The role of fibular length and the width of the ankle mortise in post-traumatic osteoarthritis after malleolar fracture

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Summary. We assessed the role of fibular length and the width of the ankle mortise as risk factors in the occurrence of post-traumatic osteoarthritis of the ankle joint by comparison of radiographs of the affected and unaffected sides. A shortened fibular malleolus ($P<0.01$), a wide ankle mortise ($P<0.01$) and Weber type B fracture ($P<0.01$) were significantly associated with the development of osteoarthritis but an elongated fibular ($P>0.05$) and a narrowing of the ankle mortise ($P>0.07$) were not.

Résumé. Cette recherche avait pour but de démontrer l'importance de la longueur du péroné et de la largeur des fourches malléolaires en tant que facteur de risque d'apparition d'ostéarthrose de la cheville après le traumatisme. La longueur de la malléole péronière et la largeur de fourche malléolaire sont mesurées à l'aide de la méthode radiomorphométrique. Cette méthode se sert des radiographies de la jambe malade et de la jambe saine en faisant la comparaison de tous les cas. Il existe une liaison significative entre le rétrécissement de la malléole péronière ($P<0,001$) et entre l'élargissement des fourches de la cheville ($P<0,01$), et entre les fractures du type B d'après Weber ($P<0,01$) et l'ostéarthrose due à la fracture malléolaire. L'élongation de la malléole péronière (>0.05) et le rétrécissement des fourches malléolaires ($P>0.05$) n'étaient pas associés à l'ostéarthrose.

Introduction

Conservative and inappropriate operative treatment of malleolar fractures often results in post-traumatic osteoarthritis [11]. The aim of this study was to analyse the role of abnormal length of the fibular and the width of the ankle mortise in the development of osteoarthritis (OA) following such injuries.

Patients and methods

Between 1978 and 1987 at the Požega General Hospital, 179 patients with fractures of the malleoli were treated by open reduction (Figs. 1, 2) and internal fixation (89 patients) or by closed reduction and immobilisation in a cast for five weeks (90 patients). Anteroposterior radiographs of both ankle joints were taken after a median of 4.5 years (range 2–10 years). Shortening of the fibular malleolus and widening of the ankle mortise were measured [12] (Fig. 3).

Fractures were classified according to Weber [4, 13]: type A fractures lay below the syndesmosis, type B at the level of the syndesmosis and type C above this site (Table 1). The results were analysed by the χ^2 -test with Yates' correction.

Results

Of the 179 patients, 46 (25%) had type A fractures, 106 (59%) type B and 27 (15%) type C (Table 1). After either open or closed reduction, a shortened fibular was observed in 97 (54%), an elongated fibular in 73 (41%) and a fibular of normal length in 9 (5%). The mortise was widened in 123 (69%), narrowed in 5 (29%) and of normal length in 5 (3%). The relationship between the length of the fibular and the width of the mortise according to the type of fracture [4] is illustrated in Table 1.

Radiological signs of OA correlated with shortening of the fibular malleolus ($P<0.001$) and a wide an-

Fig. 1. Type B fracture: in open reduction, a short oblique fracture of the fibula was fixed with a 1/3 tubular plate, interfragmentary screw, and medial malleolar screw and Kirschner's wire

kle mortise ($P<0.01$) in type B fractures ($P<0.01$) (Table 2). The overall score showed OA to correlate with reduced articular mobility ($P<0.0001$) and a painful joint ($P<0.001$) (Table 3). OA with normal joint movement was present in shortened ($P<0.0001$) and longer ($P<0.05$) fibulae and in wide ankle mortises (<0.0001). Painful joints were found in all the parameters analysed (Table 3).

Discussion

Previous measurements using other methods have confirmed the relationship of a shortened fibula and a

Fig. 2. Type C fracture: fracture of the fibula was fixed with a 1/3 tubular plate, Le Fort with interfragmentary screw, and medially with two malleolar screws. No protection screw was used

Fig. 3. Comparative anteroposterior X-rays of both ankle joints (healthy and affected leg) of each patient previously treated for malleolar fractures were copied onto tracing paper; the length of the distal segment of the fibula (AB, AC, and AY) and the width of the ankle mortise (AE, BD, BE, and EY) were measured

Table 1. Prevalence of impaired fibular length and width of the ankle mortise after treatment of various types of fractures ($n=179$)

Fractures	Total	Fibula			Ankle mortise		
		Shorter	Longer	Normal	Wide	Narrow	Normal
Number of patients	179	97	73	9	123	51	5
Weber A	46	24	21	1	32	14	0
Weber B	106	61	40	5	72	29	5
Weber C	27	12	12	3	19	8	0

Table 2. Association of osteoarthritis after malleolar fractures with fibular length and width of the ankle mortise ($n=179$)

Type of fracture/presence of osteoarthritis	Fibula				Ankle mortise			
	Shorter		Longer		Wide		Narrow	
	<2 mm	≥2 mm	<2 mm	≥2 mm	<2 mm	≥2 mm	<2 mm	≥2 mm
Total number of patients	67	30	37	36	43	80	29	22
with OA	33	26 ^b	15	23	20	58 ^a	11	9
Type A	17	7	10	11	8	24	7	7
with OA	5	5	3	7	4	14	1	2
Type B	41	20	22	18	28	44	15	14
with OA	24	19 ^a	9	11	12	36 ^b	7	7
Type C	9	3	5	7	7	12	7	1
with OA	4	2	3	5	4	8	3	0

OA=osteoarthritis; ^a $P<0.01$; ^b $P<0.001$ **Table 3.** Correlation of osteoarthritis with objective and subjective signs of the disease ($n=179$)

Fibular length and ankle mortise width	Mobility		Pain	
	normal	reduced	yes	no
Total number of patients	104	75	99	80
with OA	42	58 ^b	96 ^b	4
Fibular shorter	38	59	59	38
with OA	33 ^b	26	58 ^b	1
Fibular longer	35	38	38	35
with OA	23 ^a	15	36 ^b	2
Ankle mortise wide	57	66	77	46
with OA	48 ^b	30	76 ^b	2
Ankle mortise narrow	16	35	19	32
with OA	9	11	18 ^b	2

OA=osteoarthritis; ^a $P<0.05$; ^b $P<0.0001$

widened ankle mortise with radiographic signs of a OA [1–3, 5–13]. Our investigation also revealed this association (Table 2), especially in a type B fractures. Clinically, OA was not associated with reduced joint mobility, which has been noted before [2]. Painful joints were noted in all types of cases analysed (Table 3).

Neither an elongated fibula [8, 9, 13] or a narrow ankle mortise correlated with OA (Table 2). Our study suggests a relationship between poor late results in the treatment of malleolar fractures with bone incongruity (a shortened fibula) and joint instability

(a widened ankle mortise), irrespective of the mode of management.

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