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ULTRASONOGRAPHIC DIAGNOSIS OF TENDINITIS AND TENOSYNOVITIS IN DONKEYS

(With 1 Table & 11 Figs.)

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(Received at 20/11/1991)

إستخدام الموجات فوق الصوتية في تشخيص إلتهاب الأوتار وأغمدتها في الحمير

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تم في هذا البحث تشخيص إصابات الوتر الأصبعي السطحي القابض بإستخدام الموجات فوق الصوتية ومقارنة ذلك بالأعراض الإكلينيكية . وقد تم فحص ١٣ حمار يتراوح أعمارهم بين ٣ ـ ٧ سنوات وإقتصرت الدراسة علي الأنسجة الرخوة الموجودة علي السطح الخلفي للقوائم أسفل مفصل الرسغ أو مفصل العرقوب وقد تم تقسيم إصابات الأوتار بالموجات فوق الصوتية الي درجات علي حسب درجة ظهورها من ١ ـ ٣ حيث رقم ٣ يمثل أكبر إصابة ويظهر لونه أسود كاملا علي شاشات جهاز الموجات فوق الصوتية . ولقد أثبتت الدراسات أن الكثافة الصوتية تقل والعيوب التركيبية تزيد علي حسب زيادة درجة الإصابة . وكانت الموجات فوق الصوتية مفيدة في تشخيص إصابات الأنسجة الرخوة في الجزء السفلي من القوائم بالإضافة الي تقدير حجم ومكان ودرجة الإصابة وكذلك تقييم مدي التقدم في العلاج .

SUMMARY

Lesions of the superficial digital flexor tendon were monitored using diagnostic ultrasound (B-mode) and subsequently compared with the clinical findings. 13 donkeys between 3-7 years of age were examined. This study was limited to the soft tissues of the palmar or planter surface of the limb just proximal to the fetlock joint and below the carpal or tarsal joints. The injured tendons were graded sonographically according to their degree of echogenicity on a scale of 1-3 types, in which type-3 lesion represent the most pathologic state and appeared completely black on the sonogram. Ultrasonographic examination of the injured tendons showed that the echoic intensity decreased and structural defects were increased according to the severity of the trauma.

Diagnostic ultrasound is useful in evaluating injury of soft-tissue structures of the distal part of the donkey limb, quantifying the size, location, severity of these lesions and their recovery overtime.

INTRODUCTION

Diagnosis and treatment of equine lameness is one of the most demanding responsibilities of the equine practitioner. There is little information in the literature concerning suitable diagnostic methods to evaluate soft tissue abnormalities in the distal part of the equine limb. Diagnosis of tendinitis has been achieved by palpation skills of the examiner. Palpation, although a critical part of diagnosis, is limited in its capacity to identify anatomic defects, relies to a great extent on the skills and experience of the practitioner, and is highly subjective (GENOVESE, et al. 1986). Other reported diagnostic techniques were usually either invasive or provided little information (WEBBON, 1973; GRANT, et al. 1978 and VALDEZ, et al. 1980). Radiography often provides information about the condition of tendons and ligaments at their attachment sites (MOYER and RAKER, 1980). A technique of air tendograms has been reported by WILLIAMS and CAMBELL (1961); VERSCHOOTEN and DE MOOR (1978) and SELIEM (1991). This negative-contrast technique provides improved visualization of the margins of the tendons, digital sheath, and the proximal palmar pouch of the fetlock joint. However, since this technique is invasive, there is a posibility of introducing pathogenic organisms. The technique is painful, and general anesthesia is recommended to facilitate the procedure. Positive-contrast radiographic studies contribute minimal information about the flexor tendons and the suspensory ligament. Because of the difficulty of making a definitive radiographic diagnosis in the frequent number of horses seen with apparent soft-tissue abnormalities of the limbs, a new technique was thought to evaluate this area.

