ANGULAR FETLOCK DEFORMITY OF THE FORE LIMBS IN CAMELS

CLINICAL, RADIOLOGICAL AND HISTOPATHOLOGICAL STUDIES

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Summary

Out of 2629 camels, thirty camels of different ages, sexes, and breeds were diagnosed as angular fetlock deformity. Clinically, those camels were suffering from different degrees of valgus and varus deformities. The prevalent radiographic alterations were asymmetric division of the distal end of the third and fourth metacarpals accompanied by shortening deformities. The divergence angle of the distal end of the metacarpals were measured and classified into 3 grades. Necropsy and histopathological findings revealed variable degrees of secondary degenerative joint disease.

Introduction

Angular limb deformities of the metacarpo/metatarsophalangeal region usually occur in the distal third of the third metacarpal / metatarsal bones and varus deviations are usually encountered **(Fretz, 1980, Auer *et al*. 1982, Auer, 1985).** The condition is important in foals of all equine breeds. The term varus and valgus were introduced to identify the type and direction of the deviation. Single or multiple deformities may be exhibited, some being bilateral and approximately symmetrical **(Muson, 1981, Auer *et al*, 1982).**

Radiographic changes were recorded as asymmetric growth of the metaphysis, wedging of the epiphysis, asymmetric longitudinal growth of the phalangese and joint laxity which might be presented particularly in young foals **(Pharr and Fretz, 1981 and Stashsk, 1987).**

Angular deformity of the metacarpophalageal joint was reported in llama **(Gaosthuys, *et al*., 1996).** In camels' malformation, of the fetlock joint has been named several descriptive terms such as shortened digital bones, splayed fetlock and pigeon toes **(Schwartz and Dioli, 1992).**

The aim of this study was to investigate the problem of angular deformities of the fetlock joint in the camel. Documentation of the clinical signs, radiographic analysis, and pathological findings will be assessed and to relate these findings to prognosis.

Material and methods

A total of 2629 camels of different breeds, sexes, and ages (2 - 7 years) were examined at Cairo slaughter house for abnormalities of the fetlock of the fore limb. Fetlock joints in 30 camels revealed hard swelling were collected during one year by disarticulation at the carpometacarpal joint. Plain radiographs were carried out in two planes, dorsopalmar and lateromedial on the fetlocks and digits for each disarticulated limb. The exposure factors were 55 - 60 KVp, 20 mAs, and 75 cm FFD. The radiographs were interpreted for morphologic changes and geometric analysis. Measurement of the angle of divergence of the distal end of the metacarpals was conducted of through sheet of a tracing paper placed on each dorsopalmar radiograph on a horizontal view box. Tracings of the bones were carefully made. A midline was drawn to the line of intersection between the third and fourth metacarpals. The second two lines were drawn tangential to the deepest curvature of the outer cortices of the third and fourth metacarpals. The third two lines were drawn parallel to the second lines and bisected articular surfaces of the third and fourth metacarpals. The angles between the third lines and the midline were the angle of divergence of the distal end of metacarpals. A control group of 13 normal fetlock joints were measured.

Necropsy of the affected fetlock joints was performed to document abnormal lesions on the articular surfaces. Specimens from the articular cartilage and synovial capsule were fixed in 10% formalin. The specimens were then dehydrated, cleared and embedded in paraffin. Sections 4 - 5 microns thick were stained with hematoxylin and eosin.

Results

Thirty out of 2629 camels were affected camels with angular fetlock deformities, which represent 1.14%. Most of them, 25 camels, were unilaterally affected, however the bilateral cases were 5 camels (table 1). The predominant clinical signs in camels were valgus deformity of the digits. In few cases varus deformity was reported with lateral deviation of the fetlock and toe in conformation.

