June 2000

Tibial plateau fractures A new classification scheme

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CLINICAL ORTHOPAEDICS AND RELATED RESEARCH
Number 375, pp. 231–242

Tibial Plateau Fractures

A New Classification Scheme

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Fractures of the tibial plateaus are common injuries. Various classification schemes have been used to describe these injuries. Although each system has its own purpose, the simpler systems do not allow comparison with more complex divisions. The problem is compounded by the variable use of adjectives that describe these fractures. A comprehensive classification of tibial plateau fractures should group fractures that are similar in topography, morphology, and pathogenesis, requiring similar treatment, and having a similar prognosis. Fracture dislocations and standard tibial plateau fractures should be incorporated into a single classification to avoid the use of two complementary classifications. Any such classification should not be difficult to remember or to use. Keeping in mind these requirements, the authors devised a simple yet comprehensive classification.

The authors studied 80 cases of tibial plateau fractures from January 1988 to September 1997, and used contemporary classifications of tibial plateau fractures as a database to formulate the new classification. A new fracture, subcondylar bicondylar with coronal split, has been classified for the first time. An alphanumeric system has been developed that has made nomenclature easy to remember and use. An effort has been made to address the profoundly confusing issue of variable adjectives that describe these injuries. A review of the literature shows that fractures in the authors' classification have been grouped according to similar pathomechanics, treatment, and functional results.

The fractures involving the proximal articular surface of the tibia are grouped loosely and are defined as tibial plateau fractures. Basically, these are a conglomerate of two discrete entities. One is the standard tibial plateau fracture, arbitrarily defined as depression or displacement of the articular surfaces of the proximal tibia without concomitant significant injury to the capsule or ligaments of the knee.[14] The incidence of ligament injuries in these fractures is approximately 20% to 30%.[7,9] The second entity includes a constellation of periarticular fractures, occult ligament ruptures, and joint instability. The common radiographic finding in these cases is either a compression or avulsion fracture of the rim of the articular surface, not in its central area, or a fracture of the entire condyle accompanied by radiologically

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Received: January 23, 1998.

Revised: November 13, 1998; May 3, 1999; October 6, 1999.

Accepted: October 20, 1999.

recognizable injury to the ligamentocapsular structures.[14] The incidence of ligament injuries in these fractures is 60% to 100%.[7,9] The second fracture entities are known as fracture dislocations, and their pathomechanics, treatment, and prognosis are different from those of standard tibial plateau fractures. The prognosis of fracture dislocations is intermediate between that of tibial plateau fractures and classic knee dislocations, which are defined as pure ligamentocapsular injuries.[14]

Various classification schemes have been used to describe these injuries, making comparisons between series and appropriate therapeutic decisions difficult.[25] Earlier fracture classifications were based on the degree of fracture displacement.[11] These categories encompassed many fracture configurations and thus were broad. Later fractures were classified according to anatomic types by Palmer in 1951,[18] and by anatomic type and extent by Hohl and Luck in 1956,[8] and by Muller et al in 1979.[15] In 1979, Schatzker et al[23] realized the importance of topographic differences and morphologic features in classifying these fractures. Therefore, Schatzker et al[23] modified the classification of Muller et al.[15] Later, the classification of Schatzker et al[23] was extended and modified by Honkonen and Jarvinen in 1992.[11] In 1990, Muller et al[16] introduced another detailed but complex classification, with more than 50 types, groups, and subgroups of tibial plateau fractures based on morphologic features, topographic features, degree of fracture displacement, the extent of articular involvement, and the amount of metaphyseal comminution. Moore[14] described fracture dislocations in 1981, which were classified into five types. When considered with Hohl's[7] plateau fracture types, these accounted for most of the tibial plateau fracture configurations seen clinically. Thus, to avoid the use of two complementary classifications, which become difficult to use and remember, Hohl and Moore[9] merged their concepts into a new classification.

However, lack of a workable classification has led surgeons to use various classifications, including those of Roberts,[20] Hohl,[7] Schatzker,[22] modified Schatzker by Honkonen and Jarvinen,[11] Muller et al,[15,16] Hohl and Moore,[9] and a combination of classifications, such as the classifications of Muller et al[15] and Moore[14] combined by Tscherne and Lobenhoffer[26] and the classifications of Muller et al[16] and Schatzker[22] combined by Marsh et al.[13]

A new classification, its rationale, and its advantages compared with previous classifications is proposed, and existing classifications and their rationale and drawbacks are discussed.