Recently, however, diagnostic ultrasound has provided a new, safe, noninvasive method to assess injury to tendinous and ligamentous structures in horses (RANTANEN, 1982 and RANTANEN, et al. 1983) as well as in humans (FORNAGE, et al. 1982). A morphologic evaluation of a tendon, muscle, or ligament can document an injury and provide a permanent photographic record. This record may be used in a clinical diagnostic situation or as the morphologic basis for research. Overtime, the recovery of the injured animal can be monitored. Thus the appearance of a bowed tendon 3 days after injury may be compared with its appearance 3 months after injury (GENOVESE, et al. 1986). In veterinary medicine preliminary reports have been published on the sonographic appearance of the soft tissues of equine (RANTANEN, 1982 and HOUSER, et al. 1983). The purpose of this study was to explain the ultrasonographic findings of tendinitis in donkeys.

MATERIAL and METHODS

13 donkeys ranging in age between 3-7 years were presented to the clinic of the Faculty of Veterinary Medicine at Assiut. These animals were presented with variable degrees of unilateral fore or hindlimb lamenesses of 5 to 10 days duration. In each case, a clinical and ultrasonographic diagnosis of tendenitis of the superficial digital flexor (SDF) tendon was made. Clinical examination includes observation of the gait and degree of lameness and palpation of the affected limb. In two cases with severe lameness, survey radiographs were taken to exclude other limb injury otherwise soft tissue damage. The diagnostic ultrasound was performed with a commercially available, real-time linear scanner with 5 MHz transducer(1). Each donkey was sedated with comblene(2). Limbs were prepared for ultrasonography by shaving an area 2 to 3 cm wide along the palmar aspect of the metacarpus or the planter aspect of the metatarsus. Aquous ultrasound transmission gel(3) was applied to couple the skin surface to the transducer. To identify where on the limb a particular sonogram was taken, the metacarpus was arbitrarily divided into six zones of nearly equal area (Fig. 1). Each zone is approximately 4 cm in length, which is the approximate thickness of two forefingers. The upper zone, 1 A, includes the 4 cm distal from the base of the accessory carpal bone. The next zone, 1 B, includes the 4 cm below zone 1 A, and so on, proceeding through zones 2 A, 2 B, 3 A, and 3 B. In the metatarsus, the palmar aspect of the tarsus contains zones 1 A and 1 B, the remaining zones, 2 A, 2 B, 3 A, 3 B, are determined as before by proceeding down the leg in 4 cm increments. Because of the long length of the metatarsus, as compared with the metacarpus, the hindleg contains two additional zones, 4 A and 4 B (Fig. 2) (GENOVESE, et al. 1986). Routinely, we scan all zones, starting at the top of the metacarpus or metatarsus and proceeding distally. At each zone, the scan is "frozen" and a photograph is taken on polaroid film(4) in both longitudinal (L.S) and cross-sectional (XS) planes. The injured tendons were graded sonographically according to thier degree of echogenicity on a scale of 1-3 types. Type-1 lesions, were half echogenic and half anechoic (hypoechoic), less white in the sonogram. Type-2 lesions, were mostly anechoic and appeares light dark in the sonogram. Type-3 lesions, were totally anechoic and consequently appeared completely black and thus represent the most pathologic state.

(1) Vetscan, Fisher ultrasound LTD, Edinburgh, Scotland.
(2) Bayer-Leverkusen, Germany.
(3) Sonogel, vertriebs GmbH, Idstein, Germany.
(4) Polaroid corporation, Combridge, USA.

RESULTS

Ultrasonic examination of the injured tendons showed that the echoic intensity decreased and the structural defects were increased including 3 types of lesions. The site of lesions in the affected tendons was explained in table (1).

