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VASCULAR CHANGES CONCERNED WITH SOME SURGICAL AFFECTIONS OF THE EQUINE DIGIT

(With 7 Figures)

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تغيرات الأوعية الدموية المصاحبة لبعض الإصابات الجراحية لمنطقة السلاميات في الخيول

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أجرى هذا البحث على ست حالات أكلينيكية من الخيول تعاني ثلاثة منها بالتهاب مزمن في الصفائح الحساسة للحافر وحاله كسر عرضي لعظمه الحافر وحاله التهاب مزمن للأوتار القابضة في منطقة السلاميات وحاله بها أثر جرح قديم في منطقة القيد وقد تم التوصيف الأشعاعي لشرابين منطقة السلاميات لكل حالة ومن خلال هذه الدراسة أتضح أن التغيرات الأساسية في الأوعية الدموية تشمل على أنسداد وضيق بعض الشرايين على مستويات مختلفة - ظهور أوعية جانبية تعويضية التخصر والتمدد الشرياني المتبادل.

VASCULAR CHANGES, SURGICAL AFFECTIONS OF EQUINE DIGIT

SUMMARY

The present work was carried out on six clinical cases, three of them suffered from chronic laminitis, one suffered from fracture of the pedal bone, one from chronic tendinitis and the last one with an old wound on the pastern region. The angiographic appearance of each case was described. The main vascular alterations observed in these cases were vascular obliteration at different levels, stenosis, beading, tortuous, newly formed collateral circulations and hypervascularisation.

INTRODUCTION

The vascular anatomy of the equine extremities was grossly described by GETTY (1975) and STASHAK (1987). The angiographical appearance of the normal equine digit (Fig. 1) was demonstrated by HERTSCH (1973, 1982), ACKERMAN *et al.* (1975) and COLLES *et al.* (1979).

Alterations in the angiographic appearance of the equine foot have been implicated in the pathogenesis of a number of chronic lameness (COFFMAN *et al.*, 1970 and COLLES, 1979). The effect of neurectomy on the equine foot was studied by MAHFOUZ (1979). The minimal amount of circulation required to maintain the viability of the tissue was investigated by ADAMS (1974) and SCOTT *et al.* (1976).

The purpose of the present study is to throw the light on the vascular changes associated with some surgical affections of the equine foot.

MATERIALS AND METHODS

This work was carried out on six horses admitted to the Surgery Clinic Fac. Vet. Med., Assiut University and varying between 14 to 25 years old. Three of them had chronic laminitis, one had an old wound on the lateral aspect of the pastern region, one had fracture of the pedal bone and the last one had chronic tendinitis.

Angiographic technique

In all cases, general anaesthesia was induced using thiopentone sodium after sedation with combelen (Bayer). The animals were placed in lateral recumbency and the medial aspect of the affected forelimb as well as the lateral aspect of the affected hindlimb were prepared for surgery. The A. Digitalis

palmaris communis II was exposed through a 3-cm skin incision made at the middle of the metacarpal region. The artery was isolated and elevated through the skin incision using a curved artery forceps. A disposable Braunule (1.8 bzw and 1.6 mml Vygon, Eiconen, Frankreich) was inserted distally into the artery. The A. Metatarsae dorsalis III was exposed through a 3cm skin incision made at the lateral aspect of the proximal third of Os. Metatarsae III. The same procedure was performed as in forelimb. 20 ml. of urografin 76% (Shering Chemicals Ltd., Burgess Hill, Sussex, England) was injected as rapidly as the canula would allow. Both cranio-palmar (plantar) and latero-medial radiographic projections were made at the end of injection. The radiographic factors were 15 mAs, 80 Kv. and 90 cm F. F. D. using mobile X-ray unit. The braunule was removed after the radiographs were taken and the bleeding point was arrested by manual pressure. The skin wound was closed with simple interrupted sutures using silk No. 1. A pressure handage was applied.

