Evaluation of the Interobserver Agreement of the Fraser and Blake & McBryde Classifications for Floating Knee*

Avaliação da concordância interobservador das classificações de Fraser e Blake & McBryde para joelho flutuante

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Abstract

Objective To evaluate the interobserver agreement of two classifications for floating knee: Fraser and Blake & McBryde.

Method Thirty-two observers, subdivided according to the degree of titration (26 resident physicians and 6 orthopedic physicians specialized in orthopedic trauma), classified 15 fractures of the ipsilateral femur and tibia. Interobserver agreement was evaluated by using the Kappa coefficient.

Result When evaluating the agreement between the 9 R1, a Kappa index of 0.58 was obtained for the Fraser classification and of 0.46 for the Blake & McBryde classification. Among the 7 R2, a rate of 0.59 was obtained for the Fraser rating and 0.51 for the Blake & McBryde rating. Among the 10 R3, the agreement index was higher for both classifications: 0.72 for the Fraser and 0.71 for the Blake & McBryde classification. Considering the 3 groups (R1, R2, R3) as one large group, the general Kappa index was calculated, which resulted in 0.63 for the Fraser classification and 0.56 for the Blake & McBryde classification. In the group of trauma and orthopedic knee specialists, in turn, an agreement of 0.597 was obtained for the Blake and McBryde classification and of 0.843 for the Fraser classification.

Conclusion Comparatively, the two classifications presented a weak to moderate degree of agreement. Fraser classification had better agreement in both groups. The agreement was higher when evaluating orthopedic trauma physicians.

Keywords
- tibia fractures/ classification
- validation studies
- evaluation

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Resumo

Objetivo Avaliar a concordância interobservador de duas classificações para joelho flutuante: Fraser e Blake & Mcbryde.

Método Trinta e dois observadores, subdivididos de acordo com o grau de titulação (26 médicos residentes e seis médicos ortopedistas especialistas em trauma ortopédico) classificaram 15 fraturas de fêmur e tíbia ipsilaterais. A concordância interobservador foi avaliada pelo coeficiente Kappa.

Resultado Ao avaliar a concordância entre os 9 R1, obteve-se índice Kappa para classificação de Fraser de 0,58 e para a classificação de Blake & McBryde de 0,46. Entre os 7 R2, obteve-se índice de 0,59 para a classificação de Fraser e 0,51 para a classificação de Blake & McBryde. Entre os 10 R3, o índice de concordância foi maior para as duas classificações: 0,72 para a classificação de Fraser e 0,71 para a de Blake & McBryde. Considerando os 3 grupos (R1, R2, R3) como um só grande grupo, calculou-se o índice Kappa geral, que teve como resultado 0,63 para a classificação de Fraser e 0,56 para a classificação de Blake & McBryde. No grupo dos traumato-ortopedistas especialistas em joelho, por sua vez, obteve-se uma concordância para a classificação de Blake e McBryde de 0,597 e para a de Fraser de 0,843.

Conclusão Comparativamente, as duas classificações apresentaram grau de concordância fraco a moderado. A classificação de Fraser teve melhor concordância em ambos os grupos. A concordância foi maior quando se avaliou médicos ortopedistas especialistas em trauma ortopédico.

Palavras-chave

- fraturas da tíbia/ classificação
- estudos de validação
- avaliação

Introduction

Floating knee is a term that refers to ipsilateral fractures of the femur and tibia. It is due to high-energy traumas, such as traffic accidents,[1] with motorcycle accidents having special importance in our reality. Although its exact incidence is unknown, it is noted that it is a generally rare condition. However, there has been an increase in the number of floating knee cases in recent years, which is proportional to the increase in the number of patients affected by high-energy trauma.[2]

Due to their mechanism of trauma (high energy), episodes of floating knee are often associated with other injuries of traumatology and orthopedic importance, such as fractures at other sites or knee ligament injuries. In addition, for the same reason, there may also be life-threatening injuries, such as head, thoracic or abdominal trauma.[2] The severity of these lesions is reflected in mortality, which ranges from 5 to 15%, according to the literature. Studies also show many open fractures (59–67% of cases) and a high number of cases (20–30%) that require amputation.[3]