Type-1 lesions:

This type of lesions was observed in 4 animals. Clinically 3 of which have no signs of lameness and the SDF tendons were almost normal in palpation. One animal have a moderate degree of lameness after accident with a semihard swelling from the carpus to the fetlock along the medial, lateral and palmar aspects of the limb. In 2 cases Ultrasonographic examination revealed that the width of the SDF tendon was 0.9 cm (P to D) by 2.0 cm (M to L). There was a small, rounded defect on the palmar-lateral border that comprised 27% of the total tendon area in zone 1 A (Fig. 3). In the third case it revealed slight enlargment of the SDF measuring 1.0 (P to D) by 2.1 cm (M to L) in zone 2 A and diffuse hypoechoic pattern of the SDF as well as a marked dilation of all the vessels. There was also a small anechoic area which indicates the presence of a minimal subcutaneous edema (Fig. 4). The sonogram of the 4th animal revealed a totally anechoic area of 0.6 cm between the skin and the planter surface, the medial and the lateral borders of the SDF in zone 3 B to zone 4 B indicate edema of the peritendinous tissue. The SDF remained mostly hypo-echoic (Fig. 5 & 6), the diagnosis was tenosynovitis and tendinitis.

Type-2 lesions:

This type of lesions was observed in 6 animals. Clinically one of these animals has no signs of lameness, only semihard swelling of the left hind limb above the fetlock joint was observed. The other 5 animals have variable degrees of lameness and pain on digital pressure over the affected areas. Swelling of the SDF area was evident in all of the cases at the affected parts. Ultrasonographic examination of the first case revealed enlargment of the SDF tendon, measuring 0.8 (P to D) by 3.0 cm (M to L). A small oval, partially anechoic defect on the dorso-medial border of the SDF tendon was seen comprising about 25% of the total tendon area at zone 3 B (Fig. 7). In two cases the SDF measured 1.2 cm (P to D) by 2.8 cm (M to L), this enlarg-ment constitutes approximatly 0.9 cm and 1.7 cm in both dimensions. There was an oval medial and lateral partially anechoic defect in the SDF which measured 1.0 cm (P to D) by 0.8 cm (M to L) representing approximatly 24% of the total cross-sectional area of the tendon (Fig. 8). In other case the SDF tendon had increased in size to 1.0 cm (P to D) by 2.5 cm (M to L) and the total tendon area was partially anechoic with only a small area representing the normal tendon echogenicity at zone 2 B (Fig. 9). Sonogram of the last 2 animals of this group revealed swelling of the SDF at zone

3 B measuring 1.0 cm (P to D) by 2.6 cm (M to L) with a large partially anechoic defect in the lateral and medial two thirds of the SDF at this zone which represents 64% of the total cross-sectional area of the tendon (Fig. 10).

Type-3 lesions:

3 cases were diagnosed suffering from this type of tendenitis. All these animals had a mild & modrate degrees of lameness with painful swelling of the flexor tendon area. Ultrasonographically, the SDF had a fairly normal shape in all the cases, it was enlarged measuring 1.8 cm (P to D) by 2.7 cm (M to L) at zone 2 A, 3 B and 4 B. At zone-2 A, there was a large, cresentic, totally anechoic defect in the lateral and palmar haves of the SDF that meaured 0.6 cm (P to D) by 1.2 cm (M to L) and involved 72% of the total cross sectional area of the tendon (Fig. 11). This sonogram revealed lateral and palmar fiber tearing with accumulation of edema and haemorrhage.