RESULTS

Newly formed collateral branches as a compensatory vascularization from the lateral palmar digital artery were observed in case No. 1., which suffered from old wound on the lateral aspect of the pastern region. Obliteration of the lateral palmar digital artery was observed at the level from the midway of the first phalanx to the proximal extremity of the second phalanx (Fig. 2a, b). Stenosis of the lateral palmar digital artery from the middle of the first phalanx distally to the coffin joint was observed in case No. 2. which suffered from apical fracture of the medial proximal sesamoid bone and chronic laminitis. The arcus terminalis in the lateral quarter of third phalanx was obliterated and represented by small branches. Newly formed vascular branches from the medial palmar digital artery toward the site of fracture of the sesamoid bone were observed (Fig. 3a, b). Central obliteration of the arcus terminal and the dorsal branches of the pedal bone were observed in case No. 3. which suffered from chronic laminitis of the right hindlimb. The lateral and medial planter digital arteries were normal (Fig. 4). Alternate constriction and dilatation of the arterial wall were observed at the whole length of both lateral and medial palmar digital arteries in case No. 4. which suffered from bilateral chronic laminitis of the forelimbs. The digital vascular pattern of both limbs was irregularly distributed. Tourtous appearance in the terminal arch and its branches were observed (Fig. 5a, b, c). Deviation

VASCULAR CHANGES, SURGICAL AFFECTIONS OF EQUINE DIGIT

of the digital vascular pattern than normal was observed in case No. 5. which suffered from sagittal fracture of the pedal bone of right hindlimb. The terminal arch was completely filled with contrast media but it is twisted as a result of rotation of the fractured pedal bone (Fig. 6a, b). In case No. 6. in which the animal suffered from chronic tendinitis, a netlike pattern of vasculature distributed on planter aspect of the digit of right hindlimb was observed. Numerous fine capillaries arised from both lateral and medial planter digital arteries were also observed (Fig. 7a, b).

DISCUSSION

Angiographic studies provided a more definite description of vascular pattern in some diseases causing lameness. Several alterations were observed in the angiographic appearance associated with some surgical affections of the phalangeal region in the present study. Obliterations of the lateral digital artery was clearly observed at the level of the pastern region as a result of accidental wound. This interruption of circulation was tolerated by developing of newly formed collaterals (Fig. 1). This is in agreement with that given by PERKINS and EDMARK (1971) and SCOTT *et al.* (1976). Stenosis of the digital artery and obliteration of terminal arch were observed with varying degrees in case of chronic laminitis (Fig. 2, 3). COFFMAN *et al.* (1970) and HERSTCH (1982) concluded that while increased amounts of blood are shunted through other parts of the lower limb, the laminar corium is deprived of blood supply. COLLES (1979) added that thromboses of the distal navicular nutrient arteries may be the most common pathological changes causing clinical signs of navicular disease. The alteration in hoof vascularity could be considered as a major factor in the development of abnormal feet since it would presumably interfere with normal keratinization (ACKERMAN *et al.*, 1975). Abnormal hoof growth in both forelimbs was observed in association with arterial beading of both lateral and medial palmar digital arteries. (Fig. 3.). Arterial beading in case of laminitis may be attributed to the alteration of the arterial wall elasticity due to endotoxine which predispose the arteries to spasm. (ACKERMAN *et al.*, 1975). Increase in number of newly formed blood capillaries arised from the main branches of the digit were only observed in case of chronic tendinitis.

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VASCULAR CHANGES, SURGICAL AFFECTIONS OF EQUINE DIGIT

LEGENDS

Fig. 1: Normal distribution of the digital arteries (after Herstch, 1982).

Fig. 2(a,b): Angiographic appearance in case of an old wound at the Level of pastern region:

- 1- A. digitalis communis II.
- 2- Medial palmar digital artery.
- 3- Lateral palmar digital artery.
- 3- Obliterated part of the Lateral palmar digital artery.
- 4- Palmar and dorsal branch of the first phalanx.
- 5- Branches of the digital cushion.
- 6- Palmar and dorsal branch of the second phalanx.
- 7- Newly formed collateral branches.
- 8- Central arch.
- 9- Small branch of the fetlock joint.
- 10- Compansatory new Ly formed blood vessels.
- 11- Dorsal rami of the third phalanx.

Fig. 3(a,b): Angiographic appearance in case of apical fracture of proximal sesamoid bone accompanied by chronic Laminitis:

- 1- Medial palmar digital artery.
- 2- Lateral palmar digital artery.
- 3- Stenosis and obliteration of the lateral palmar digital artery at the level of the coffin joint.
- 4- Obliteration of the central arch in the lateral quarter of the third phalanx.
- 5- Newly formed vascular branch at the site of apical fracture of the proximal medial sesamoid bone (S).

Fig. 4: Angiographic appearance in case of chronic laminitis in right hindlimb.

- 1- Medial planter digital artery.
- 2- Lateral planter digital artery.
- 3- Central obliteration of the terminal arch.
- 4- Obliteration of the dorsal rami of the third phalanx.

Fig. 5(a,b,c): Angiographic appearance in case of bilateral chronic laminitis:

- a) 1- Lateral palmar digital artery.
- 2- Medial palmar digital artery.
- 3- Palmar branch of the third phalanx.
- 4- Tortous appearance of the terminal arch.

