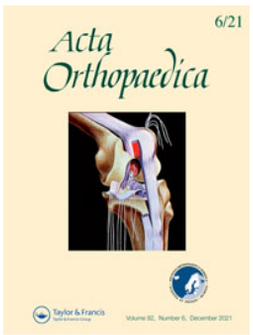

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P Martin Gehrchen, JørgenØ Nielsen, Birgit Olesen & Bjarke K Andresen

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Seinsheimer's classification of subtrochanteric fractures

Poor reproducibility of 4 observers' evaluation of 50 cases

P Martin Gehrchen[1], Jørgen Ø Nielsen[1], Birgit Olesen[2] and Bjarke K Andresen[1]

We examined the reliability of the Seinsheimer classification of subtrochanteric fractures of the femur. 50 consecutive anteroposterior and lateral radiographs were assessed independently by 4 observers twice with a 6-week interval. The interobserver variation was large; only 13 of the 50 fractures were classified identically by all 4 observers. The intraobserver variation showed identical classification in 26–37 of 50 radiographs. When assessing only whether the fracture was subtype 3A or not, the 4 observers agreed in 31 of 50 radiographs. We conclude that the Seinsheimer classification has no value in clinical practice.

Departments of [1]Orthopedics and [2]Radiology, Aalborg Hospital, DK-9100 Aalborg, Denmark. Correspondence: Dr. P. Martin Gehrchen, Department of Orthopaedic Surgery U-2161, Rigshospitalet, University of Copenhagen, Blegdamsvej 9, DK-2100 Copenhagen Ø, Denmark. Tel +45 35 45-27 81. Fax -67 33. E-mail: Gehrchen@rh.dk
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Several attempts have been made to classify subtrochanteric fractures (Zickel 1976, Watson et al. 1964, Fielding and Magliato 1966). Seinsheimer (1978) devised a classification based on morphology. He found that one type, 3-part spiral fractures (type 3A), had an increased risk of failure of internal fixation. He also reviewed reported failures in the literature and found that the majority were type 3A.

No previous study has assessed the reproducibility of the Seinsheimer classification.

Material and methods

We studied retrospectively 50 consecutive preoperative radiographs (anteroposterior and lateral) from our department. All the radiographs had been taken in patients older than 18 years having a subtrochanteric fracture (24 left, 26 right). Each set of radiographs was assessed by the authors collectively (before the study) and was found classifiable by the Seinsheimer system. The fractures are classified by the number of major fragments and the locations and shapes of the fracture lines (Figure 1). To be included, part of the fracture line must lie within a zone between a horizontal line through the inferior aspect of the lesser trochanter and another horizontal line 5 centimeters below it. Any fragment whose largest dimension measures one centimeter or more is considered major.

Type 1. Non-displaced fractures: any fracture with less than 2 millimeters of displacement of the fracture fragments.

Type 2. Two-part fractures: (A) transverse fracture; (B) spiral fracture with the lesser trochanter attached to the proximal fragment; (C) spiral fracture with the lesser trochanter attached to the distal fragment.

Type 3. Three-part fractures: (A) spiral fracture in which the lesser trochanter is part of the third fragment, which has an inferior spike of cortex of varying length; and (B) fracture of the proximal one-third of the femur with the third part a butterfly fragment.

Type 4. Comminuted fractures: 4 or more fragments.

Type 5. Subtrochanteric-intertrochanteric fractures: any subtrochanteric fracture with extension through the greater trochanter.

There were 4 orthopedic observers, all from our department: 2 orthopedic specialists, 1 registrar and 1 trainee (Table). The 4 observers did not use the Seinsheimer classification in daily clinical practice. They were, however, acquainted with the classification. A written instruction, including illustrations, was given to each observer before the assessment. A special form was devised and each observer was asked to classify the fractures according to Seinsheimer. The observers worked independently. 6 weeks later, the same radiographs were assessed again by the 4 observers, but in a new and random order with the identification labels covered.

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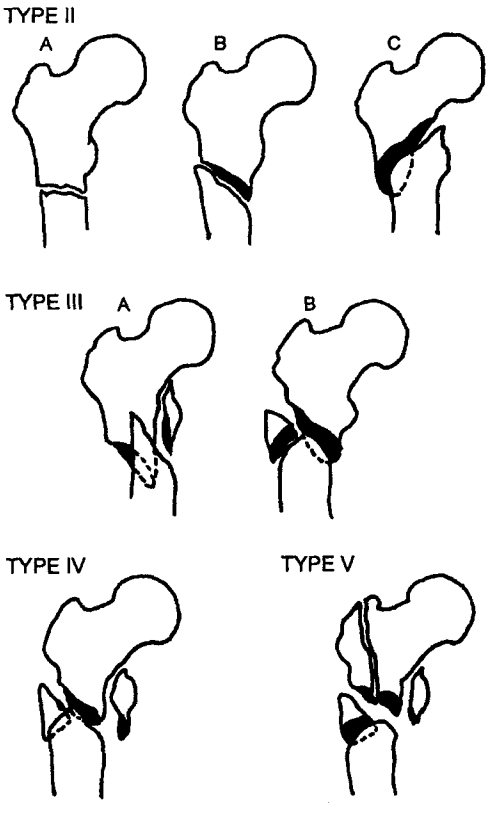

Figure 1. Types II–V subtrochanteric fractures according to Seinsheimer (1978).