Table (1) Distribution and clinical findings of angular fetlock deformity of the forelimb in 30 camels

Affected camels	Number	Percentage (%)
Breeds		
Saudanese	22	73.3 %
Baladi	8	26.7 %
Sex		
Male	27	90 %
Female	3	10 %
Unilateral	25	83.3 %
Bilateral	5	16.7 %
Medial deviation (Valgus)	24	80 %
Lateral deviation (Varus)	6	20 %

Most camels had radiographic abnormalities other than abnormal angulation of the limb; the predominant cases had one or more additional radiographic abnormalities. The prevalent radiographic alterations were asymmetric division of the distal end of the metacarpals, shortening deformity of the distal end of the metacarpals, osteophyte formation, broadening and irregularity of the distal articular surface, axial subluxation of the sesamoid, osteolysis and cortical bone thickening of the metacarpals (table 2).

Table (2) Radiographic changes of angular fetlock deformities in 30 camels

Radiographic sign	Affected bone	Number	(%)
Asymmetric division	-Distal end of metacarpals	28	93.3%
Shortening deformity	-Distal end of 3rd metacarpal -Distal end of 4th metacarpal	24 4	80 % 13.3%
Osteophyte formation	-Metaphysis of 3rd metacarpal - Proximal extremity of 1st phalanx of the third digit - Metaphysis of 4th metacarpal - Proximal extremity of 1st phalanx of the fourth digit	8 7 6 5	26.7% 23.3 % 20 % 16.7%
Broadening and irregularity	- Distal articular surface of 3rd metacarpal - Distal articular surface of 4th metacarpal	15 4	50 % 13.3%
Axial subluxation	- Sesamoid bones of third metacarpophalangeal joint - Sesamoid bones of fourth metacarpophalangeal joint	6 1	20 % 3.3 %
Osteolysis	- Proximal extremity of 1st phalanx of the third digit - Proximal extremity of 1st phalanx of the fourth digit - Metaphyseal area of 4th metacarpal	3 3 1	10 % 10 % 3.3 %
Cortical bone thickening	- 4th metacarpal	4	10 %
Broadening and flattening	- Proximal articular surface of 1st phalanx of third digit	2	6.7 %
Distal subluxation	- Sesamoid bones of fourth metacarpophalangeal joint	1	3.3 %

The magnitude of the divergence angle of the distal end of the metacarpals was measured in a control group. The mean values of the divergence angle of the third and fourth metacarpals were 20.46° ± 2.24 and 21.15° ± 2.20 respectively, (fig. 1a,b, c &d). The angle of divergence of the 4th metacarpals was wider than the 3rd one. In the affected camels, the degree of divergence of the distal end of the metacarpals was measured and classified into three grades (table 3). Grade I, the divergence angle was (23° - 28°) and in grade II, the divergence angle was (28.5° - 33.5°), while in grade III the angle of divergence was > 34°. Grade I was considered a mild degree and grade III a severe degree of angular deformity. The correlation between the clinical and radiographic findings in the different grades is illustrated in figures 2a,b, c; 3a,b, c & 4a,b, c.

Table (3) Measurement of the divergence angle of the distal end of the metacarpus from radiographs of angular fetlock deformities in thirty camels

Grade I			Grade II			Grade III		
No	3rd metacarpal	4th metacarpal	No	3rd metacarpal	4th metacarpal	No	3rd metacarpal	4th metacarpal
1	22°	25°	1	28°	25°*	1	37°	25°*
2	23°	23°	2	28°	23°	2	36°	21.5°
3	27°	19°	3	23.5°*	29°	3	23.5°	35.5°
4	27.5°	18°	4	13°	31.5°	4	36°	15°
5	26.5°	19°	5	29.5°	18°	5	18°	37°
6	23.5°	21.5°	6	28.5°	18°	6	34°**	13°
7	24°	19°	7	18°	31.5°	7	18.5°	38.5°
8	27.5°	21°	8	19°	29°	8	18°	34°
9	27.5°	19.5°	9	31.5°	19.5°	9	40.5°	19.5°
10	26°	26°	10	19.5°	28.5°	10	26.5°*	35°
11	28°	25°	11	16°	30.5°			
12	37° ***	25°						