DISCUSSION

Ultrasonography as used in this study was found to be a useful modality for evaluating the soft tissues of the donkeys distal limb. The procedure was rapid, non-invasive and thought not to be harmful to either the patient or operator. In this study, the abnormal echogenic pattern of the superficial digital flexor tendon was evaluated. Defects that produce fiber disruption in the SDF occur in all aspects of the tendon table (1). They can be medial, lateral (Fig. 8 & 10), palmar (Fig. 3), dorsal (Fig. 7) and centeral (Fig. 5). Defects can disrupt large areas of the tendon (Fig. 8, 10 & 11). We have not yet established the significance of the location of the defect in terms of the eventual outcome of the injury. It may prove to have prognostic implications. We can clearly identify the location of the lesion and measure its cross-sectional area and length. We can also recognize degrees of severity of defects, based on their echogenicity, and rate them accordingly. GENOVESE, et al. (1986) graded the lesions of the tendons sonographically according their degree of echogenicity on a scale of 1 to 4: type 1 lesions were mostly echogenic (hyperechoic) appears more white; type 2 lesions were half echogenic and half anechoic (hypoechoic) less white; type 3 lesions were mostly anechoic; type 4 lesions were totally anechoic and consequently appeared completely black and thus represent the most pathologic state. The previous authors experience suggests that the rating and the degree of cross-sectional involvement in the worst, most anechoic zone of a lesion offers some prognostic value. Statistical evidence is forthcoming. In the present study, the lesions of the tendons were graded sonographically into 3 types. Ultrasonic examination of the injuired tendons showed that the echoic intensity decreased and the structural defects were increased according to the severity of the trauma (Fig. 11), the total anechoic areas at zones 2 A, 3 A and 4 B in the SDF tendons of these group represent the severity of the fiber pattern disruption and presence of haemorrhage and inflammatory exudates. The ultrasonic results were confirmed with the clinical manifestation of these animals (lameness and pain in the flexor tendon area). The longitudinal scan at zone 4 B (Fig. 6) revealed the very weak fiber pattern of the SDF, the appearance of this lesion suggested that significant fiber disruption with an intense inflammatory response had occured.

Diagnostic ultrasound demonstrated that the tendon fiber pattern was far more compromised than was indicated by palpation. In Fig. (3) the tendon defect comprised 27% of the total tendon area while it appears normal in palpation. In Fig. (10) the fiber pattern of the SDF tendon was disrupted in 64% of its total cross-section and palpation revealed only swelling and pain of the tendon area. In Fig. (11) the tendon damage was 72% of the total C.S. area. For this reason when the extent of tendon damage is not known, a serious decision may often be made on the basis of a paucity of data. The quality and ability of the animal were greatly enough to overcome the fact that it had a tendon comprised of 70% normal fibers and 30% damaged fibers (GENOVESE, et al. 1986). Diagnostic ultrasound can assist the clinician by providing meaningful morphologic evaluation of the tendon, quantify the size, location and severity of soft-tissue lesions and to follow the recovery of these lesions overtime. This was supported by the estimation of GENOVESE, et al. (1986) that, the equine with a defect subsumed less than 20% of the cross-sectional area of the tendon and was rated lower than type 4 could continue to work or race.

The ability of diagnostic ultrasound to accurately assess the anatomic defects and the internal character of the injured superficial digital flexor tendon is supported by this study.

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LIST OF FIGURES

Fig. (1): The forelimb was divided into six zones from 1 A through 3 B, as shown.

Fig. (2): The hind limb was divided into eight zones, from 1 A through 4 B, as shown.

Fig. (3): 2-year-old donkey. A type-1 lesion (XS) of SDF zone 1 A-RH can be visualized.

Fig. (4): 4-year-old donkey. A type-1 lesion (XS) of SDF zone 2 A-RF. subcutaneous edema (SUB Q). and dilation of the vessels (d.v.) can be visualized.

Fig. (5): 3-year-old donkey A type-1 diffuse lesion (XS) of SDF, zone 4 B-RH. Tenosynovitis is evidenced by a large anechoic area (SUB Q) surrounded the SDF tendon.

Fig. (6): LS of sonogram shown in Fig. (5). Note: weak fiber pattern and disruption of the normal echogenicity of the SDF as well as the SUB Q edem.

Fig. (7): 4-year-old donkey. A type-2 lesion (XS) of SDF, zone 3 B-LH.

Fig. (8): 4-year-old donkey. A type-2 lesion (XS) of SDF, zone 3 A.

Fig. (9): 6-year-old donkey. A type-2 lesion (XS) of SDF, zone 2 B-RH.

Fig. (10): 5-year-old donkey. A type-2 lesion (XS) of SDF, zone 3 B-LF can be seen encompassing a large area of the total tendon.