- 5- Serrated and tortous appearance of the dorsal branches of the third phalanx. F- First phalanx. S- Second phalanx.
- b) Beading of the 1-lateral and 2-Medial palmar digital arteries.
- 3-Tortous appearance of the dorsal branch of the first phalanx (F),
- 4-Dorsal branch of the second phalanx and
- 5-Palmar branch of the third phalanx. Abnormal growth of the hoof horn (H).
- C) Lateral and medial digital artery (1,2) showed alternate constriction and dilatation (beading). Incomplete filling of the digital cushion (3). F-First phalanx, S-Second phalanx, T-Third phalanx, P-Bented apex of the third phalanx.

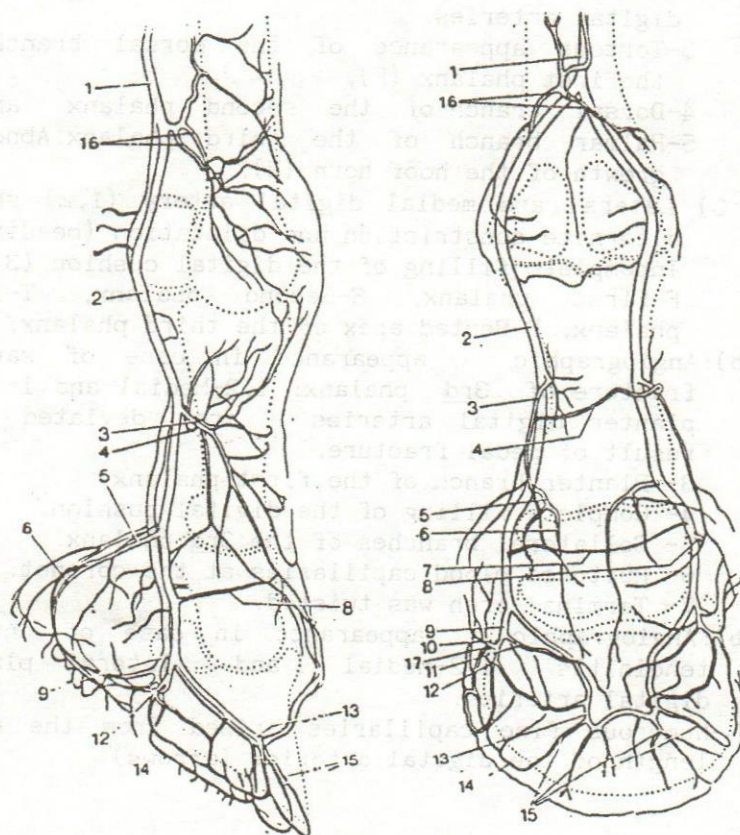
Fig. 6(a,b):Angiographic appearance in case of sagital fracture of 3rd phalanx: 1,2-Medial and lateral planter digital arteries are deviated as a result of pedal fracture.

- 3- Planter branch of the first phalanx.
- 4- Complete filling of the digital cushion.
- 5- Collateral branches of the 3rd phalanx.
- 6- Ruptured blood capillaries at the coronet.
- 7- Terminal arch was twisted.

Fig. 7(a,b):Angiographic appearance in case of chronic tendinitis 1,2-Medial and lateral planter digital arteries.

-Numerous fine capillaries arised from the whole length of the digital arteries (arrows).

VASCULAR CHANGES, SURGICAL AFFECTIONS OF EQUINE DIGIT



- | | | |
|--|--|---|
| 1 A.digitalis palmaris communis II | 7 Ramus palmaris phalangis mediae | 12 dorsaler Zweig des lateralen Astes (Wandarterie) |
| 2 A.digitalis palmaris lateralis | 8 Ramus dorsalis phalangis mediae | 13 Arcus terminalis |
| 3 Ramus dorsalis phalangis proximalis | 9 Ramus palmaris phalangis distalis | 14 Sohlenrandarterie |
| 4 Ramus palmaris phalangis proximalis | 10 lateraler Ast des Ramus palmaris phalangis distalis | 15 Rami dorsales phalangis distalis |
| 5 Ramus tori digitalis | 11 medialer Ast des Ramus palmaris phalangis distalis | 16 Äste an das Fesselgelenk |
| 6 axialer Ast des Ramus tori digitalis | | 17 palmarer Zweig des lateralen Astes des Ramus palmaris phalangis distalis |

Fig. 1- Normal distribution of the digital arteries(after Herstch, 1982)