* **Grade 1**
** **Grade 2**
*** **Grade 3**

Necropsy findings displayed varying degrees of degenerative joint disease. The predominant lesions were erosions, deep ulceration, broadening and irregularity, fibrillation and roughening of the articular cartilage (table 4). Correlation between the autopsy lesions with the clinical and radiographic findings is shown (fig.2d, 3d & 4d). The severity of the lesions had a positive relation to the higher grade of angular deformity in most examined cases. Histopathological examination showed articular cartilage degeneration, which was characterized by multiple fissures of the articular surface with fibrillation of the matrix. Variable numbers of small cysts are detected in the deep layers (fig.5a). Some chondrocytes showed different degenerative changes including myxomtous, hydropic and fatty degeneration and even necrosis. These changes were associated with widening of the lacunae. In occasional cases focal area of cartilage necrosis and ulceration exposing of the underlying bony trabeculae were seen (fig.5b). The macerated bone specimens were more supportive to the clinical and radiographic results (fig. 2e,3e & 4e).

Discussion

Angular fetlock deformity in foals is a well-recognized clinical syndrome. In camels, few reports described the condition on the basis of clinical findings (Schwartz and Dioli, 1992). The clinical symptoms were abnormal swelling of the fetlock joint with medial or lateral deviation of the joint. Unlike the findings in horses, medial deviation of the fetlock in camels with valgus deformity was the prevalent clinical sign.

The predominant radiographic changes were asymmetric division and shortening deformity of the distal end of the metacarpals, broadening and irregularity of the distal articular surfaces of the metacarpals. These radiographic findings were usually accompanied by secondary degenerative joint disease in adult camels. The shortening deformity of the distal end of the metacarpals may be explained as a Salter-Harris type V physeal injury causing local trauma to the physis followed by diminished growth and eventual premature closure of the physis in that area (Watkins and Auer, 1984). Moreover, asymmetry of the cortical thickness secondary to altered stress was fairly common (Pharr and Fretz, 1981).

Table (4) Autopsy findings in thirty camels with angular fetlock deformities

Lesion	Affected articular surface	Number	(%)
Erosions	-3rd metacarpal	9	30 %
	-4th metacarpal	9	30 %
	-1st phalanx of the third digit	9	30 %
	-1st phalanx of the fourth digit	5	16.7 %
Deep ulceration	-3rd metacarpal	13	43.3 %
	-4th metacarpal	9	30 %
	-1st phalanx of the third digit	4	13.3 %
	-1st phalanx of the fourth digit	2	6.7 %
Broadening and irregularity	-3rd metacarpal	15	50 %
	-4th metacarpal	4	13.3 %
	-1st phalanx of the third digit	2	6.7 %
	-1st phalanx of the fourth digit	1	3.3 %
Fibrillation and roughening	-3rd metacarpal	11	36.7 %
	-4th metacarpal	1	3.3 %
	-1st phalanx of the third digit	2	6.7 %

The magnitude of angular fetlock deformity was measured in the affected fetlock joint and compared with a group of normal control. The measured angles were categorized into three grades. Generally, the degree of the divergence angle of the distal end of the metacarpals could be taken as an indication for poor prognosis. The third grade was considered the worst degree of the divergence angle. But in some cases of grade I angular deformity showed severe secondary degenerative joint disease, suggesting that the severity of the secondary degenerative joint disease depends not only on the degree of the divergence angle but also on the duration of the affection.

The post-mortem of the affected fetlock joints in camels displayed the criteria of secondary degenerative joint disease. It was in contrast with (Ramadan *et al*., 1984). The articular cartilage showed fibrillation, superficial erosion and deep ulceration with exposure of the subchondral bone. These findings were similar to equine degenerative joint disease (Riddle, 1970; Nilson and Olsson, 1973).

The cause of angular deformities remained speculative but would appear to be mechanical injury (Fretz, 1978, Kirk, 1979), overfatness or unusual feeding regime (Mason, 1981), and congenital (Stashak, 1987).

In conclusion, early recognition of angular fetlock deformity is important. If the deformity is detected early, when the growth plate is still open and the bone is still in a growing phase, it may be surgically corrected.

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Fig. 1a : Symmetrical appearance of the fetlocks and digit in a two year-old male camel.

Fig. 1b: dorsopalmar radiographs of the same case (1a) revealing symmetrical division of the distal end of the metacarpals.

