractures in adults - unicondylar / bicondylar

The external tibial plateau was affected in 79 cases (65.28%), the internal one in 13 cases (10.74%), and the bicondylar fracture occured in 29 cases (23.96%). These findings are presented in figure 3.

Of the total 126 cases, 3 were open fractures (2.38%) – two of these were type I GA and one was type II GA, and the remaining 123 were closed fractures (97.62%).

Studying the mechanism of injury correlated with the fracture type, we observed that most road accidents led to Schatzker type II fractures (17 cases), followed by Schatzker type V and III (14 cases, 13 cases respectively). Type V fractures mostly occurred in high energy impacts (table 3) [21- 23].

Tibial plateau fractures are often complicated by association with other significant regional lesions in 2/3 of the cases.

Not taking into account skin lesions, the most frequent associated regional lesions are: fractures of the fibula head, external meniscus tears, cruciate ligament injuries, internal meniscus tears, collateral ligament injuries and avulsion fractures of the tibial spines or rim (table 4).

From the total of associated regional lesions, external meniscus tears and fibula head fractures affected almost half of the patients (46%) in almost equal parts. In 15 patients with meniscus lesions primary surgery for these was performed, and in 13 patients delayed surgery was performed. The following occurrence were injuries of the internal collateral and anterior cruciate ligaments, both with 5.55%.

Correlations have been made between fracture type and associated regional injuries (table 5).

		Road	Fall	Fall from height	Direct injury	Sports	Other	Total
Schatzker	I	11	2	3	2	3	2	23
	II	17	6	4	3	2	3	35
	III	13	8	-	-	-	-	21
	IV	10	1	1	1	-	-	13
	V	14	1	4	2	-	1	22
	VI	4	-	3	-	-	-	7
Salter Harris	I	1	-	-	-	1	-	2
	III	1	-	1	-	-	-	2
	IV	1	-	-	-	-	-	1
Total		**72**	**18**	**16**	**8**	**6**	**6**	**126**

Table 3

CORRELATION BETWEEN FRACTURE TYPE AND MECHANISM OF INJURY

Table 4

ASSOCIATED REGIONAL LESIONS

Associated lesions	Number	Percent (%) of the total cases
Fibula head fractures	30	23.80
External meniscus (EM) tears	28	22.22
Medial collateral lig. (MCL) lesions	7	5.55
Anterior cruciate lig. (ACL) lesions	7	5.55
Avulsion fractures of the tibial spines	6	4.76
Lateral collateral lig. (LCL) lesions	2	1.58
Posterior cruciate lig. (PCL) lesions	2	1.58
Internal meniscus (IM) tears	2	1.58
Total	**85**	**66.62**

Fibula head fracture occurred in almost half of the cases in type II fractures, while most of the external meniscus tears associated with Schatzker type III and II.

Medial collateral ligaments (MCL) injuries were uniformely distribuited among I, II, V and VI Schatzker type fractures.

Anterior cruciate ligament (ACL) injuries occurred in most cases (6) of significant compression and split fractures (type II, V and VI). A single case was observed in a Schatzker type III fracture.

Avulsion of tibial spines was noted in 5 out of 6 cases of high energy fractures (type IV, V and VI).

Conclusions

In the last decades, the frequency and severity of tibial plateau fractures has increased, due to road accidents becoming the main cause of their occurrence. In our study, road accidents were responsible for 57.14% of tibial plateau fractures, outnumbering the total of other causes combined.

In comparison to other fracture sites, imperfect reduction of tibial plateau fractures results more frequently in long term sequellae.

Being frequently complex and comminuted fractures, with associated regional lesions, they raise the complexity of the medical procedures from establishing a complete diagnosis to the final therapeutic measures. From the lot of patients studied, 2/3 of the fractures were associated with various regional lesions.

Schatzker type I, II and III fractures were observed in 65.28% of cases, which shows the involvement of the external tibial plateau in 2/3 of the cases. The most complex fractures of Schatzker type VI were observed in 5.78% of cases, their mechanisms of injury being equally distributed between road accidents and falls from height.

For a correct and complete preoperatory diagnosis frequently high performance imaging is needed (MRI, CT, arthroscopy).

Tibial plateau fractures significantly affect patients, the healthcare and social-economic system, during the treatment, healing and rehabilitation period.

The evolution of internal fixation devices and early passive and active knee motion have improved the treatment results of these fractures.

Table 5

CORRELATION BETWEEN FRACTURE TYPE AND ASSOCIATED REGIONAL INJURIES

Associated injury	Schatzker					
	I	II	III	IV	V	VI
Fibula head fracture	3	13	4	-	4	6
EM tears	-	11	12	-	3	2
MCL lesions	1	3	-	-	2	1
ACL lesions	-	2	1	-	2	2
Tibial spines avulsion	-	-	1	2	1	2
LCL lesions	-	-	-	2	-	-
PCL lesions	-	-	-	1	1	-
IM tears	-	1	1	-	-	-
Total	**4**	**30**	**19**	**5**	**13**	**13**

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