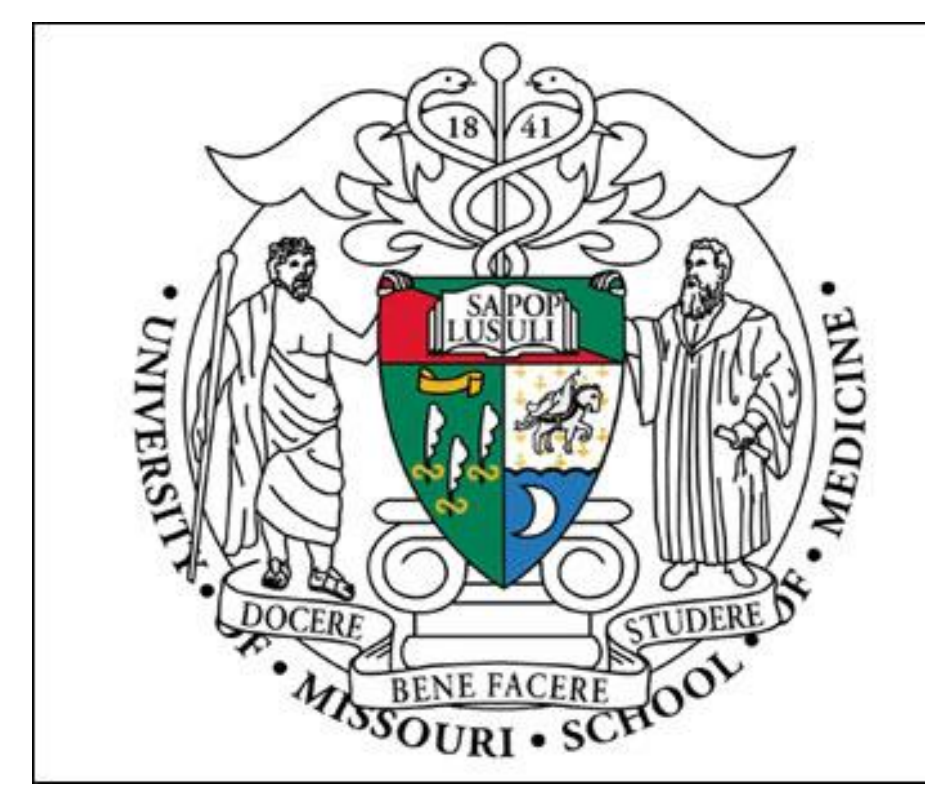




Understanding the correlation between coronal plane tibial plateau fractures and the Schatzker classification system

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Introduction

Tibial plateau fractures are complex injuries, that compromise a critical weight bearing surface of the knee and account for 1.2% of all fractures⁵. Multiple classification systems have been developed to describe the severity of these injuries, with the Schatzker classification in use most frequently today^{1,2} (*Figure 2*). Because Schatzker classification was proposed before the advent of computer tomography, it took into consideration mainly fractures in the sagittal plane of the knee. However, with the advent of tridimensional imaging studies (*Figure 1*), the fractures oriented in the coronal plane have become more evident³. The importance of understanding the exact plane of the fracture is related to the accuracy of planning and treatment. Today, computer tomography and magnetic resonance imaging are instrumental for optimal preoperative planning and understanding of associated soft tissue injuries^{6,7,8}. The relationship between Schatzker classification and fractures oriented in the coronal plane has yet to be investigated.

Objective

The primary goal of our study was to correlate Schatzker classification with coronal plane oriented fractures documented by radiologic studies. Our secondary goal was to understand the association of coronal plane fractures with soft tissue injuries allowing a better characterization of the extent of these complex injuries.

Materials & methods

We performed a retrospective analysis of data related to patients who were treated for tibial plateau fractures between 1/1/2007 and 5/15/2017 at the University of Missouri Hospital and the Missouri Orthopedic Institute. Pediatric patients, patients with incomplete plain films, patients with pathological fractures, and those with previous hardware or existing knee injury, were excluded. Knee radiographs (XR) were reviewed for all patients, Computer tomography (CT), and magnetic resonance imaging (MRI) studies, when available, were also assessed. Each fracture was classified based on the Schatzker system and also on the main plane of fracture (coronal, coronal and sagittal, or sagittal). An epidemiologic analysis of all collected data was performed.