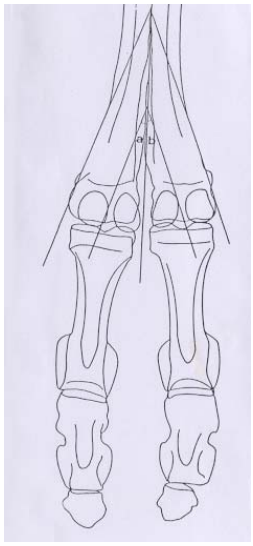

Fig. 1c: Sketch of normal radiograph, showing the divergence angle of the third (b = 21°) and fourth (a = 20°) metacarpals from the midline.

Fig. 1d: Macerated bone specimen in a normal fetlock and digit. Notice symmetric division of the distal end of the 3rd and 4th metacarpals.

Fig. 2a: Angular fetlock deformity (Grade I) in a three year-old male camel. Note asymmetric appearance of the fetlock joints and the 3rd digit appeared shorter than the fourth one.

Fig. 2b: Dorsopalmar radiograph of the same camel (2a) showing asymmetric division of the distal end of the metacarpals, broadening of the articular surface of the 4th metacarpal and slight shortening of the distal end of the third metacarpal.

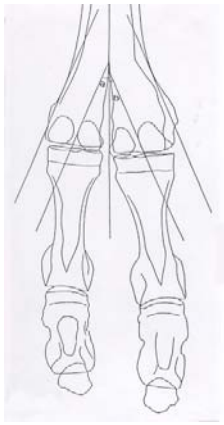

Fig. 2c: Sketch of dorsopalmar radiograph of grade I angular fetlock deformity; note the altered angle of divergence the third (a = 23°) and fourt
(b = 23°) metacarpals

Fig. 2e: Macerated bone specimen of the same case. Note altered angle of divergence of the distal end of the metacarpals and the articular surface of the fourth metacarpal is wider than third one.

Fig. 2d: Necropsy findings of the same camel showing erosive lesions on the articular cartilage of the 3rd and 4th metacarpals, and the articular cartilage of the first phalanx of the 3rd and 4th digits (arrows).

Fig. 3a: Angular fetlock deformity (Grade II) in a five year-old male Saudanese camel. Note, the large swelling and medial deviation of the fetlock with valgus deformity of the digit.

Fig. 3b: Dorsopalmar radiograph of the same camel (3a). Note, the asymmetric division of the distal end of the 3rd and 4th metacarpals, irregular articular surface of the 3rd metacarpal, axial subluxation of the sesamoid bone of the 3rd metacarpo-phalangeal joint, and periosteal reaction at the metaphyseal area of the 3rd and 4th metacarpals and cortical bone thickening of 4th metacarpal.

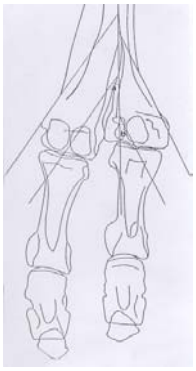

Fig. 3c: Sketch of dorsopalmar radiograph of grade II angular fetlock deformity, note the angle of divergence of the third (a = 30°) and the fourth (b = 27°) metacarpals.

Fig. 3e: Macerated bone specimen of the same camel. Showing asymmetric division of the distal end of the metacarpals and shortening of the third digit.

Fig. 3d: Necropsy findings of the same camel displaying irregularity of the articular surface of the 3rd metacarpal with deep ulceration and exposure of the subchondral bone. Deep ulceration of the articular cartilage of the fourth metacarpal (arrows).

Fig. 4a: Angular fetlock deformity A two year-old she camel. Notice, the large swelling of the fetlock joint with medial deviation and valgus deformity of the digits

Fig. 4b: Dorsopalmar radiograph of the same case. Showing asymmetric division of the distal end of the metacarpals , shortening , broadening and irregularity of the articular surface of the third metacarpal, axial subluxation of the sesamoid bones of medial fetlock joint, and cortical bone thickening of 4th metacarpal.

