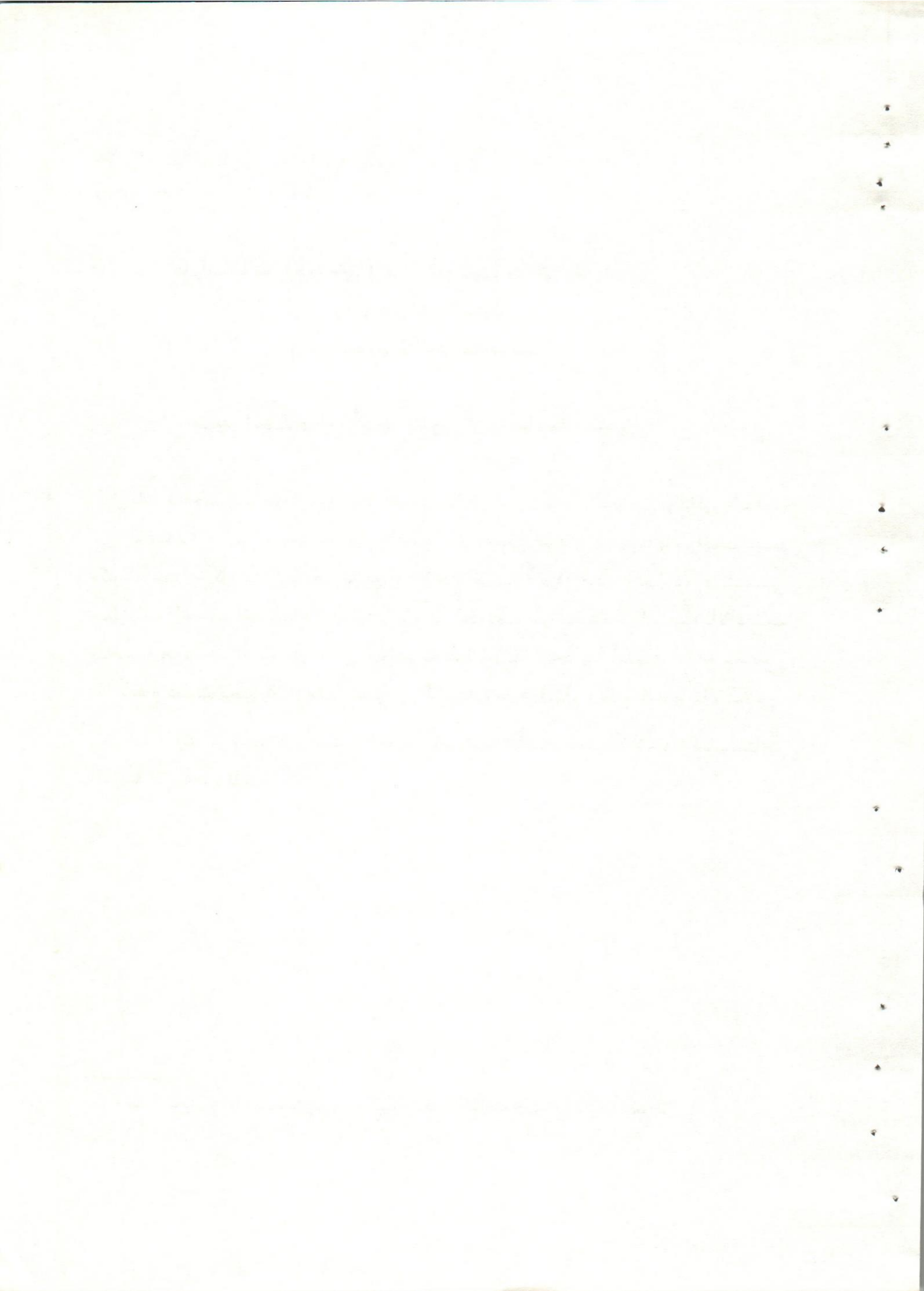


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دراسات تشريحية على الجيب الجبهى والفكى العلوى
فى حيوانات المزرعة
١ - الفصيلة الخيلية

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قام الباحثون باجراء دراسات تشريحية لكل من الجيب الجبهى والفكى العلوى فى الفصيلة الخيلية . وقد تم بيان التكوين العظمى لهذه الجيوب واجزائها وكذلك حد ود كل منها - كما تم بيان الاختلاف فى أجزاء هذه الجيوب فى حيوانات الفصيلة الخيلية تحت الدراسة . كما تمت دراسة هذه الجيوب بالاشعة السينية وباستخدام وسائل حقن ومواد مختلفة وذلك لتحديد أحسن نتائج تصوير بالاشعة كما تم تحديد أنسب العوامل المستخدمة لظهار أوضح الصور بالاشعة . هذا وقد تم تحديد أنسب الاماكن باستخدام أسهل طريقة لاجراء عمليات التربنة فى هذه للحيوانات .