CLASSIFICATION

Tibial plateau fractures have been divided topographically into seven broad groups (Table 1). The first two groups are the lateral tibial plateau fractures (Fig 1A) and medial tibial plateau fractures (Fig 1B). These groups consist of fractures occurring in the sagittal plane. Fractures involving either tibial plateau in the coronal plane, with separation of the fracture fragment posteriorly, have been grouped under posterior tibial plateau fractures (Fig 1C). This term has been used like the term posterior malleolar fractures to accommodate coronal splits in the topographic classification. Coronal splits with separation of the fracture fragments anteriorly have been grouped under anterior tibial plateau fractures (Fig 1D). The peripheral rim of the tibial plateaus has been identified as a separate topographic landmark with no distinction between the lateral and medial halves, and its fractures have been grouped under rim fractures (Fig 1E). Fractures that simultaneously involve both tibial plateaus have been grouped under bicondylar fractures (Fig 1F). Finally, fractures involving one or both plateaus with an additional fracture at the subcondylar level or at the metaphyseal diaphyseal junction have been grouped under subcondylar fractures (Fig 1G).

An alphanumeric system was developed, which in some respects is similar to those described by Tscherne and Lobenhoffer in

TABLE 1. Tibial Plateau Fractures: Authors' Classification

Topographic Features	Morphologic Features
1. Lateral tibial plateau fractures	L1-Wedge L2-Pure depression L3-Wedge and depression L4-Total condyle L5-Entire condyle
2. Medial tibial plateau fractures	M1-Wedge M2-Pure depression M3-Wedge and depression M4-Total condyle M5-Entire condyle
3. Posterior tibial plateau fractures	P1-Posterolateral split P2-Posteromedial split
4. Anterior tibial plateau fractures	A1-Anterolateral split A2-Anteromedial split
5. Rim fractures	R1-Rim avulsion fractures R2-Rim compression fractures R3-Rim combination fractures
6. Bicondylar fractures	B1-Nonarticular bicondylar B2-Articular lateral B3-Articular medial B4-Articular lateral and medial
7. Subcondylar fractures	S1-Subcondylar lateral S2-Subcondylar medial S3-Subcondylar bicondylar S4-Subcondylar bicondylar with split

1993[26] and to the AO universal classification system proposed by Muller et al in 1990.[16] The main benefit of using this system is to make the nomenclature easy to remember and use. It also helps in effectively organizing and displaying the data. The first letter of each group is used with a number to describe fractures in a group. Thus, L is used for lateral tibial plateau fractures, which are divided additionally into five subgroups L1 through L5. Similarly, the other six groups are denoted by the first letter of their names and divided in subgroups as shown in Table 1.

Lateral and medial tibial plateau fractures each are subdivided into five subgroups. Morphologically, these fractures are similar, but topographic, pathomechanical, treatment, and prognostic differences necessitate this stratification. These subgroups are wedge, pure depression, wedge and depression, total condyle, and entire condyle (Fig 1A–B). All of these fractures occur in a sagittal plane.

Posterior and anterior coronal splits are grouped separately under posterior tibial plateau fractures and anterior tibial plateau fractures, respectively. Each of these is divided into two types, posterolateral and posteromedial splits (P1, P2) and anterolateral and anteromedial splits (A1, A2), respectively (Fig 1C–D).

The fifth group is that of rim fractures. The topographically significant feature is the rim itself and not its medial or lateral halves. These fractures have been subdivided into three types: rim avulsion fractures (R1), either lateral or medial; rim compression fractures (R2), either lateral or medial; and rim combination fractures (R3) with lateral avulsion and medial compression or vice versa (Fig 1E). Because the basic mechanism of injury causing all rim fractures is the same, avulsion and compression fractures can be seen in the same knee.[14] Avulsion of Gerdy's tubercle is included in lateral rim avulsion fractures as suggested by Moore,[14] but avulsion of the fibular styloid, tibial spines, and tibial tuberosity have been considered associated fractures and are not included in the classification presented here.