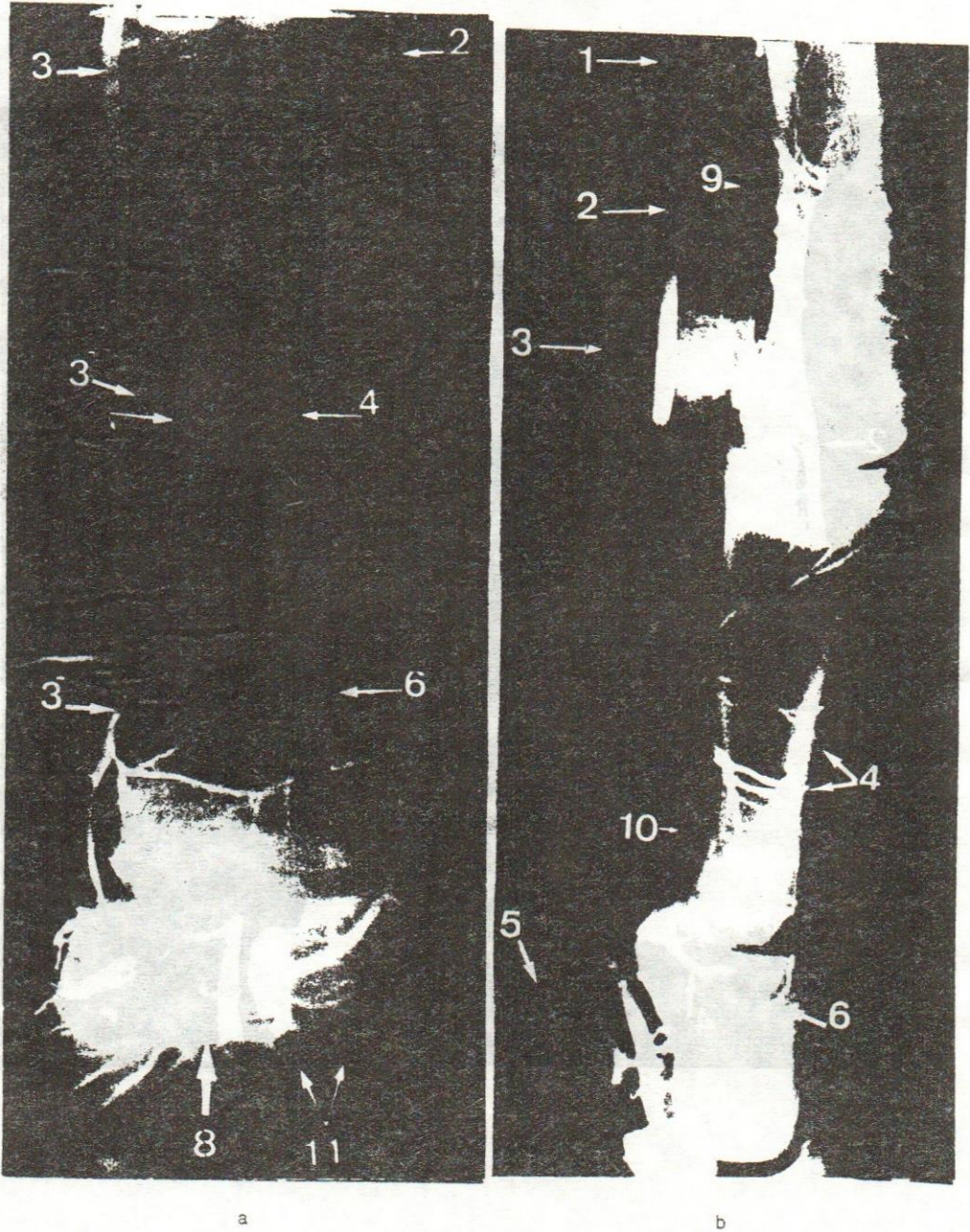


Fig. 2

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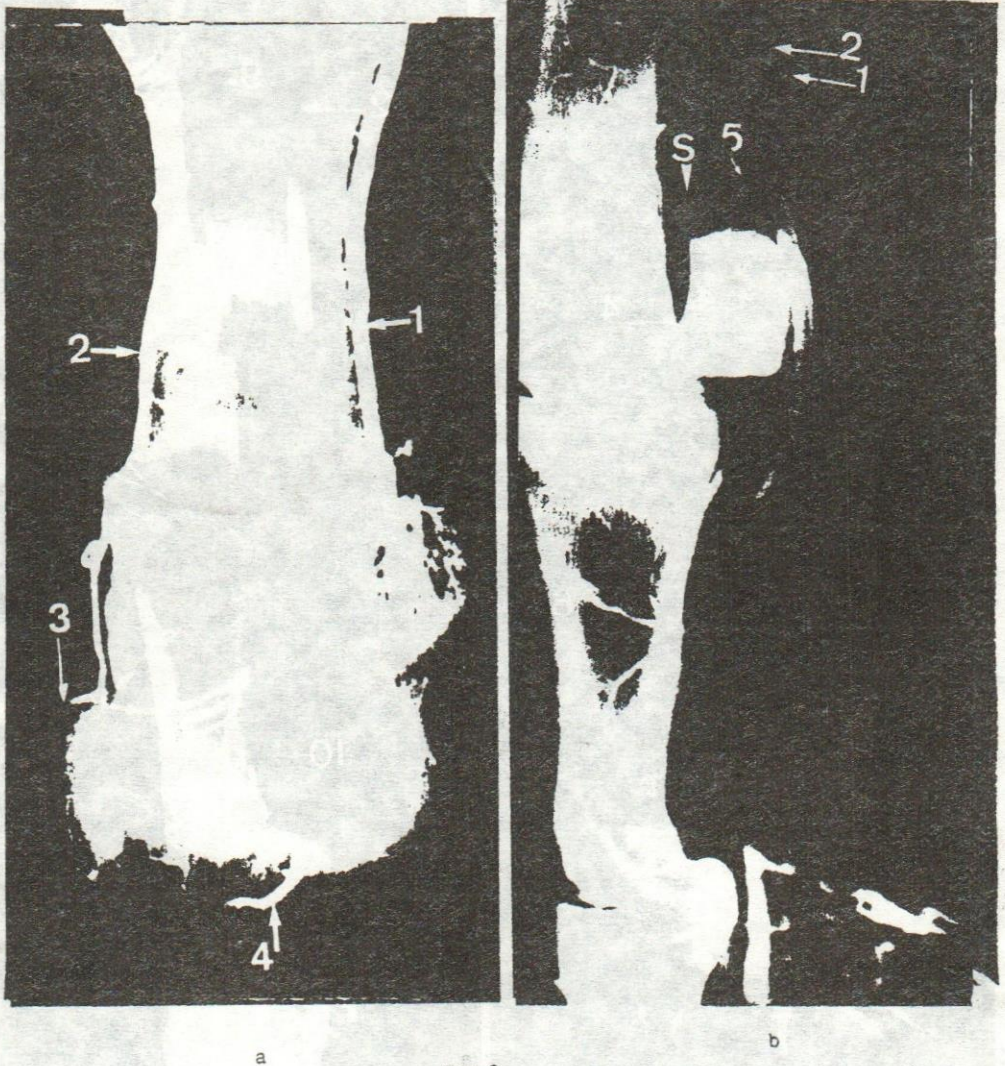


