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Original Article

Evaluation of the reproducibility of the Tronzo classification for intertrochanteric fractures of the femur^{☆,☆☆}



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ABSTRACT

Objective: To evaluate the inter-observer reproducibility of the Tronzo classification for transtrochanteric fractures using the kappa concordance coefficient (κ).

Methods: Twenty radiographic images in anteroposterior view on hips with transtrochanteric fractures of the femur were used. These were classified by 12 observers using the Tronzo method. The images were presented in sequence and a questionnaire containing all the options of the Tronzo classification was filled out, along with a simplified classification using Tronzo divisions into two groups (stable and unstable). The data were analyzed by means of the kappa concordance test.

Results: The following kappa indices were found: for images with stable fractures (Tronzo 1 and 2), 0.11; for images with unstable fractures (Tronzo 3, 3 variant, 4 and 5), 0.52; and for the complete classification, 0.44 (moderate concordance). In turn, the simplified classification did not increase the concordance rates.

Conclusion: The Tronzo classification is unsuitable for clinical practice. We suggest that another system should be used or created for this type of fracture.

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Avaliação da reprodutibilidade da classificação de Tronzo para fraturas introtrocantéricas do fêmur

RESUMO

Objetivo: Avaliar a reprodutibilidade, interobservadores, da classificação de Tronzo para fraturas transtrocantéricas com o uso do coeficiente de concordância kappa (κ).

Métodos: Foram usadas 20 imagens de radiografias do quadril na incidência antero-posterior com fraturas transtrocantéricas do fêmur, classificadas, segundo Tronzo, por

Palavras-chave:

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12 observadores. As imagens foram apresentadas em sequência e foi preenchido um questionário com todas as opções da classificação de Tronzo, além da classificação simplificada, com a divisão de Tronzo em dois grupos (estáveis e instáveis). Os dados foram analisados por meio do teste de concordância de kappa.

Resultados: Foram encontrados os seguintes índices de kappa: para imagens com fraturas estáveis (Tronzo 1 e 2), 0,11; para imagens com fraturas instáveis (Tronzo 3, 3 variante, 4 e 5), 0,52; e para a classificação completa, 0,44 (concordância moderada). Por sua vez, a classificação simplificada não aumentou os índices de concordância.

Conclusão: A classificação de Tronzo não é adequada para a prática clínica. Sugerimos o uso ou a criação de outro sistema para esse tipo de fratura.

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Introduction

Transtrochanteric fractures of the femur occur in the region between the greater and lesser trochanters of the proximal femur and are exclusively extracapsular.¹ In Brazil, in a survey conducted by the Ministry of Health through the National Health System (SUS), it was found that 90% of the funding destined for orthopedic diseases was consumed by nine diseases, which included transtrochanteric fractures.²

Their consequences for society are alarming. Around one-third of the patients die during the first year after the injury, approximately 50% become incapable of walking unaided or going up stairs and 20% start to need continual home care.³

Several systems have been used to classify transtrochanteric fractures and thus guide their treatment. The commonest of these are the Tronzo,⁴ Evans^{5,6} and AO classifications.⁵⁻⁷

The Tronzo classification is widely used in Brazilian orthopedics and traumatology services.

Exact documentation of the fracture depends on the capacity for radiographic evaluation and classification. Its reproducibility depends on the surgeon's skill in interpreting a classification system. The position of the fractured limb, the radiographic technique and the surgeons' levels of experience are factors that contribute toward the reproducibility of a classification system.⁸

Ideally, a classification system should be easy to apply, reliable and helpful in making treatment decisions, and consequently should influence the final result. An ideal system should not have interobserver discrepancies.⁹

Therefore, the aim of this study was to assess the interobserver reproducibility of the Tronzo classification for transtrochanteric fractures of the femur using the kappa coefficient of concordance (κ).

Materials and methods

A cross-sectional observational study was conducted, in which 20 radiographic images of hips with transtrochanteric fractures of the femur, in anteroposterior view, were used. All the patients were over the age of 65 years and had suffered low-energy trauma. The following were used as exclusion criteria for the images: pathological fractures caused by bone

tumors, previous surgery in the region of the proximal femur and images of transtrochanteric fractures from patients under the age of 65 years.