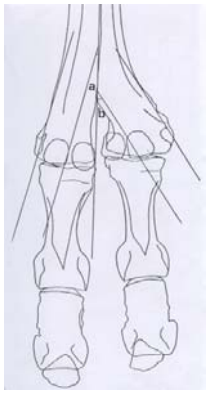

Fig. 4c: Sketch of dorsopalmar radiograph of grade III angular fetlock deformity. Note the angle of divergence of the third (a = 34°) and the fourth (b = 14°) metacarpals.

Fig. 4e: Macerated bone specimen of the same case. Notice the difference in the angle of divergence at the distal end of the metacarpals, the articular surface of the third metacarpal is wider than the fourth one.

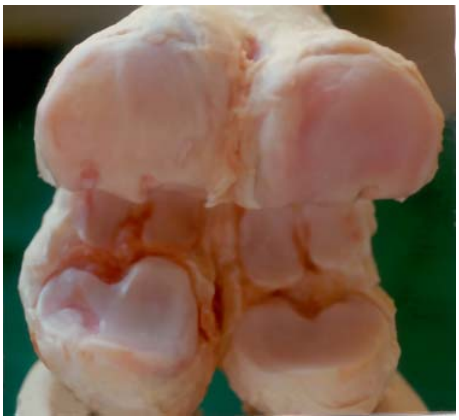

Fig. 4d: Necropsy findings of the same camel notice, the deep ulceration on the articular cartilage of the third and fourth metacarpals and on the articular cartilage of the fourth digit.

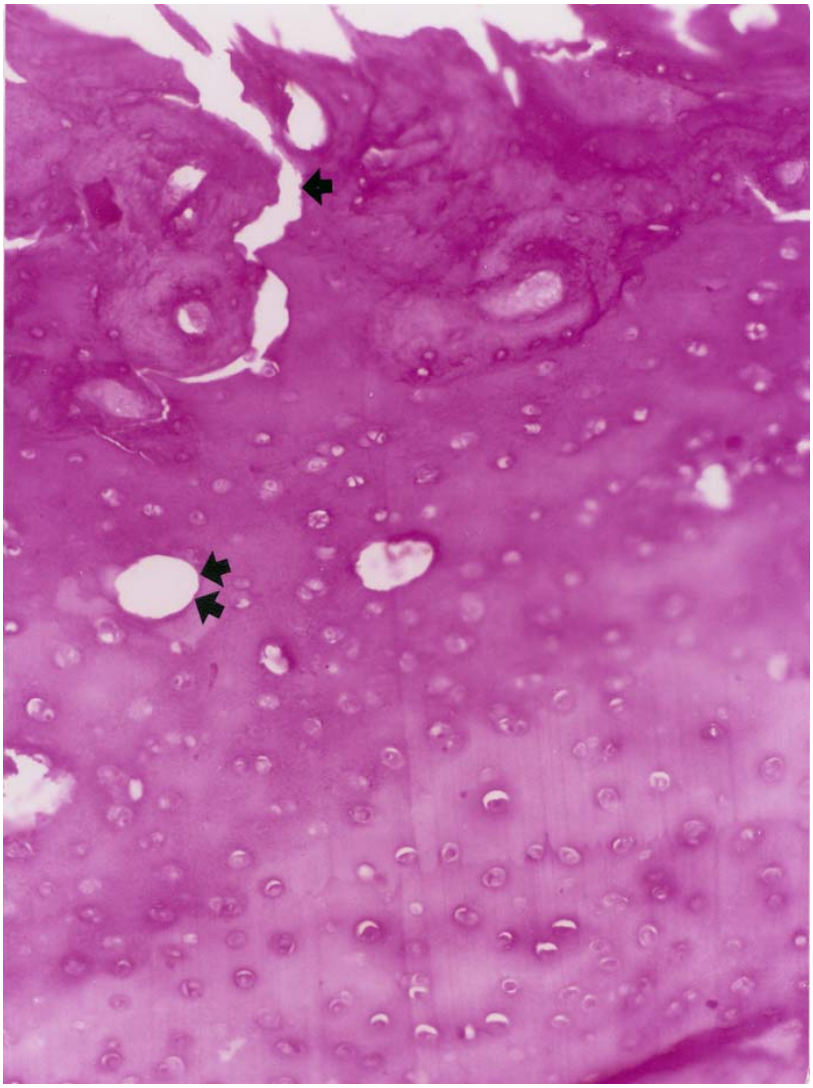

Fig. 5a: Proximal articular cartilage of 1st phalanx. The cartilage surface showing multiple fissures (arrow) with the presence of few cysts (two arrows) in the depth. Note degenerative changes of the chondrocytes.