Fig. (11): 5-year-old donkey. A type-3 lesion (XS) of SDF, zone 2 A-LF.

Abbreviations:

M: medial; L: lateral; P: Palmar; D: dorsal; SDF: superficial digital flexor tendon; RF: right forelimb; LF: left forelimb; RH: right hindlimb; LH: left lindlimb.

Table (1): Explain the site of lesions in the affected tendons

Zones	Type 1		Type 2		Type 3		Total	
	FL	HL	FL	HL	FL	HL	FL	HL
I A		1						1
B								
II A	1		1		1		3	
B				1				1
III A			1				1	
B		1	2	1	1		3	2
IV A								
B		1				1		2
Total	1	3	4	2	2	1	7	6

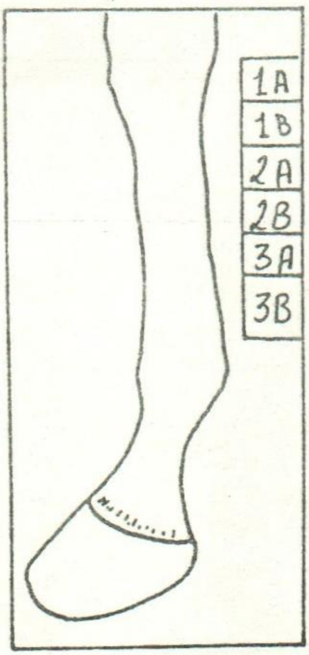
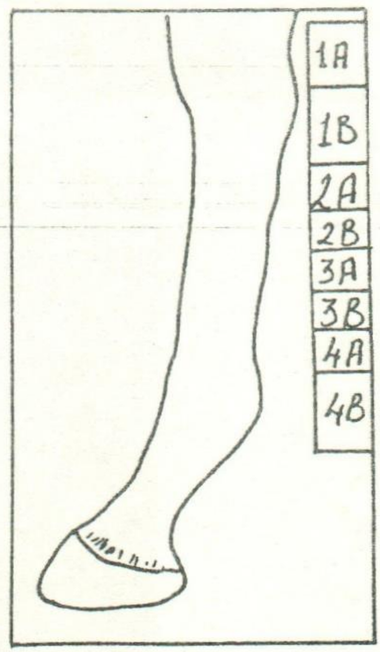


Fig. (1)