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**ANATOMICAL AND RADIOLOGICAL STUDIES ON
THE FRONTAL AND MAXILLARY SINUSES OF THE FARM ANIMALS**

I- Family Equidae
(With 5 Figs.)

By
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SUMMARY

The main anatomical features of the frontal and maxillary sinuses in horse (*Equus caballus*), mule (*Equus hinnus*) and in donkey (*Equus asinus africanus*) were completely described. The shape, capacity, bony boundaries, as well as, the suitable site for trephining in relation to the obtained topographic anatomical results were focused upon.

As the radiological studies of the paranasal sinuses are considered to be an essential aid for both research work, as well as, for diagnosis, radiographic pictures of the before mentioned two sinuses in the Family Equidae were obtained. The study includes also the suitable positions and the correct factors for the best radiographic examination.

INTRODUCTION

The paranasal sinuses including the frontal and the maxillary were described by EL-HAGRI (1967), NICKEL/SCHUMMER/and SEIFERLE (1973) and HILLMANN (1975) in horse. However, no informations could be traced in the available literatures concerning the frontal and maxillary sinuses in mule and donkey. This study was, therefore, carried out to describe the points of similarity and differences in the anatomical features of the two sinuses among the equine family.

MATERIAL and METHODS

The anatomical and radiographical studies were carried out on 10 heads of each: horse, mule and donkey. The heads were completely macerated and cleaned, then divided by an electric saw through their median plane.

The radiographic examination was done on half of the available specimens by 3 methods:

- 1- Injection of Lipidol (of Laborat. Ander Guerbet, Saintauen, France).
- 2- Full contrast method using 50% Barium sulphate.
- 3- Double contrast method using a thin coat of Barium sulphate lining the interior of the studied sinuses.

The radiographic pictures were performed in all known positions using different Factors.

The outer plates covering the examined sinuses were removed to study their boundaries and

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divisions. For determination of Capacity, Volume and Shape of the frontal and maxillary sinuses, additional sectioned skulls were injected by a liquid mixture of paraffin, bee wax and stearic acid. The specimens then were digested with Conc. Hcl leaving a complete Wax casts for the injected sinuses. These casts were used to determine the capacity and volume of each sinus.

RESULTS

I - Sinus frontalis:

In horse, mule and donkey the frontal sinus lies completely between the two plates of the frontal bone. It extends rostrally till the fronto-nasal suture and reaches caudally a level about 3 cm caudal to the caudal border of the orbit. The right and left sinuses are separated from each other by a bony sagittal septum. Each is divided into a middle, lateral and medial portion (Fig. 1,2,3).

The middle portion of the frontal sinus communicates freely with the maxillary sinus through the fronto-maxillary aperture. The lateral portion in horse has 2 diverticulae which roofs the dorsal aspect of the orbit rostromedial to the supraorbital foramen. The lateral portion in mule contains only one rostral diverticulum which roofs also the dorsal aspect of the orbit, while in donkey it has 2 rostral diverticulae as those found in horse. The medial portion of the frontal sinus lies parallel to the median plane and extends rostrally to join the dorsal conchal sinus. In horse, the medial portion has 3 diverticulae at its caudal end which roofs the frontal lobe of the cerebrum. It has also 3 diverticulae in mule, while in donkey it possesses only 2 caudal diverticulae.

The capacity of the frontal sinus in adult horse and mule is about 150-160 ml, while in donkey it measures 130-150 ml according to the size of the animal.

Site of trephining:

A transverse line is drawn from the supraorbital foramen to the median plane, operation is done 2 cm lateral to the median plane (Fig. 1,2,3).