Bicondylar fractures have been divided into four subgroups: nonarticular; articular lateral (both plateaus are fractured but there is predominant involvement of the lateral plateau); articular medial; and articular lateral and medial. Nonarticular bicondylar fractures have been described as extraarticular bicondylar fractures (Type 5A) by Schatzker et al,[23] and as inverted V fractures by Hohl and Moore.[9] In this type of fracture, articular cartilage is not involved because the fracture lines begin near the median eminence. Because of the attachments of respective collateral and cruciate ligaments to the sheared fragments,

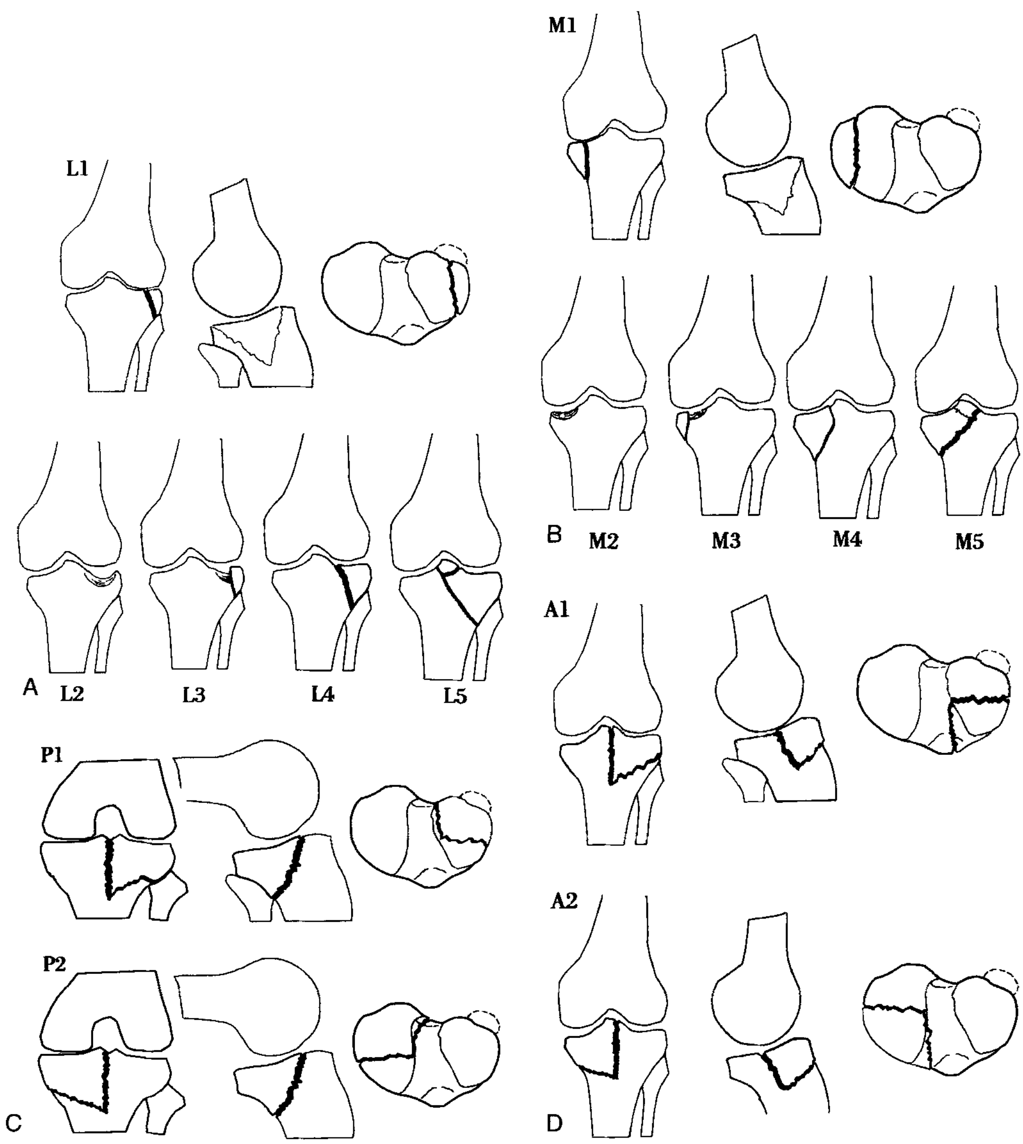
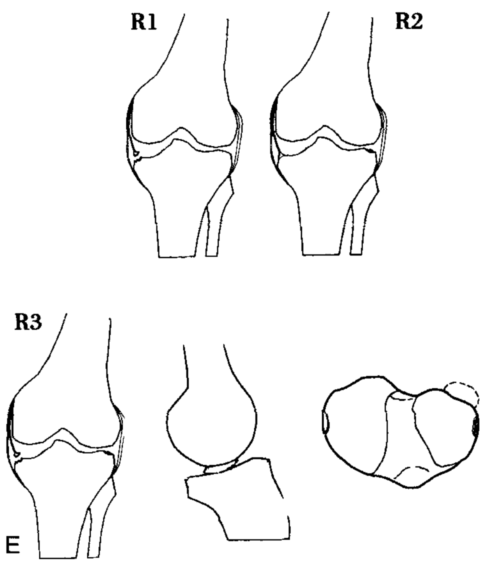
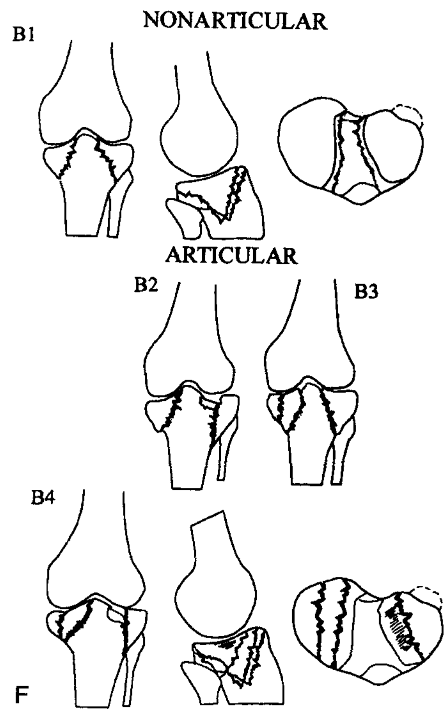