Fig.3

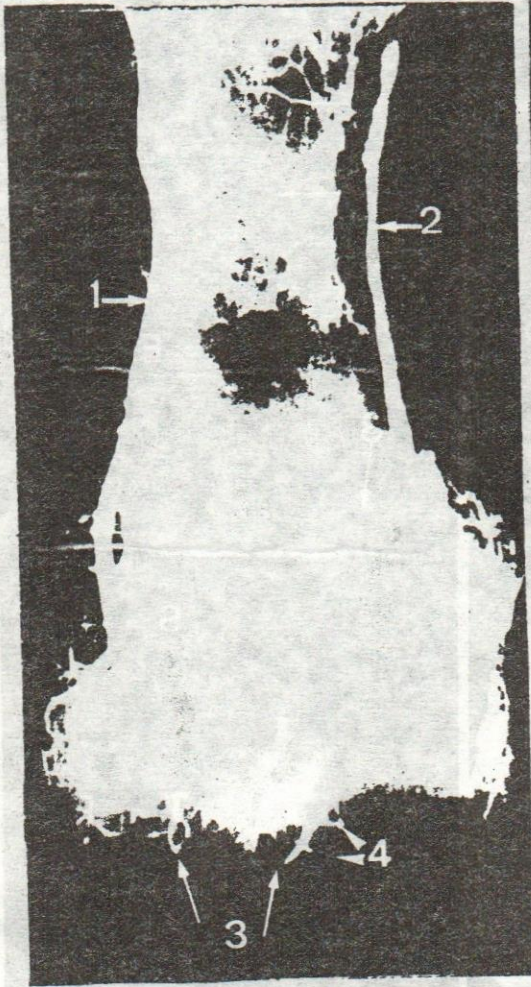


Fig. 4

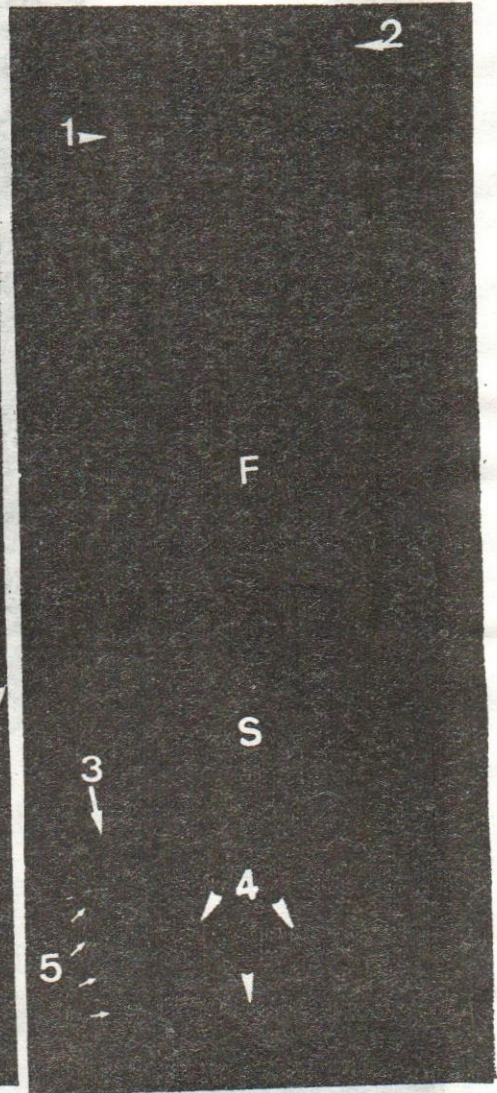