II- Sinus maxillaris:

The morphological features of the maxillary sinus in horse and mule are greatly similar. It excavates the most part of the maxilla, zygomatic and partly the lacrimal bones. The infraorbital foramen forms the rostral limit of the maxillary sinus, while caudally it extends till the maxillary tuberosity. Its medial wall is formed by an osseous plate descending from the bony infraorbital canal till the floor of the sinus.

The maxillary sinus is divided by a transverse thin bony plate into a small rostral and a large caudal portions (Fig. 4). The rostral maxillary sinus excavates completely the maxilla, its rostral limit lies just ventral to the infraorbital foramen. The sinus communicates medially with the ventral conchal sinus and indirectly with the nasal cavity. The caudal maxillary sinus extends from the oblique thin bony septum rostrally till nearly the middle of the temporal process of the zygomatic bone and the maxillary tuberosity. It communicates dorsally with the frontal sinus through the frontomaxillary aperture, caudoventrally with the sphenopalatine sinus and dorsomedially with the nasal cavity through the masomaxillary aperture. Externally, the facial crest appears as dividing the maxillary sinus in horse and mule into a dorsal and ventral portions. The ventral portion extends normally till the alveolar border of the bone (Fig. 4).

FRONTAL AND MAXILLARY SINUSES IN EQUINES

In donkey, the rostral maxillary sinus extends to a point 1.5 cm caudal to the level of the infraorbital foramen. The oblique septum dividing the maxillary sinus in all donkey specimens is reduced into a low ventral ridge (Fig. 5). The rostral maxillary sinus lies just dorsal to the level of the facial crest, however, the caudal sinus extends about 1 cm ventral to the before mentioned level.

The capacity of the maxillary sinus in horse is about 200-250 ml and in mule about 300-350 ml, while in donkey it measures about 100-120 ml.

Site of trephining:

In horse and mule the rostral maxillary sinus is trephined 2 cm dorsal to the rostral end of the facial crest, while the caudal one is operated 6 cm caudal to the rostral end of the facial crest then 2 cm dorsal (Fig. 4). As there is no complete separation between the two portions of the maxillary sinus in donkey, the sinus can be opened either 2 cm caudal to the rostral end of the facial crest then 2 cm dorsal or 6 cm caudal to the rostral end of the crest and 3 cm dorsal (Fig. 5).

Radiological studies:

The radiographical examination of lipiodol injected specimens showed no clear pictures of the examined sinuses, the full contrast method was also not so better, however, the most clear pictures were obtained by using the new double contrast method. Moreover, best results were recorded by using the oblique lateral and dorsoventral positions on x- raying the studied sinuses.

The factors used at the oblique lateral position were: 50 KV, 90 mAs and 1 sec at 90 FFD*. The same factors were used at the dorsoventral position but with 55 KV instead of 50.

DISCUSSION

The anatomical features of the frontal sinus in Family Equidae are generally similar to that described in horse by EL-HAGRI (1967), NICKEL *et al.* (1973) and HILLMAN (1975).

The frontal sinus divides into middle, medial and lateral portions which are described by NICKEL *et al.* (1973) as medial, rostral and caudal ones. However, the topographical studies and the relations between the different compartments of the frontal sinus in the three species indicate that the nomenclature of medial and lateral portion which include the middle portion in location is more reasonable than that mentioned by NICKEL *et al.* (1973).

Informations about the anatomical differences between the frontal sinuses in horse, mule and donkey are lacking in the available literature and the well known anatomical books. However, the lateral portion of the frontal sinus in horse possesses two rostral diverticulae as in donkey, while in mule, the lateral portion has only one rostral diverticulum. On the other hand, the medial portion of the frontal sinus in donkey contains two caudal diverticulae instead of three ones present in the medial portion of both horse and mule.

The division of the maxillary sinus into rostral and caudal parts in horse was reported by EL-HAGRI (1967), NICKEL *et al.* (1973) and HILLMANN (1975). The same results were also found in mule. However, the bony septum dividing the maxillary sinus into a rostral and caudal portions in horse and mule is reduced into a low ridge in donkey.

* Kilovoltage (KV), Milliamperage (mAs), Exposure time (sec), distance between the film and focus (FFD).

The facial crest which appears to divide the maxillary sinus externally into a dorsal and ventral portions in horse and mule, forms in donkey the external demarcation of the floor of the maxillary sinus as the case in young horses reported by NICKEL et al. (1973).