Fig 1A–D. Comprehensive topographic and morphologic classification of tibial plateau fractures. Mechanisms of injury also are shown. (A) Lateral tibial plateau fractures: wedge (L1), pure depression (L2); wedge and depression (L3); total condyle (L4); entire condyle (L5). (B) Medial tibial plateau fractures: wedge (M1), pure depression (M2); wedge and depression (M3); total condyle (M4); entire condyle (M5). (C) Posterior tibial plateau fractures: posterolateral split (P1); posteromedial split (P2). (D) Anterior tibial plateau fractures: anterolateral split (A1); anteromedial split (A2). *(continues)*





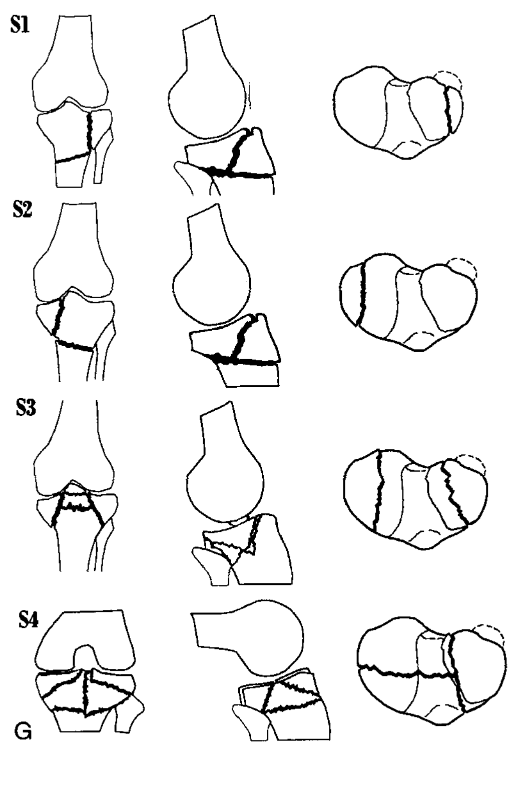


Fig 1E–G. (*continued*) (E) Rim fractures: rim avulsion (R1); rim compression (R2); combination fractures (R3). (F) Bicondylar fractures: nonarticular (B1), articular lateral (B2); articular medial (B3), articular lateral and medial (B4). The essential distinguishing feature from the subcondylar bicondylar fractures is the continuity of the metaphysis and the diaphysis. (G) Subcondylar fractures: subcondylar lateral (S1), subcondylar medial (S2), subcondylar bicondylar (S3), subcondylar bicondylar with coronal split, which may involve either of the plateaus and be posterior, anterior, or combined anterior and posterior. Moore's four-part fracture dislocation has been included in subcondylar fractures. A double shadow on the side of the coronal split may be visible in the anteroposterior view and a step-off in the lateral view with an inverted V sign in combined anterior and posterior coronal split.

traction frequently effects acceptable reduction. Articular bicondylar fractures are those in which the fracture line begins within the articular cartilage (Schatzker et al,[23] Type 5B). These fractures have been grouped according to the location of the principal articular lesion, whether predominantly lateral, predominantly medial, or lateral and medial. An anatomic reduction cannot be achieved in these fractures with traction. Thus, closed reduction has no role in the treatment of this type of fracture with significant displacement. Fractures with predominant involvement of the lateral plateau have a better prognosis.