Fig. 5a

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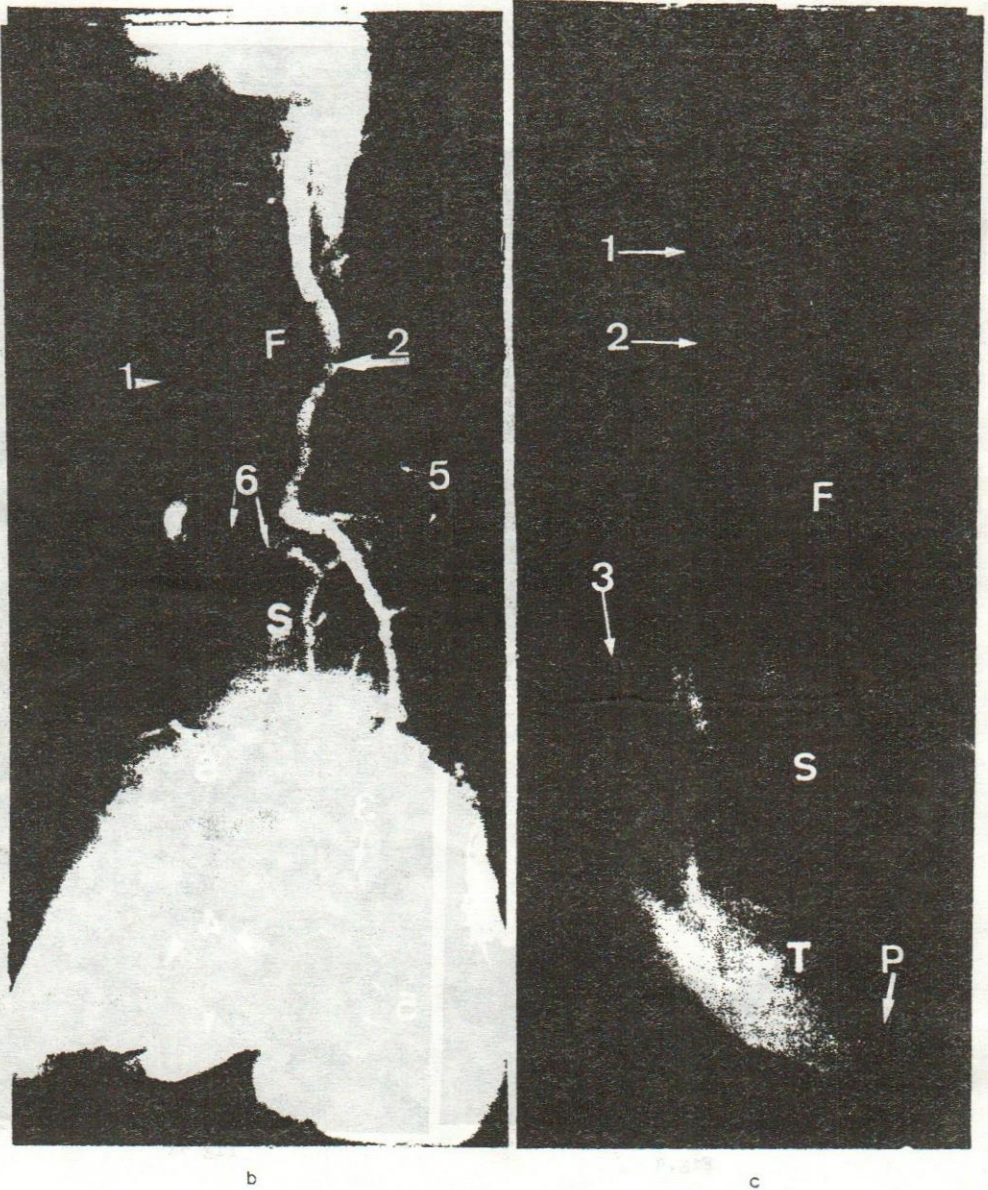