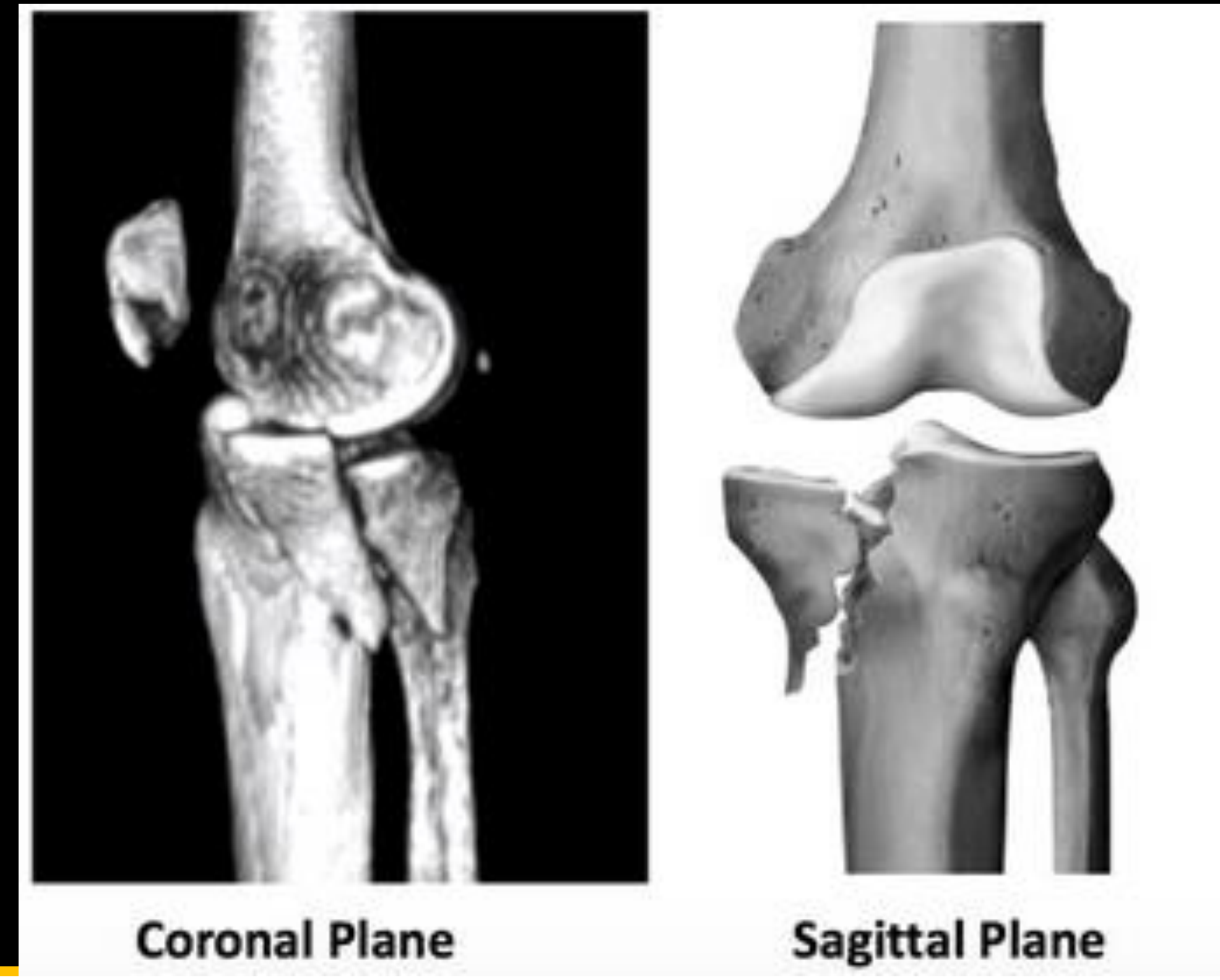


Figure 1: 3D characterization of main fracture planes in tibial plateau fractures