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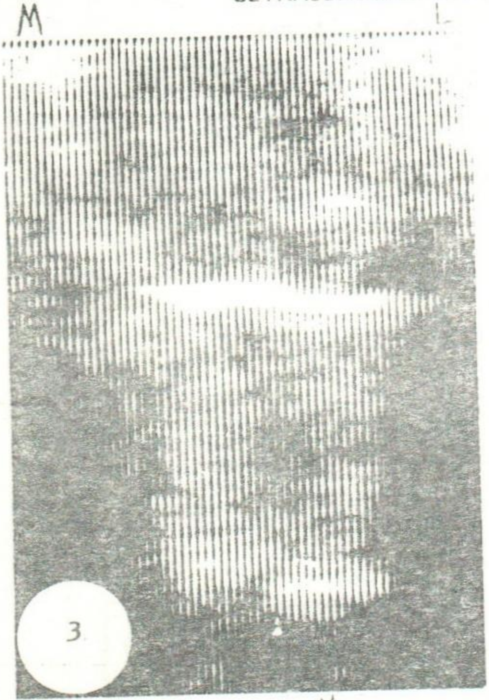
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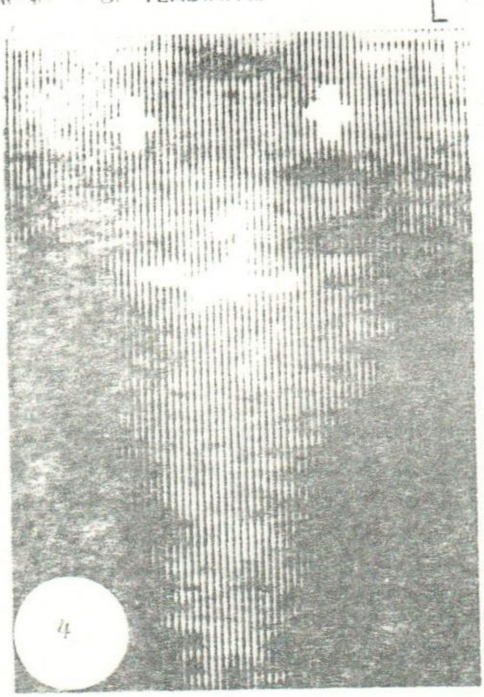
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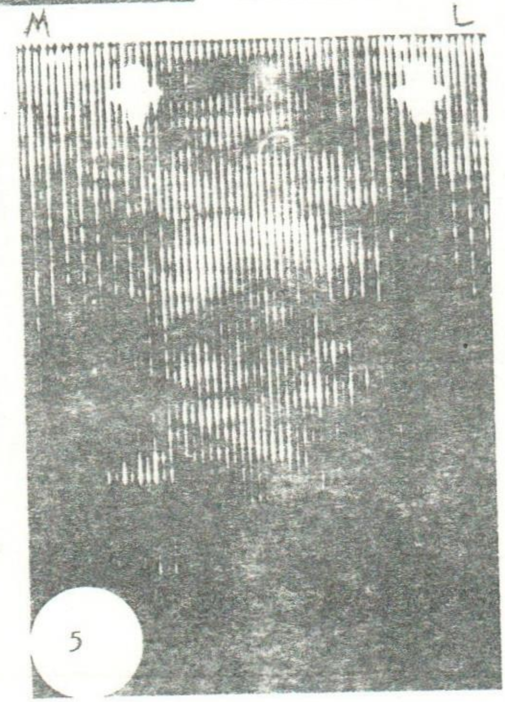
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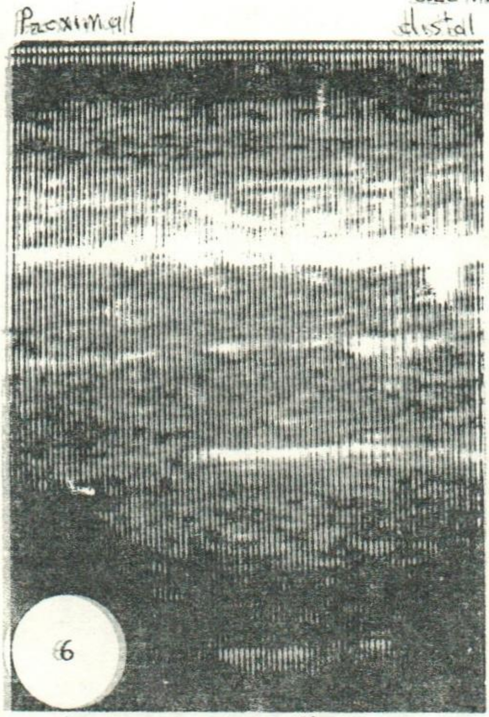