Fig. 5

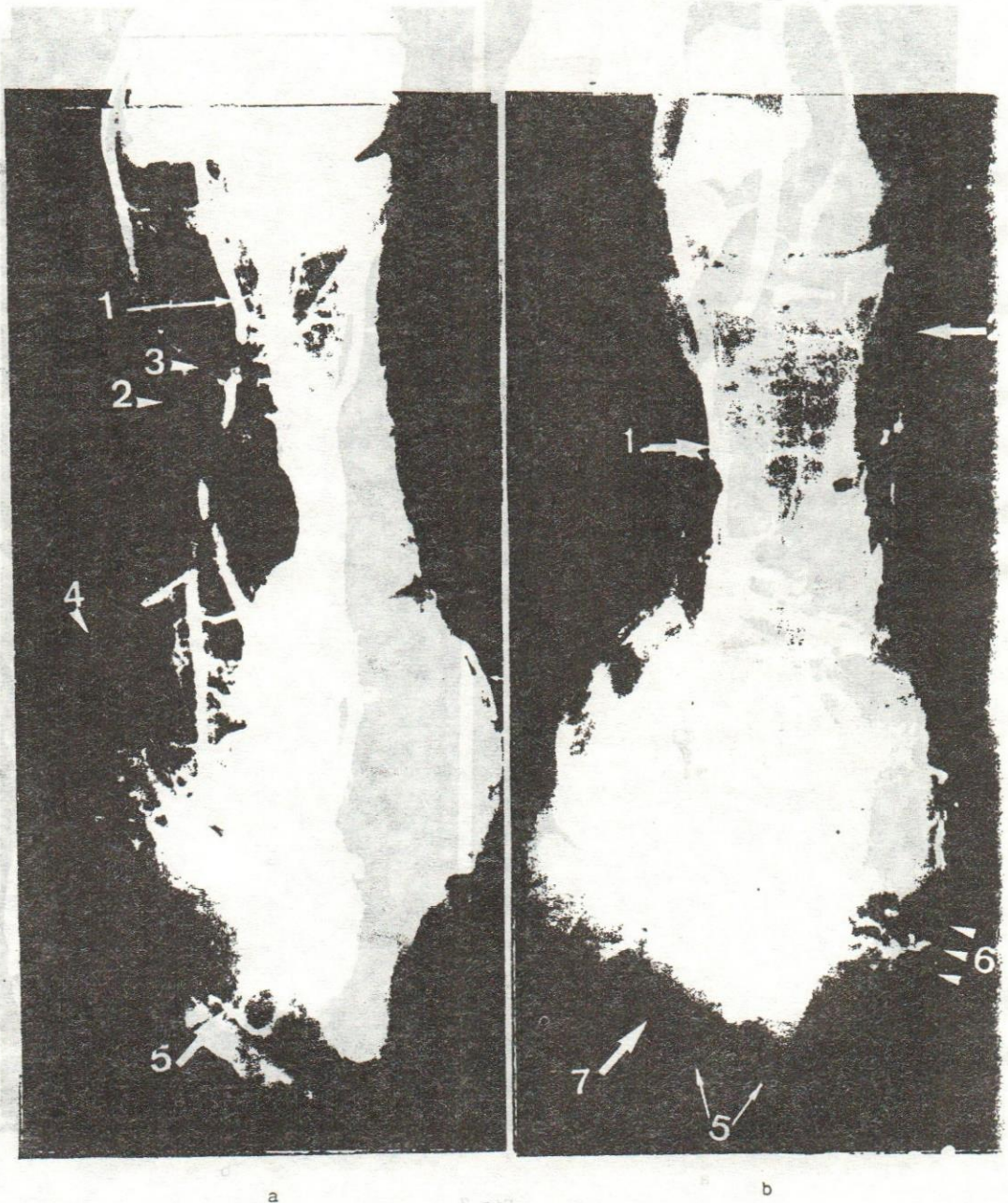


Fig.6