A bony septum which encloses the osseous infraorbital canal divides the caudal maxillary sinus in horse into a small dorsomedial and large ventrolateral parts as stated by EL-HAGRI (1967) and NICKEL et al. (1973) is found also in other equines under examination.

The double contrast method which was applied to examine the studied paranasal sinuses appeared to be the most suitable method for this purpose. However, the full contrast method which was formerly used by AHMED (1974) gave less clear pictures for the injected sinuses.

MORGAN (1972) mentioned that the normal air present in an affected sinus can be used as a contrast medium because of its cloudy appearance, however, such result using only the air is not sufficient.

The best radiographic pictures were obtained by using the oblique lateral view as mentioned by AHMED (1974) and NIGAM/ SINGH/ CHANDNA (1981), while the dorsoventral view is claimed to be the best by CARLSON (1967), AMMANN/ FACKELMAN (1971) and MORGAN (1972). In radiographing the paranasal sinuses in equines, SCHEBITZ/ WILKENS (1968) have used the lateral view. They divide the skull into two parts, an oral part radiographed at 70 kV, 30 mAs at 120 cm FFD, and an aboral part radiographed at 70 kV, 50 mAs at 120 cm FFD. However, the differences between the best factors in this study and those mentioned by other authors may be due to the differences in factors between the different x- ray apparatuses.