The radiographs were classified in accordance with Tronzo, by 12 observers: four specialists who were members of the society for orthopedic trauma surgery, four third-year residents and four first-year residents of an orthopedics and traumatology service. All of these observers were given prior explanations regarding the Tronzo classification, with graphic images on spreadsheets.

The radiographs of the fractures were presented in the form of slides in the Power Point® software, in sequence, individually numbered from one to twenty, and each image was analyzed for a maximum of 45 s. During the presentation, a questionnaire was filled out to gather data on all the options of the Tronzo classification (**Anexo 1**).

The series of radiographs were analyzed by means of the complete Tronzo classification (six types). Subsequently, this classification was subdivided for analysis into two simple subtypes: stable fractures (Tronzo I and II) and unstable fractures (Tronzo III, III variant, IV and V).

In 1974, Tronzo subdivided these fractures into five types. Types I and II were stable; type I was described as an incomplete transtrochanteric fracture, while type II could present fracturing of the lesser trochanter, but without posteromedial comminution. Types III and IV presented posteromedial comminution; in type III, the diaphysis was brought to a medial position and proximal calcar was fitted to it. When fracturing of the greater trochanter was also present, the situation was classified as III variant (**Fig. 1**). In type IV, the diaphysis was brought to a lateral position, the fracture line was more vertical and the comminution was generally greater. Type V had an inverted line, from lateral to medial and from distal to proximal, which made the fracture unstable (**Fig. 2**). In presenting his classification, Tronzo described the osteosynthesis techniques proposed for the various types of fracture.^{1,4}

The data gathered were analyzed statistically using the kappa concordance test. The software used comprised SPSS V16, Minitab 15 and Excel Office 2007.

Results

Taking all of the observers into account, we found the following kappa indices: for images with stable fractures, 0.11;



Fig. 1 – Transtrochanteric fracture of type III variant. Note the fracturing of the greater trochanter.

for images with unstable fractures, 0.52; and for the complete classification, 0.44 (Table 1).

When we divided the observers into groups consisting of all the residents together versus the orthopedic trauma specialists, we found the following results: for residents, 0.49 for the complete classification, 0.18 for stable fractures and 0.55 for unstable fractures; for orthopedic trauma specialists, 0.39 for complete fractures, 0.20 for stable fractures and 0.52 for unstable fractures (Table 2).

Table 1 – Concordance for the total sample.

	kappa	p value
Stable	0.11	<0.001
Unstable	0.52	<0.001
Complete	0.44	<0.001

Table 2 – Concordance according to title.

	kappa	p value
<i>Residents</i>		
Stable	0.18	<0.001
Unstable	0.55	<0.001
Complete	0.49	<0.001
<i>Orthopedic trauma specialists</i>		
Stable	0.20	<0.001
Unstable	0.52	<0.001
Complete	0.39	<0.001

Lastly, when we took into consideration the division of the observers into all of the groups, we obtained the following results for the group of first-year residents: 0.50 for the complete classification, 0.24 for stable fractures and 0.66 for unstable fractures. For the third-year residents, the results were 0.53 for the complete classification, 0.37 for stable fractures and 0.51 for unstable fractures. Meanwhile, the result for orthopedic trauma specialists was 0.39 for the complete classification, 0.20 for stable fractures and 0.52 for unstable fractures (Table 3).

Table 3 – Concordance according to group.

	kappa	p value
<i>First-year residents</i>		
Stable	0.24	<0.001
Unstable	0.66	<0.001
Complete	0.50	<0.001
<i>Third-year residents</i>		
Stable	0.37	<0.001
Unstable	0.51	<0.001
Complete	0.53	<0.001
<i>Orthopedic trauma specialists</i>		
Stable	0.20	<0.001
Unstable	0.52	<0.001
Complete	0.39	<0.001



Fig. 2 – Radiograph showing Tronzo type V transtrochanteric fracture.