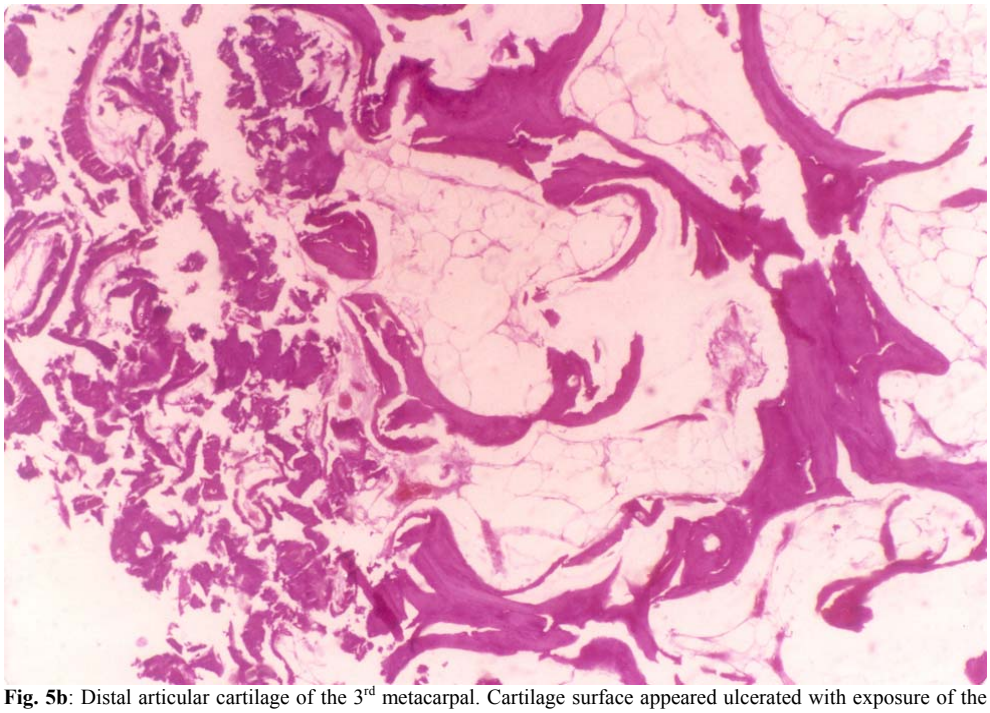

Fig. 5b: Distal articular cartilage of the 3rd metacarpal. Cartilage surface appeared ulcerated with exposure of the underlying cancellous bone.

تشوهات زاوية لمفصل الزمعه (الثنه) من الرجل الأمامية للإبل
دراسة إكلينيكية – إشعاعية و باثولوجية

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الملخص :

تم فحص ٢٦٢٩ من الإبل من الجنسين ومن السلالات و أعمار مختلفة للكشف عن وجود آي تورم صلب عند مفصل الزمعه (الثنة) من الرجل الأمامية (القادمة). واجري الفحص المرضي والإشعاعي علي مفصل الثنة المصابة في ٣٠ حيوان. أظهرت النتائج أن هذه الحالات كان بها تشوهات زاوية في الزمعه (أو الثنه) وكانت الأعراض المرضية السائدة هي تشوه الإصبع الأصفد(الأفحج). أما التغيرات الإشعاعية الشائعة فشملت الانقسام اللامتناظر في الجزء الأسفل من السنع (الوظيف)، تشوه وقصر السنع ، تكوين زوائد عظمية (العرق أو النبج)، توسع وعدم انتظام في السطح المفصلي الأسفل، خلع جزئي محوري في العظام السمسمانيه ، انحلال العظم وزيادة سمك لحاء السنع. أما الفحص المرضي فقد أوضح درجات متفاوتة من اعتلال المفاصل التنكسي.