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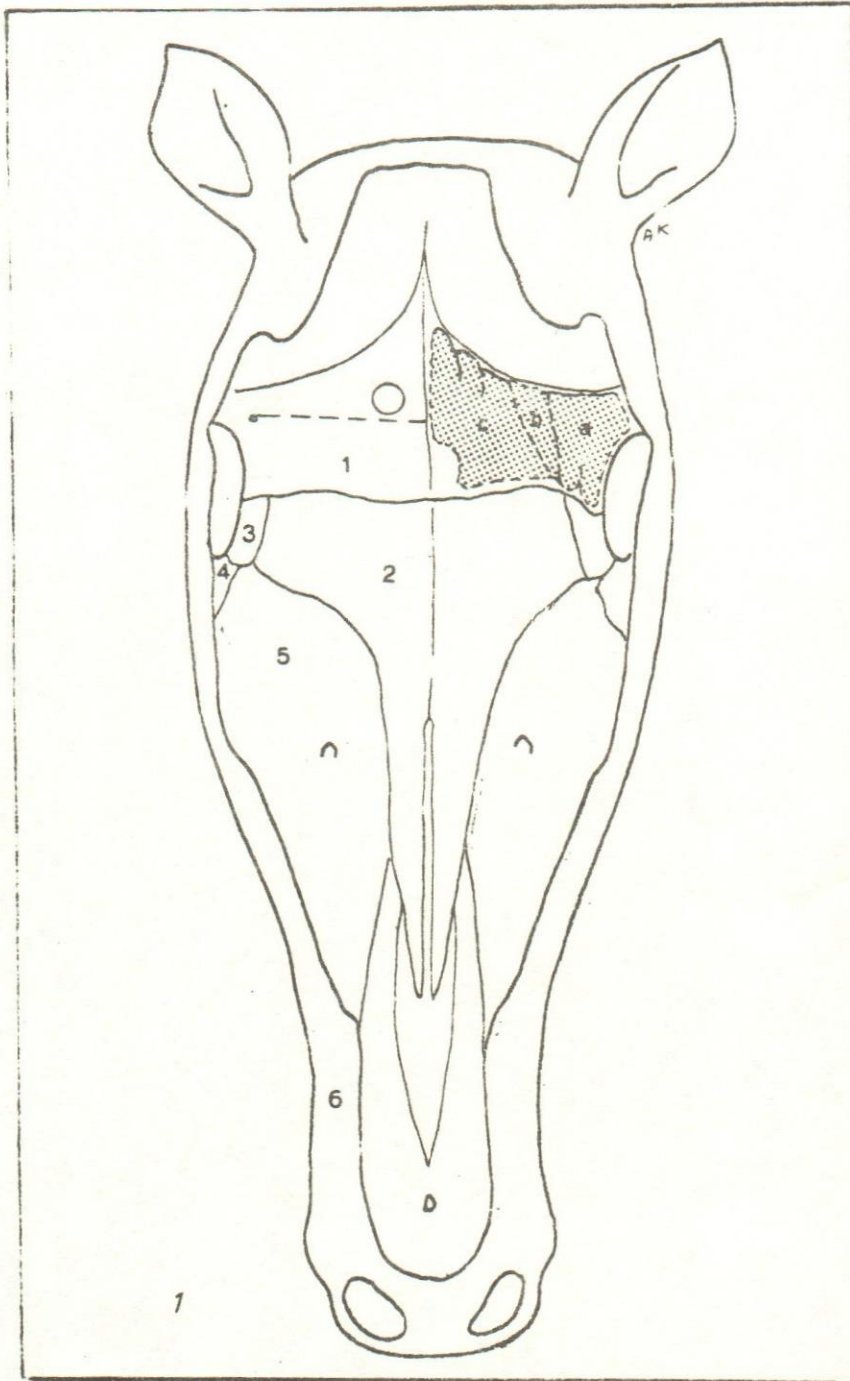
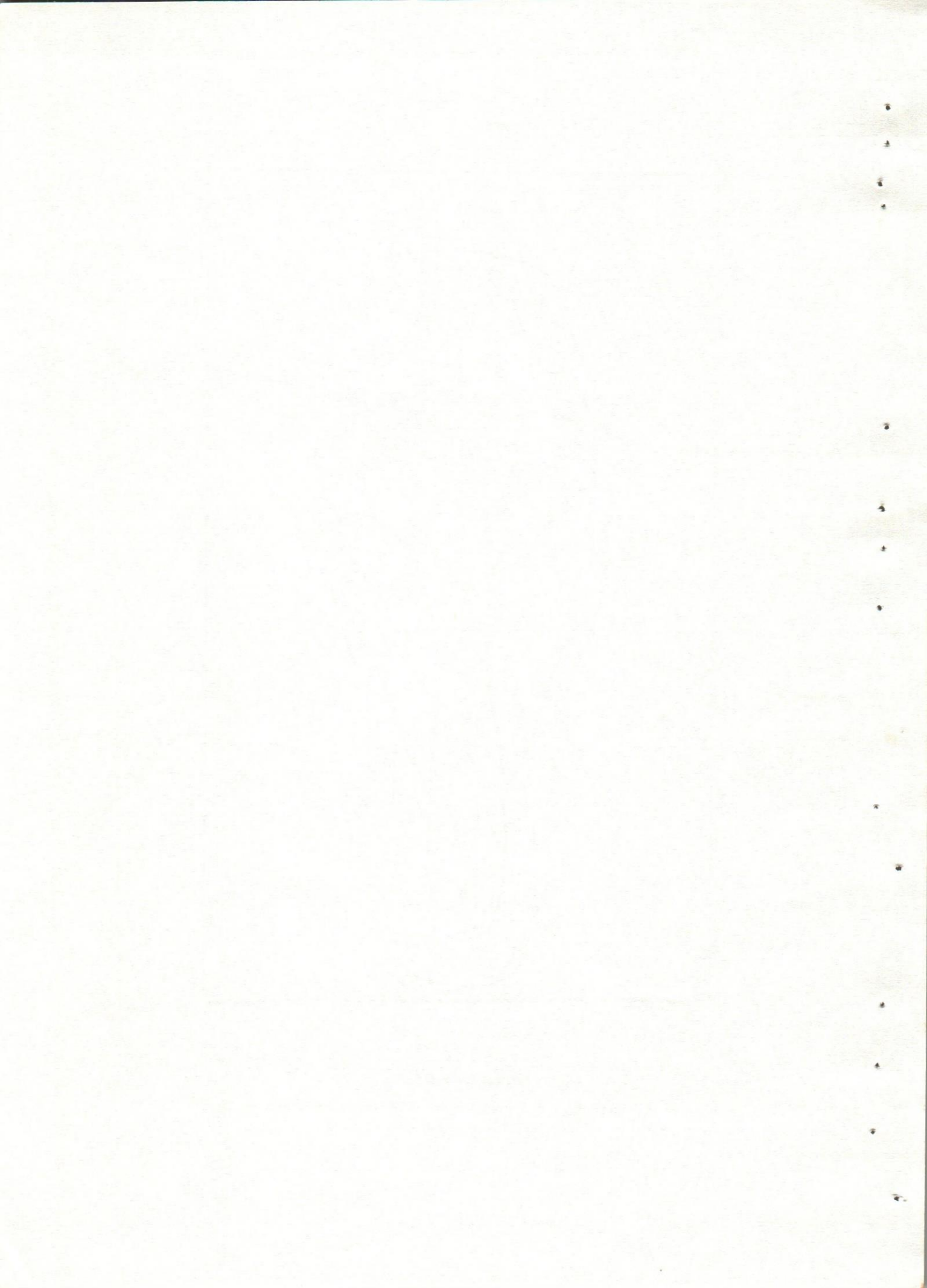