According to Hohl,[7] subcondylar fractures are those that are associated with subcondylar or upper tibial shaft fracture. Schatzker et al[23] defined these as fractures in which the metaphysis is separated from the diaphysis. These fractures cannot be reduced by closed means or by indirect methods before internal fixation as traction results in separation at the metaphyseal diaphyseal junction or higher at the subcondylar (epiphyseal) metaphyseal junction. In addition, angular deformity may develop at these levels, which subsequently would affect adversely the long-term results of treatment. Thus, fractures occurring anywhere from the subcondylar level to the metaphyseal diaphyseal junction have been classified as subcondylar fractures. The prognosis becomes worse as the amount of comminution increases in this region, so Moore[14] and Hohl and Moores'[9] four-part fracture dislocation has been included as a subgroup of subcondylar fractures, termed subcondylar bicondylar fracture. Subcondylar fractures have been divided into four subgroups, S1 to S4 (Fig 1G): subcondylar lateral (involvement of only the lateral plateau); subcondylar medial; subcondylar bicondylar; and subcondylar bicondylar with split (coronal). The split may involve either of the plateaus and be posterior, anterior, or combined anterior and posterior. The last split has been classified for the first time, although it seems to have been recognized by others.[1,5,12,26] The fracture configuration at the subcondylar or metaphyseal diaphyseal junction may be oblique in the sagittal plane, oblique in the coronal plane, transverse, or comminuted.[16]

MATERIALS AND METHODS

One hundred thirteen cases of tibial plateau fractures were studied retrospectively at the authors' hospital between January 1988 and September 1997. Difficulties were encountered in classifying these injuries. Many of these injuries could not be classified using any of the known classifications, and most of the fractures with different topographic features, morphologic features, pathophysiologic characteristics, and treatment were grouped together as one entity in most of these classifications. Another problem was the use of variable adjectives to describe these injuries. These difficulties led to the development of a new comprehensive topographic and morphologic classification with similar pathophysiologic features, treatment, and prognosis. An attempt was made to standardize the use of variable adjectives that describe these injuries.

The classification was based on the data available from 80 of 113 cases. Sufficient data were not available in 33 of the 113 cases that subsequently were eliminated from the study group. Because of the inadequate number of fractures, contemporary classifications of tibial plateau fractures also were used as a fracture database to formulate the new classification.[6–9,11,14,15,16,22,23]

RESULTS

Eighty cases treated between January 1988 and September 1997 were studied. The mean age of the patients was 42 years (range, 24–72 years). Men outnumbered women by four to one. Standard tibial plateau fractures were present in 75% of the cases and fracture dislocations in 24% of the cases. The most common mode of injury was a traffic accident, followed by an automobile and pedestrian accident. Less commonly the injuries involved falls or gunshots.

The distribution of fracture types in the study group, according to the authors' classification, is shown in Table 2.

TABLE 2. Distribution of Fracture Types According to Authors' Classification

Fracture Types	Number
L1	02
L2	02
L3	22
L4	05
L5	02
M2	01
M5	02
P1	03
P2	07
A1	01
A2	01
R1	05
B4	01
S1	03
S3	07
S4	16

n = 80 fractures.

DISCUSSION

Fractures of the tibial plateaus are common and difficult to treat, and the optimum treatment is a matter of controversy. The anatomic differences between lateral and medial tibial plateaus should be considered when treating these injuries. Several investigators have shown that, on weightbearing, loads are not applied equally to the entire joint surface, but are transmitted over small areas of the tibial plateau, with the medial joint surface bearing a larger load than the lateral surface. The menisci are major load transmission and loadbearing structures.[4,17] It has been shown in experiments with anatomic specimen knees that almost the entire load of weight borne on the lateral compartment is carried by the lateral meniscus.[4] In contrast, load distribution on the medial side is shared equally by the medial meniscus and the exposed articular cartilage. The weightbearing function of the lateral meniscus may explain why functional results after lateral plateau fractures are usually good to excellent, despite the sometimes unsatisfactory radiographic appearance. This function also may explain the higher frequency of less satisfactory functional results in the medial tibial plateau fractures. Additional credence has been provided by an arthroscopic evaluation of tibial plateau fractures in which it was found that the lateral tibial plateau fracture consistently is covered well by the lateral meniscus, which is the true weightbearing surface.