Thus, often, in cases of instability, complex joint fractures or severe soft-tissue injuries, the principles of orthopedic damage control may be the safest solution initially. Thus, the definitive fixation, which usually requires a long surgical time, needs to be postponed until the conditions are better for the patient.[4]

It is also important to emphasize that several complications associated with floating knee cases are reported, such as infections, excessive blood loss, fat embolism, delayed consolidation, pseudarthrosis, joint stiffness, prolonged hospitalization, and inability to sustain weight.[1]

In order to establish treatment, as well as in several other trauma injuries, it is of paramount importance that there is an adequate classification of each case. Classification systems have the purpose of facilitating the communication between physicians, assisting in documentation and research, estimating prognosis and guiding therapy.[5]

In their original article, Blake & McBryde, the first to describe the floating knee frame, elaborated the first classification. They divided the traumatological lesion into types I, when both diaphyses are fractured (true floating knee), IIA, when there are fractures involving the knee joint, and IIB, when fractures involve the hip or ankle joint.

In 1978, Fraser et al.,[6] in turn, classified it differently, dividing it into types I (both diaphyses affected), IIA (fractures of the femoral diaphysis and tibial plateau), IIB (fractures of the tibia diaphysis and intra-articular distal femur), and IIC (intra-articular fractures of the knee in the femur and tibia).

To this end, the objective of this study was to evaluate the interobserver agreement of the two best known classifications for floating knee, Fraser and Blake & McBryde, in order to analyze the degree of reliability of these classifications.

Methods

The present study consists of a cross-sectional, observational and quantitative study. The epidemiological study is said to be cross-sectional when factor and effect are observed at the same historical moment. In observational studies, there is no manipulation of the study factor by the researcher. We used radiographs in the anteroposterior incidences and profile of patients treated at the hospital, in the period between

January and May 2013, with ipsilateral fractures of the tibia and femur, accounting for a total of 25 fractures, which, after the exclusion criteria, were summarized to 15. The exclusion criterion was inadequate radiographic documentation, such as poor or incomplete quality radiographs.

The radiographs were randomly organized, and, with them, a Power Point (Microsoft Corp., Redmond, WA, USA) slide-test presentation was prepared. This test was applied to 26 traumatology and orthopedic residents in our institution. Among the tested, there were residents of the 1st, 2nd and 3rd years, 9 R1, 7 R2 and 10 R3. The application of the test occurred during a theoretical session that they participate in weekly (orthopedics and traumatology integrated residency). At the time of the evaluation, each resident received an illustrative picture containing the two classifications (Fraser and Blake & McBryde) and a template to mark the subtype that they judged corresponding to each of the cases. For each case displayed, there was a maximum time of 2 minutes for the answers.

Subsequently, the same test was applied with six trauma and orthopedic knee specialists. The evaluation with the specialists occurred under the same conditions as that performed with the residents regarding the time and sequence of radiographs.

To assess the degree of agreement, we used the Kappa statistical index, according to the interpretation of Landis and Koch (< 0 = without agreement; 0.0–0.20 = slight agreement; 0.21–0.40 = weak; 0.41–0.60 = moderate; 0.61–0.80 = substantial; > 0.81 = excellent).[7] This is a coefficient of agreement that corrects the error due to chance and is used to determine intra- and interobserver variation, being used when two observers separately classify a sample of objects using the same category scale.[8]

The medical records and the corresponding radiographs used in the present study were from the Medical Archive Center (NUAME, in the Portuguese acronym) of the IJF.

The project was submitted to the approval of the Research Ethics Committee, in accordance with Resolution 196/96 of the National Health Council (guidelines and regulatory standards for research involving human beings) under number 87963018.2.0000.5047. The study was informed to patients and observers and a consent form was requested.