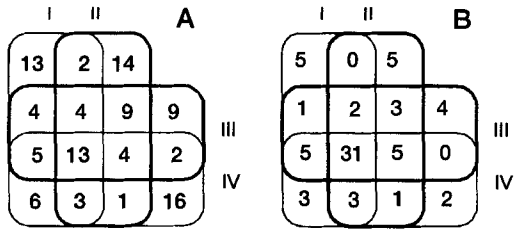

Figure 2. Venn diagram showing the agreement between 4 observers (I, II, III and IV) assessing the Seinsheimer classification.
A. Agreement when assessing type and subtype.
B. Agreement when only assessing whether the fractures were type 3A or not. Figures represent number of fractures.

Number of identical Seinsheimer classifications (n^1) and type 3A statements (n^2) for each observer between the first and second assessment and for each pair of observers at first assessment (N = 50)

Observer	Months of orthopedic experience	Seinsheimer All types n^1	± type 3A n^2	κ^a
I	15	37	44	0.72
II	56	26	41	0.37
III	72	33	41	0.37
IV	80	34	41	0.45
pairwise				
I+II		22	36	0.20
I+III		26	39	0.36
I+IV		27	42	0.57
II+III		30	41	0.30
II+IV		21	40	0.32
III+IV		24	41	0.37

[a] Kappa coefficient concerning type 3A

Statistics

We evaluated the reproducibility of the Seinsheimer classification system using Venn diagrams (assessing Seinsheimer type and whether the fractures were type 3A or not) and κ (kappa) statistics (assessing type 3A). Kappa values can vary from −1 (complete disagreement) through 0 (chance agreement) to +1 (complete agreement).

Results

Only 13 fractures were classified identically by all 4 observers. Pairwise the 4 observers agreed in 21–30 fractures. The agreement improved when the observers only assessed whether the fractures were type 3A or not. 31 fractures were then classified identically by all 4 observers, and there was pairwise agreement in 36–42 fractures (Figure 2 and Table).

Intraobserver agreement ranged from 26–37 fractures assessing Seinsheimer's classification, and from 41–44 fractures assessing whether the fracture was type 3A or not (Table). Seniority did not alter the intraobserver variation.

To complete the assessment of observer variation, we calculated the kappa coefficient when only assessing whether the fracture was type 3A or not. When assessing the interobserver agreement, kappa ranged from 0.20 to 0.57 and when assessing intraobserver agreement, it ranged from 0.37 to 0.72 (Table).

Discussion

Since subtrochanteric fractures are often comminuted and complex, it is difficult to establish an accurate classification system, as in our study. Since we had no true/false classification, we could not decide for what

type of fracture there was maximal agreement and/or maximal disagreement. Earlier studies of pertrochanteric and femoral neck fractures show that the use of classification systems is often difficult, with low agreement (Frandsen et al. 1988, Andersen et al. 1990, Gehrchen et al. 1993). The results of these studies accord with the low level of interobserver agreement in our study. A total agreement of 26% or at the best 60% is not acceptable.

Seinsheimer (1978) could identify type 3A with an increased risk of failure of internal fixation and, if this is possible, one would have a valuable tool in preoperative planning. Thus, in 47 subtrochanteric fractures treated with internal fixation, he had failures of fixation in 9 fractures; 8 of them being type 3A and 1 being type 4. In another study, 2 failures of 12 internal fixations occurred, both of them in type 3A (Bajaj et al. 1988). Lechner et al. (1990) had failures of internal fixation in 8 of 60 internal fixations and only 2 of them were of type 3A. The fraction of type 3A is 0.2–0.3 in our study and is the same in the literature (Seinsheimer 1978, Bajaj et al. 1988, Lechner et al. 1990).

The intraobserver agreement, when assessing whether the fracture was type 3A or not, showed fair-to-substantial agreement (κ 0.37–0.72) according to Landis and Koch (1977), who suggested $\kappa = 0.40$ to distinguish between fair and moderate strength of agreement and $\kappa = 0.60$ to distinguish between moderate and substantial agreement. But intraobserver agreement is generally less clinically important than interobserver agreement.

Our results, and those of others, suggest that different observers apply the Seinsheimer classification differently. It should also be mentioned that Seinsheimer in his original work changed his classification in 2 cases, because 3 major fragments were observed peroperatively instead of 2, as seen on the preoperative radiographs.

On the basis of our study we find the Seinsheimer's classification to be inaccurate for classifying subtrochanteric fractures. The surgeon might get valuable additional information using the image intensifier when the patient is anesthetized and thus choose the right method of osteosynthesis. Furthermore, the reproducibility could be improved by instruction, as shown by Rasmussen et al. (1993).

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