In contrast, the medial condylar fracture frequently shows osteochondral defects in the weightbearing surface medial to the meniscus.[4] In addition, fractures of the medial tibial plateau, with or without an associated fibular fracture, and particularly those with significant obliquity, readily collapse in varus if subjected to weightbearing. Lateral tibial plateau fractures with associated fibular fracture have a tendency to collapse in valgus because of the loss of support provided by the intact fibula.[4,21] Similarly, medially tilting and axial bicondylar fractures have a tendency to collapse in varus, whereas laterally tilting bicondylar fractures have a tendency to collapse in valgus.[10,11] Studies have shown that subjective and functional results of varus deformity are worse than a comparable valgus deformity.[10,11] This observation necessitates different treatment for medial tibial plateau fractures than for lateral tibial plateau fractures, which carry a different prognosis.

Lateral tibial plateau fractures result from a strong valgus force combined with axial loading.[7,9] Medial tibial plateau fractures are caused by a strong varus force combined with axial loading.[7,9] Posteromedial coronal split occurs as a result of varus forces combined with axial loading in a hyperflexed knee.[14] This observation could lead one to think that the rare anterior coronal split of either tibial plateau would be the result of varus or valgus forces combined with axial loading in extension or hyperextension of the knee. Rim avulsion and compression fractures result from severe valgus or varus forces leading to avulsion of a ligamentocapsular attachment from the peripheral rim of the tibial plateau on the side of the stress.[7,9,14] If the force continues, a compression fracture of the peripheral rim of the condyle occurs on the opposite side of ligament rupture or avulsion. Thus, rim avulsion and compression fractures can be seen in the same knee.

Bicondylar and subcondylar fractures result from severe high energy trauma and a combination of mechanisms such as varus or valgus stresses combined with axial loading, which may be concentrated on the lateral or the medial side or be applied more equally to both sides.[7,9,11] Bicondylar subcondylar fractures with coronal split result from a combination of mechanisms mentioned, with hyperflexion leading to posterior coronal split of either or both tibial plateaus or extension and hyperextension leading to an anterior coronal split or a combination of anterior and posterior coronal splits. Thus, the proposition that all of the tibial plateau fractures, including the medial ones, are caused by a mechanism that first involves the lateral tibial plateau is incorrect.[2]

Existing Classifications of Tibial Plateau Fractures

Rationale and Drawbacks

In 1979, Muller et al[15] proposed a simple classification. It groups fractures into wedge, depression, wedge and depression, and comminuted fracture types (bicondylar Y and T fractures). Essentially, this is a morphologic classification and thus does not differentiate between lateral and medial tibial plateau fractures. It does not include fracture dislocations, as described by Moore.[14] It has been used in conjunction with Moore's classification of fracture dislocations.[26]

Schatzker et al[23] modified the AO group classification. Because of differences in pathophysiologic factors, prognosis, and treatment, medial tibial plateau fractures were considered a distinct entity from lateral tibial plateau fractures. Two types of bicondylar fractures also were recognized. The advantages of this classification are that it incorporates topographic and morphologic characteristics, pathophysiologic factors, and treatment. The topographic significance of the medial tibial plateau has been recognized in this classification, but three morphologic types of medial tibial plateau (total, entire condyle, and pure depression) with different treatments and prognoses have been grouped together. With this system, many fractures still remained unclassified.

In 1992, Honkonen and Jarvinen[11] additionally modified the classification of Schatzker et al.[23] They divided the bicondylar fractures into medially tilting, laterally tilting, and axial fractures. They based their arguments on the standard indications for treating tibial plateau fractures being generally based on displacement or on instability, but no differentiation is made between varus and valgus injuries. The tendency of inadequately fixed medial tibial plateau fractures to collapse into varus has been reported.[3,4,21] They found the same phenomenon occurred in medially tilting and axial bicondylar fractures. They also showed that functional and subjective tolerance of varus deformity is lower than that of valgus deformity.[10,11] Their classification attempted to expand the significance of topographic features to bicondylar fractures and to incorporate treatment options and prognosis in classifying these fractures. However, they ignored subcondylar fractures described by Schatzker et al,[23] believing the classification of Schatzker et al[23] divides bicondylar fractures into bicondylar fractures and subcondylar fractures. In addition, fracture dislocations[14] described by Moore have not been included in these classifications, resulting in numerous unclassifiable fractures.

The other system of classification was proposed by Hohl and Luck in 1956.[8] It describes undisplaced, local depression, split depression, and split fractures. Hohl[6,7] expanded the classification and revised the terminology to undisplaced, local compression, split compression, total, split and comminuted (bicondylar) fractures. This was a morphologic classification that did not take into account topographic and pathophysiologic factors.