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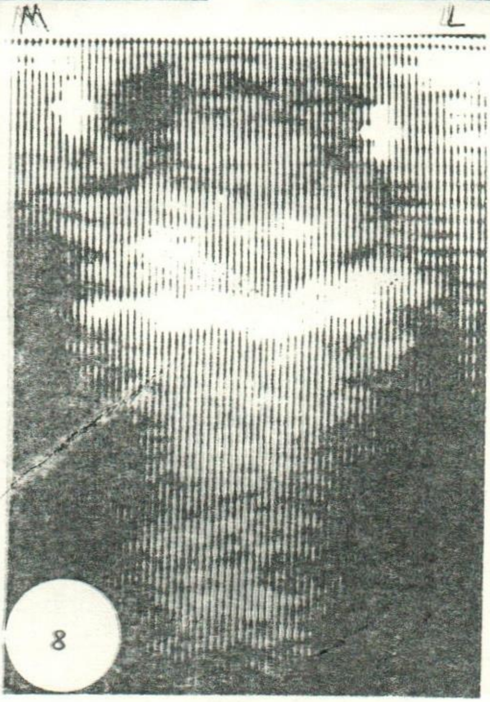
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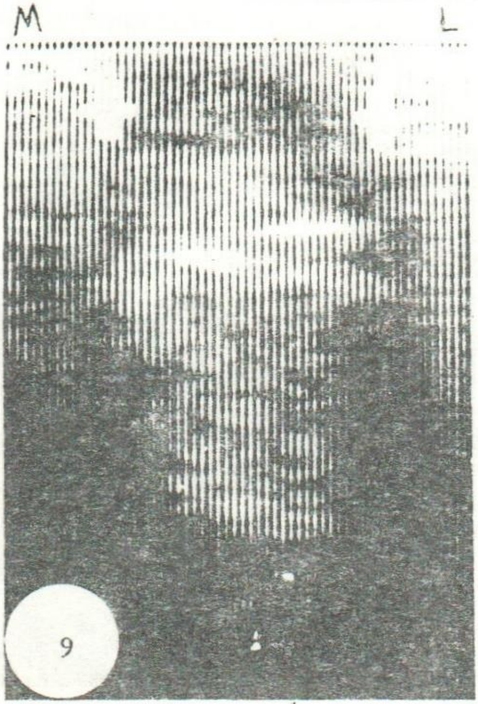
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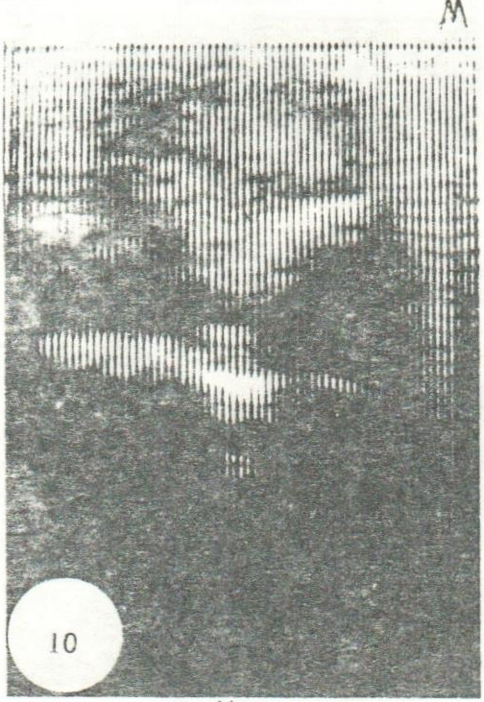
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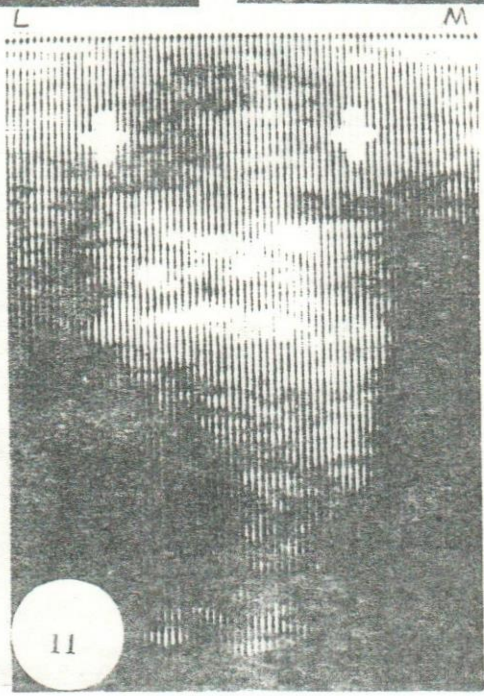
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