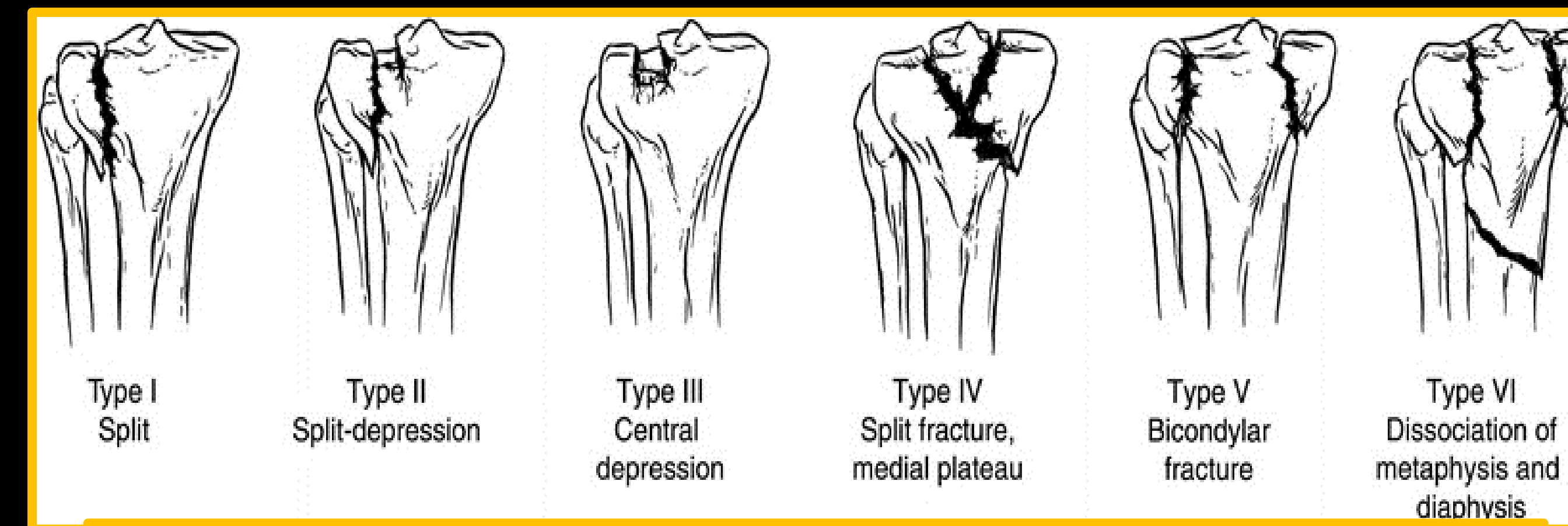


Figure 2: Schatzker classification method of tibial plateau

Soft Tissue Injury	Coronal Plane Fractures
Lateral meniscus	57.26%
Medial meniscus	42.74%
ACL	42.74%
MCL	33.33%
LCL	23.08%
PCL	21.37%
Popliteus	17.95%

Table 1: Prevalence of soft tissue injuries in tibial plateau fractures

All	Coronal	Sagittal	Total	MRI	Coronal	Sagittal	Total
Type I	0	23	23	Type I	5	6	14
Type II	54	158	212	Type II	18	46	62
Type III	2	8	10	Type III	1	2	4
Type IV	50	54	104	Type IV	27	23	50
Type V	100	64	164	Type V	51	23	73
Type VI	61	64	125	Type VI	16	16	32
Totals	267	371	638	Totals	118	116	235

*Table 2: A: Total number of fractures in each Schatzker category separated by the presence of coronal involvement
B: Number of fractures with MRI studies in each Schatzker category separated by the presence of coronal involvement*

Results

Our initial search, returned 1235 patients with tibial plateau fractures. After applying inclusion and exclusion criteria, 638 cases remained. 267 (41.84%) of these patients had either isolated or concomitant coronal involvement of the tibial plateau, with 118 cases in this cohort (44.19%) undergoing magnetic resonance imaging (MRI). The remaining 371 (58.15%) cases were fractures in the sagittal plane. 116 (31.27%) of the sagittal plane oriented plane fractures underwent MRI studies. Further analysis revealed that the fracture dislocation types of Schatzker (IV, V, and VI)¹, were the most likely to have coronal involvement. Of these categories, Type V fractures were the most likely to have coronal involvement (60.97%), with Type VI (48.80%) and Type IV (48.08%) fractures also showing significant incidence (*Table 2A*). The rates of coronal involvement are even higher for the population of patients that underwent MRI, with 69.86%, 54.00%, and 50.00% involvement for type V, Type IV, and Type VI, respectively (*Table 2B*). Additionally, many of the fractures with coronal involvement were associated with significant soft tissue compromise. The most often reported injuries were lateral meniscus (57.26%), medial meniscus (42.74%), ACL (42.74%), and MCL (33.33%) (*Table 1*).

Conclusion

Fractures oriented in the coronal plane were overlooked for many years, before the advent of three dimensional imaging studies. The current study demonstrates that this pattern is very prevalent and most frequently associated with high energy trauma. This is highlighted by the finding that fracture dislocation types, described as Schatzker classifications IV, V and VI, are most likely associated with coronal plane compromise of the joint. Such injuries may require special surgical planning, and are good indications for complementary three dimensional imaging studies.

Further research is needed to determine the exact patterns of soft tissue injuries associated with each Schatzker type. This future analysis may offer guidance to surgeons regarding what should be expected for each Schatzker type and, therefore, enable surgeons to foresee all needed resources to address not only the bony injury, diagnosed by radiographs, but all associated soft tissues damage.

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