In 1981, Moore[14] described fracture dislocations of the knee. These dislocations were divided into five types: Type I (split); Type II (entire condyle); Type III (rim avulsion); Type IV (rim compression), and Type V (four part bicondylar fractures).

Hohl and Moore[9] merged their concepts into a new classification. This classification essentially divides fractures into nonarticular (pure subcondylar) and intraarticular.

Intraarticular fractures are divided into minimally displaced (< 4 mm) and displaced. Displaced fractures additionally are subdivided into seven types: local compression, split compression, total depression, split, rim avulsion, rim compression, and bicondylar fractures. According to Hohl,[7] this classification system is popular among North American surgeons. It has certain limitations. First, the division of tibial plateau fractures into nonarticular and intraarticular is inappropriate. As in the classification by Schatzker et al,[23] in Type 5A bicondylar fractures, the fracture lines may be nonarticular, beginning near the median eminence. Similarly, rim avulsion or compression fractures may be nonarticular. Second, although it considers medial tibial plateau fractures as a separate entity, it groups these together with the lateral tibial plateau fractures. Third, two morphologic types, total depression and entire condyle, have been grouped together, and finally, bicondylar fractures and subcondylar fractures also have been grouped together. However, many fractures remain unclassified, such as pure depression of the medial plateau; posterolateral, anterolateral and anteromedial coronal splits; and subcondylar lateral, medial, and subcondylar bicondylar fractures with coronal split.

Currently, the universal classification of Muller et al[16] is popular. An attempt to classify numerous different fractures of the body according to a particular classification system is appreciated but may not be practicable, such as in the knee, where topographic differences resist any such generalization. This classification is the best among the existing classifications because of its comprehensive nature, although true rim avulsion fractures and subcondylar lateral, medial, and subcondylar bicondylar fractures with coronal split remain unclassified. Although topographic features have been considered, the stress primarily has been on a morphologic basis, resulting in grouping of fractures with different prognostic significance and treatment. Because this classification also takes into account the extent of the injury, it has become broad and thus is difficult to remember and bulky to use.

Standardization of Variable Adjectives

The definition of minimally displaced fractures varies or is unspecified by various authors.[7,10,25,26] A review of the literature shows the amount of depression considered to be significant has ranged from 2 to 10 mm.[24,25] Minimally displaced fractures involve one or both plateaus with various fracture configurations. A minimally displaced fracture may have significantly displaced at the time of injury and be inherently unstable. These fractures generally are treated by nonoperative means.[7,9] However, topographic and morphologic differences in fractures do not support any such generalization. Honkonen[10] considers a step-off of less than 3 mm in a lateral tibial plateau fracture as minimally displaced and thus a candidate for nonoperative treatment. However, all fractures of the medial tibial plateau, except fissures, medially tilting, and axial bicondylar fractures, irrespective of the amount of displacement, are considered potentially unstable, and thus are candidates for operative treatment with rigid internal fixation. Therefore, the degree of displacement is not a useful criterion to group together fractures with different topographic features, morphologic features, treatment, and prognosis. It can be described only for individual fracture types and should serve as an indication for surgery.

The issue of variable adjectives is confusing when one considers displaced fractures. The terms impression, compression, depression, crumbly, impaction, and displacement have been used synonymously to mean longitudinal translation distally of the tibial articular surface only or to mean complete longitudinal translation of the fractured condyle distally.

Rasmussen[19] described depression of the tibial plateau as vertical displacement of the cartilage covered joint surface, as seen on lateral radiographic projection. The depression can be total, in one piece or mosaiclike of the whole articular surface, or partial, involving only the central, anterior, or posterior parts of the articular surface of the tibial plateau.[16] Depression has been accepted and used by two authors.[7,22] Muller et al[16] later modified the terminology to pure depression. The other terminology used for such fractures is local compression.[7,9] Rasmussen[19] described compression as crushing of the subchondral bone. There is no doubt that subchondral bone gets compressed and is displaced vertically downward under the collapsing articular cartilage in this type of fracture. However, the term compression has been used synonymously by Hohl[7] and Hohl and Moore[9] to denote local compression fractures of the articular surface of the tibial plateau and also to denote crushing of its peripheral nonarticular part, the rim compression fractures. To avoid confusion between these two uses, the term compression is reserved by the current authors for rim compression fractures only. In addition, the decision to use operative or nonoperative treatment involves the amount and extent of joint depression and not the amount and extent of joint compression. The prefix local is inappropriate because the depression can involve part or all of the articular surface. Thus, the prefix pure is more appropriate. To avoid two terms for one type of fracture, the authors prefer the term pure depression, as described by Muller et al.[16]