Results

When evaluating the agreement between the 9 R1, a Kappa index of 0.58 was obtained for the Fraser classification and of 0.46 for the Blake & McBryde classification. Among the 7 R2, a Kappa index of 0.59 was obtained for the Fraser classification and 0.51 for Blake & McBryde. Among the 10 R3, the agreement index was higher for both classifications: 0.72 for the Fraser classification and 0.71 for Blake & McBryde. Considering the 3 groups (R1, R2, R3) as one large group, the overall Kappa index was calculated, resulting in 0.63 for the Fraser classification and 0.56 for the Blake & McBryde classification (►**Table 1**).

In the group of trauma and orthopedic knee specialists, in turn, the agreement obtained for the classification of Blake & McBryde was of 0.597 and for the Fraser classification, 0.843 (►**Table 2**).

Table 1 Agreement assessment among traumatology and orthopedic residents for the classifications of floating knee (Fraser and Blake & McBryde), according to the Kappa index

YEAR OF RESIDENCE	NUMBER OF RESIDENTS	FRASER CLASSIFICATION	BLAKE & MCBRYDE CLASSIFICATION
1°	9	0.58	0.46
2°	7	0.59	0.51
3°	10	0.72	0.71

Table 2 Evaluation of agreement between orthopedists specialized in knee trauma for the classifications of floating knee (Fraser and Blake & McBryde), according to the Kappa index

NUMBER OF SPECIALISTS	FRASER CLASSIFICATION	BLAKE & MCBRYDE CLASSIFICATION
6	0.597	0.843

Discussion

Classifications in orthopedics and traumatology are tools that help to standardize an international language in the approach to injuries. The proposal of the adoption of a classification system involves its reproducibility capacity, simplicity and ease of memorization, helping in the choice of appropriate therapy and in the prognostic prediction of the lesion.[9]

It is believed that this is the first study that evaluates the degree of agreement between the most used classifications for floating knee. The most important finding of this study was that the Fraser classification presented a higher degree of agreement in relation to the Blake & McBryde classification both among residents and orthopedists. In addition, the only excellent agreement for floating knee was the Fraser classification among knee orthopedists ($K = 0.843$).

Unlike other studies that compared the agreement between very popular classifications in orthopedics, such as Lauge-Hansen and Weber for ankle fractures,[10] Neer for fracture of the proximal humerus,[11] and Garden for femoral neck fractures,[12] that obtained weak agreement according to the Kappa index, the present study showed that all groups, including in 1st-year residents, obtained at least moderate level of agreement for both classifications evaluated. This information reinforces the reproducibility of both Fraser and Blake & McBryde classifications.

The importance of classification in orthopedics and, more specifically, in cases of floating knee can be represented in the study by Demirtas et al.,[13] who, using the classification of Blake & McBryde, demonstrated that associated fractures,

and rate of complications and quality of life can be estimated from the classification. Therefore, an accuracy when classifying cases of floating knee may have value in the search for certain associated lesions and have prognostic value.

Although some publications point out that the Blake & McBryde classification was evidenced as the most recognized and most used one,[14] the authors' opinion is that the Fraser classification should be of choice in cases of floating knee. This is due to the fact that, in addition to being more reproducible as shown in the results, several studies point to the presence of intra-articular fracture as one of the main prognostics factors,[15–18] and the Fraser classification offers greater detail of intra-articular trait.

To minimize the risk of bias, we used the Kappa method. However, we highlight as a limitation of the study that the sample of knee-specialist orthopedists is smaller than that of residents, which makes it difficult to compare agreement between these groups. We can mention as another limitation, the non-performance of intraobserver comparison. Finally, case samples (N) could be more expressive.

Conclusion

The only excellent agreement for floating knee was the Fraser classification among knee specialist orthopedists. Substantial agreement was obtained among 3rd-year orthopedic residents for both Fraser and Blake & McBryde classifications. All other evaluations of agreement between the evaluated groups were considered moderate.

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Conflict of Interests
The authors declare that have no conflict of interests.

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