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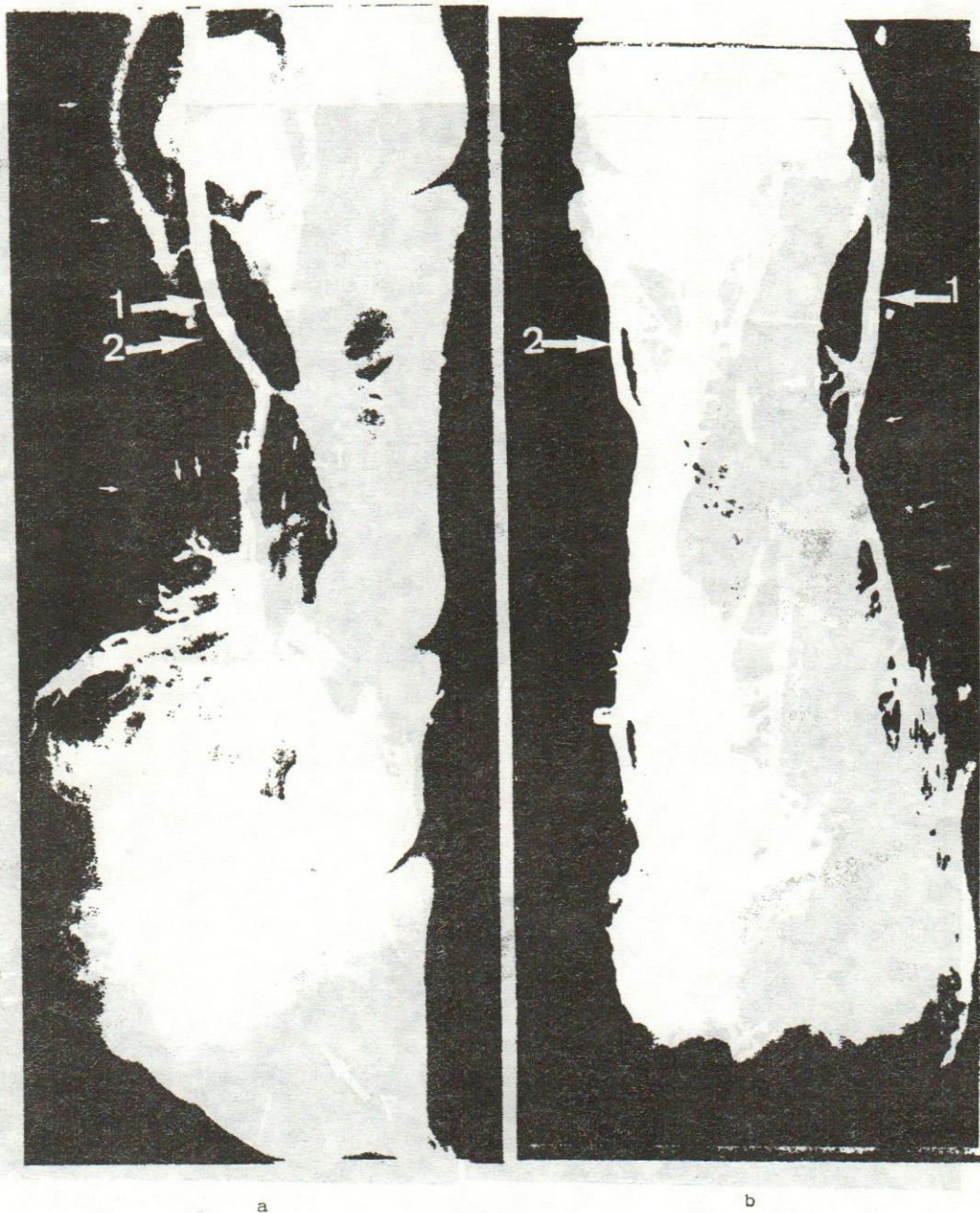


Fig.7