Wedge and split are terms that are used synonymously. Rasmussen[19] described split fracture as the one in which the margin of the condyle of the tibia, usually as one large fragment but occasionally as two or three small fragments, is separated from the rest of the condyle in a sagittal plane with only slight crushing of the bone bordering the fracture defect. Other authors[7,9,14,16] have used the term split for a fracture of one of the condyles of the tibia in the coronal plane, which usually involves the medial plateau and is more commonly posterior but can be anterior. However, other authors[7,22] have used the terminology wedge fracture for separation of the margin or part of the condyle in the sagittal plane. The synonymous use of the term split in describing two different types of fractures is confusing. In the current study, the term split is reserved for a fracture of condyles in a coronal plane, either anterior or posterior, and the term wedge for fracture separation in the sagittal plane. Arbitrarily, a wedge fracture can be said to involve half or less of the articular surface of either tibial plateau in a sagittal plane to differentiate it from fracture of the entire condyle.

To elaborate on this description, one can rationalize that a wedge and depression[7,22] fracture would be one in which, apart from the separation of the margin of the condyle of the tibia in a sagittal plane, there is concomitant vertical displacement of the cartilage covered joint surface bordering the fracture defect, which can be seen on a lateral radiograph. Some authors[7,9,22] have used split compression to describe such fracture type. For reasons mentioned, the terms wedge and depression are preferred to that of split compression.

The terminology total depression has been used by Hohl[7] and by Hohl and Moore[9] to describe an oblique fracture of the lateral or medial condyle in a sagittal plane that begins near the intercondylar eminence but does not include it and extends to the cortex of the medial or lateral tibial flare respectively. It is essentially complete longitudinal translation of the entire fractured condyle distally, rather than longitudinal translation distally of the tibial articular surface only, as in pure depression fractures. However, as described, total depression fractures have been described by Muller et al[16] as a subgroup of pure depression fractures for which only the whole of the articular surface of one of the condyles of the tibia, and not the entire condyle, is translated distally. Thus, it seems appropriate to use the terms total condyle in line with the terms entire condyle used by Moore[14] (to describe a similar fracture but one that also includes the intercondylar eminence as part of the fractured condyle or as a separate piece, Moore's Type II fracture dislocation) in place of the term total depression.

Schatzker et al[23] have used the terms extraarticular and intraarticular to classify bicondylar fractures. All of these fractures are in the knee and thus intraarticular. Better terms would be nonarticular, meaning not involving articular cartilage, and articular, meaning involving articular cartilage.

Because each classification has its own purpose, the simpler classifications tend to group together different fractures in one category. However, more complex divisions tend to stratify these injuries on the basis of the extent with other parameters, such as topographic and morphologic characteristics. This has made them too extensive to use and difficult to remember. It is imperative to consider the anatomic differences between the weightbearing surfaces of the lateral and medial tibial plateaus when treating these injuries. Thus, a comprehensive classification of tibial plateau fractures should group fractures that are similar in topographic features, morphologic features, pathogenesis, treatment, and prognosis. Fracture dislocations and standard tibial plateau fractures should be incorporated in one classification to avoid using two complementary classifications. Any such classification should not be difficult to remember or use.

The authors' classification is comprehensive because it includes all of the fracture types reported in the literature, barring those based on the extent of injury. A new fracture (the subcondylar bicondylar with coronal split) has been classified for the first time, although it seems to have been recognized by others.[1,5,12,26] An alphanumeric system has been developed that has made nomenclature easy to remember and use. Fractures have been grouped according to similar pathomechanics. An effort has been made to address the confusing issue of variable adjectives that describe these fractures. This effort should help in the understanding of treatment evaluation and comparison between series. The authors' classification system combines the classification systems of Hohl,[6,7] Muller et al,[15,16] Schatzker et al,[23] and Hohl and Moore.[9]

Tibial plateau fractures are a conglomerate of injuries with differences in topographic features, morphologic features, pathomechanics, treatment, and prognosis. These differences have to be considered when classifying and treating these injuries.

Acknowledgments

The authors thank the residents and medical students who helped in the collection and preparation of the data. The authors especially thank Aslam Bashir and Amir Tariq for help in preparing illustrations and photographs, and Sulaiman Sadruddin, Syed Hameedudin, and Aziz G. Hayder for secretarial assistance.

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