Discussion

The kappa concordance coefficient is often used when the intra- and interobserver reliability and reproducibility are evaluated. This coefficient provides paired proportions of concordance between observers, which may by chance be correct. Kappa values can range from -1 to $+1$; -1 indicates total discordance, zero indicates a fortuitous level of concordance and $+1$ indicates total concordance. In general terms, kappa values below 0.5 are considered unsatisfactory, values between 0.5 and 0.75 are considered adequate and satisfactory and values above 0.75 are considered excellent.⁸

Landis classified kappa values as follows: poor (below 0), slight ($0-0.2$), weak ($0.2-0.41$), moderate ($0.41-0.6$), substantial ($0.61-0.8$) and almost perfect ($0.81-1$).¹⁰

The classification of a fracture is the basis for the choice of treatment. Thus, it is important to assess the validity of a classification system. Gusmão et al.¹¹ evaluated the Garden classification system for femoral neck fractures and found poorly reproducible concordance (0.32). Schwartzmann et al.⁷ did the same in relation to the AO classification for transtrochanteric fractures and found weak concordance for the complete AO classification (0.34). Pervez et al.⁵ found a weak concordance index (0.34) for the Evans/Jensen classification for transtrochanteric fractures.

In our searches in the Lilacs and Medline databases, we did not find any studies that evaluated the concordance index of the Tronzo classification.

The greatest difficulty regarding the Tronzo classification⁴ is in interpreting the stability of the fracture, since the author's description states that the stability is in the comminution of the posteromedial wall, and also that in type II fractures (which are considered stable), the lesser trochanter may be fractured. This probably explains the insignificant reproducibility for stable fractures (0.11) that we found in our study, which gave rise to large bias in the observers' classifications of type II and III fractures.

The unstable fractures presented a higher degree of concordance than shown by the stable fractures (moderate; 0.52), between the observers in general. This can be explained by Tronzo's descriptions of the patterns of fracture types IV and V, given that they are specific and do not leave room for doubt regarding their pattern of instability.

Schipper et al.⁶ studied 20 fractures using 15 observers to make the complete AO classification. The interobserver kappa value was 0.33 . When they used the simplified AO classification, the kappa value was 0.67 . They concluded that the simplified AO classification had good reproducibility but that this was not repeated in the complete classification. In our study, simplification of the Tronzo classification into stable and unstable fractures did not increase the concordance index in relation to the complete classification.

Fung et al.⁹ reported that, unexpectedly, in a study evaluating the reproducibility of the Evans/Jensen classification, increasing experience among the observers correlated with a declining concordance index and they inferred that this classification system was unclear or that another system was necessary.

In another study that assessed the Evans/Jensen classification using four residents (two seniors and two juniors) and 52 radiographs to evaluate the concordance, Gehrchen et al.¹² did not find any differences and took increasing experience into consideration.

Schipper et al.⁶ used the AO classification and did not observe any appreciable difference in the concordance among different groups of professionals (residents, orthopedic surgeons and radiologists).

We observed a decline in the kappa concordance index when the increase in the observers' experience was taken into consideration: 0.50 for the first-year residents, 0.53 for the third-year residents and 0.39 for the orthopedic trauma surgeons. This difference was statistically insignificant when the groups of residents were taken into consideration. This result was unexpected because greater training and greater experience generally ought to imply greater reliability.

Although the Tronzo classification is used in many Brazilian orthopedic services, its value in practice is very questionable, given that we found concordance of 0.44 for the complete classification, which is considered moderate according to Landis. Its subdivision into stable and unstable fractures presented major bias, in that the stable fractures presented slight to weak concordance (0.11) and the unstable fractures, moderate to substantial (0.52).

Conclusion

The Tronzo classification presented moderate concordance, with kappa of 0.44 . However, simplification of the

classification into stable and unstable fractures did not increase the concordance indices.

Therefore, the Tronzo classification does not fit within the criteria for an adequate classification for clinical practice. Thus, we suggest that another system should be used or another one should be created for this type of fracture.

Conflicts of interest

The authors declare no conflicts of interest.

Anexo 1. Data-gathering table

Observer:

Specialty:

IMAGE	TRONZO CLASSIFICATION					
	I	II	III	III VARIANT	IV	V
-						
1						
2						
3						
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