GARDEN'S CLASSIFICATION OF FEMORAL NECK FRACTURES

AN ASSESSMENT OF INTER-OBSERVER VARIATION

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Radiographs of 100 randomly chosen femoral neck fractures were assessed by eight observers using Garden's classification. The radiographs were classified identically by all eight in only 22 cases. Another 45 cases were classified by some observers as undisplaced fractures (Stages 1 and 2) and by others as displaced fractures (Stages 3 and 4). Between the different observers the number of displaced fractures varied from 63 to 89. These results show that observers had a relatively poor ability to delineate the various stages of Garden's classification.

Several classifications of femoral neck fractures have been suggested (Faltin 1924; Pauwels 1935; Garden 1961); during the last decade Garden's classification has been the one used most commonly. A classification is useful only if it can assist in decision-making, and the Garden stages have to a certain extent fulfilled this demand (Frandsen and Frigaard 1980).

However, the value of a classification must also be assessed by its reliability, and no such study of Garden's classification has previously been undertaken. We assessed the reliability of Garden's classification (1961) of femoral neck fractures by determining the correlation between different observers when examining an identical series of radiographs.

MATERIAL AND METHODS

The pre-operative radiographs of 100 patients with femoral neck fractures were chosen at random, excluding films from patients with pathological fractures or diseases resulting in deformation of the hip. No special criteria were set as to the quality of the radiographs except that they had been accepted as of sufficient quality to form the basis of treatment.

The observers selected were: 1 to 3, orthopaedic consultants; 4 and 5, consultant radiologists; 6, a

radiologist in training; and 7 and 8, orthopaedic surgeons in training. Although all of the observers were familiar with Garden's classification of femoral neck fractures, and three of them had used the Garden stages in scientific papers, re-instruction was provided, based on Garden's original description (1961). No pilot study was made to ensure that the observers had a completely uniform interpretation of Garden's classification before assessing the radiographs, as this would have changed the aims of the study by reducing the variation between different observers.

The series of radiographs was studied by each observer working alone. With each set of radiographs the observers were asked to assess the Garden stage according to the description made in 1961:

Stage 1: Incomplete fracture (impacted valgus fracture)

Stage 2: Complete fracture without displacement

Stage 3: Complete fracture with partial displacement

Stage 4: Complete fracture with full displacement

RESULTS

Only 22 fractures (four in Stage 1, 16 in Stage 3, two in Stage 4) were classified identically by all observers (Fig. 1). In another 37 cases fractures were classified as displaced (either Stage 3 or Stage 4) by all observers. Eight cases were classified as undisplaced (either Stage 1 or Stage 2) by all observers. Sixteen fractures obtained both Stage 2 and Stage 3 classification among the eight opinions and 15 fractures collected three different stages. One fracture was given all four stages by different observers.

Of the 100 fractures the number diagnosed as displaced (Stage 3 and Stage 4) varied from 63 to 89

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(Table I). Likewise, the proportions in which undisplaced fractures were divided between Stages 1 and 2 and displaced fractures between Stages 3 and 4 varied considerably between the eight observers (Table I).

DISCUSSION

Garden's classification (1961) of femoral neck fractures seemingly consists of four well defined stages. However, our results have shown a poor ability to delineate the different stages in the classification. Only in 22% of the fractures did all eight observers agree on the stage,

ences, it can hardly explain the discrepancies reported. Furthermore, the inter-observer variation found in the present study corresponds very well with the variations found in the literature.

Comparative studies of Garden's and Pauwels' classification of femoral neck fractures have shown Garden's classification to be superior (Niemenen and Satokari 1975; Frandsen and Frigaard 1980). However, disagreement has been reported with regard to the prognosis of Stage 3 and Stage 4 fractures. Some authors (Garden 1961; Brown and Abrami 1964; Graham 1968; Frandsen and Andersen Jr. 1981) have reported a higher rate of union in Stage 3 than in Stage 4 fractures, whereas

Fig. 1

Variation between eight observers assessing Garden's classification in 100 femoral neck fractures (see text).

whereas in 33% they disagreed as to whether the fractures were displaced or undisplaced.

The literature reflects similar disagreement with respect to the different stages. In most consecutive series of femoral neck fractures almost equal proportions of Stage 3 and Stage 4 displacement have been reported (Garden 1961; Barnes et al. 1976; Frandsen and Frigaard 1980; Frandsen and Andersen 1981; Frandsen et al. 1984), but Brown and Abrami (1964) and Niemenen and Satokari (1975) found that Stage 3 fractures constituted only 13% (26/169) and 11% (40/366), respectively. Disagreement on the proportion of Stage 1 and Stage 2 fractures also has been reported in several studies (Garden 1961; Barnes et al. 1976; Frandsen and Frigaard 1980; Jensen and Høgh 1981; Niemenen and Satokari 1975). Although biological variation between different populations might cause some of these differ-

Table I. Variation between eight observers assessing Garden's classification in 100 femoral neck fractures

Observer	Stage		Total undisplaced	Stage		Total displaced
	1	2		3	4	
1	14	23	37	52	11	63
2	20	17	37	39	24	63
3	25	7	32	38	30	68
4	12	20	32	61	7	68
5	18	18	36	31	33	64
6	14	9	23	54	23	77
7	11	0	11	74	15	89
8	14	16	30	60	10	70

others (Barnes et al. 1976; Høgh, Jensen and Lauritzen 1982) found no difference between these stages. These discrepancies might be explained by our results.

Although Garden's classification seems to be of some prognostic significance, our study has shown eight observers to have a poor ability to delineate the four stages. Randomised studies (Frandsen and Andersen Jr. 1981; Frandsen et al. 1984; Strömquist et al. 1984; Senningsen et al. 1984; Madsen et al. 1987) of femoral neck fractures are recommended as the best way to reduce the effect that the variation between observers might have on the results of treatment.

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