Fig. (1)
Frontal sinus in horse

a lateral, b middle, c medial frontal sinus (note the two rostral diverticulae in a and three caudal ones in c).



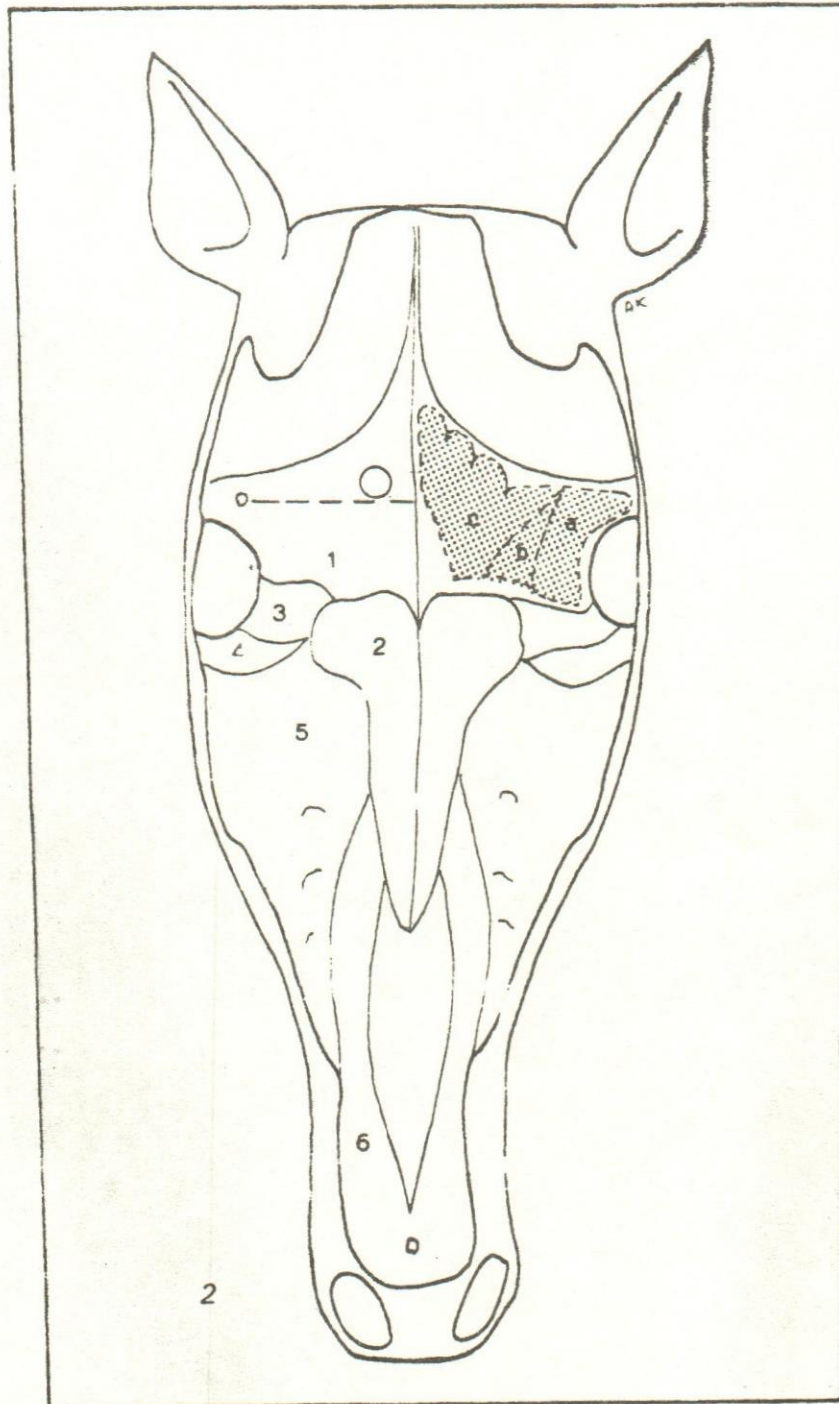
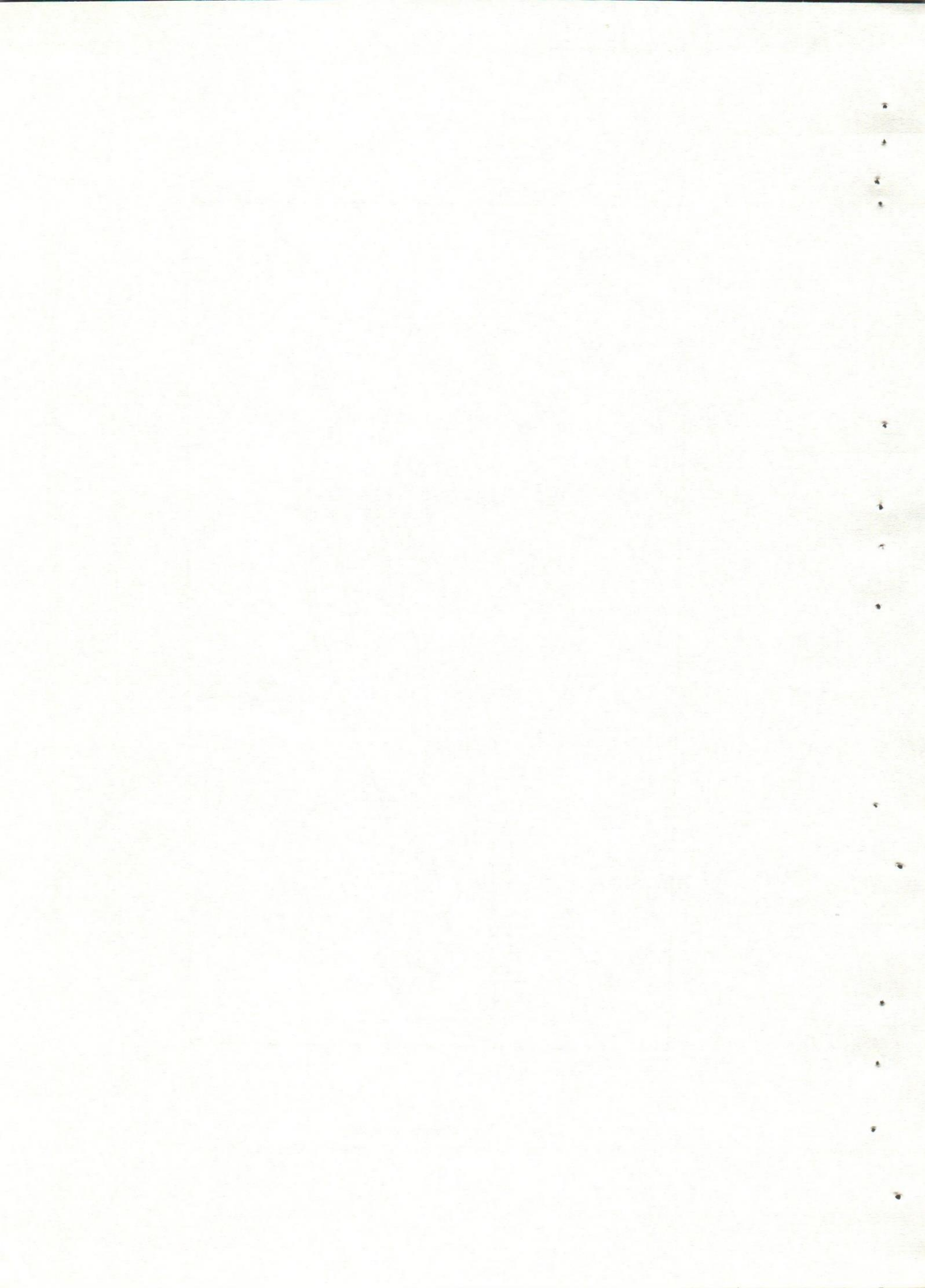


Fig. (2)
Frontal sinus in mule
(note one rostral diverticulum in a and three caudal ones in c).



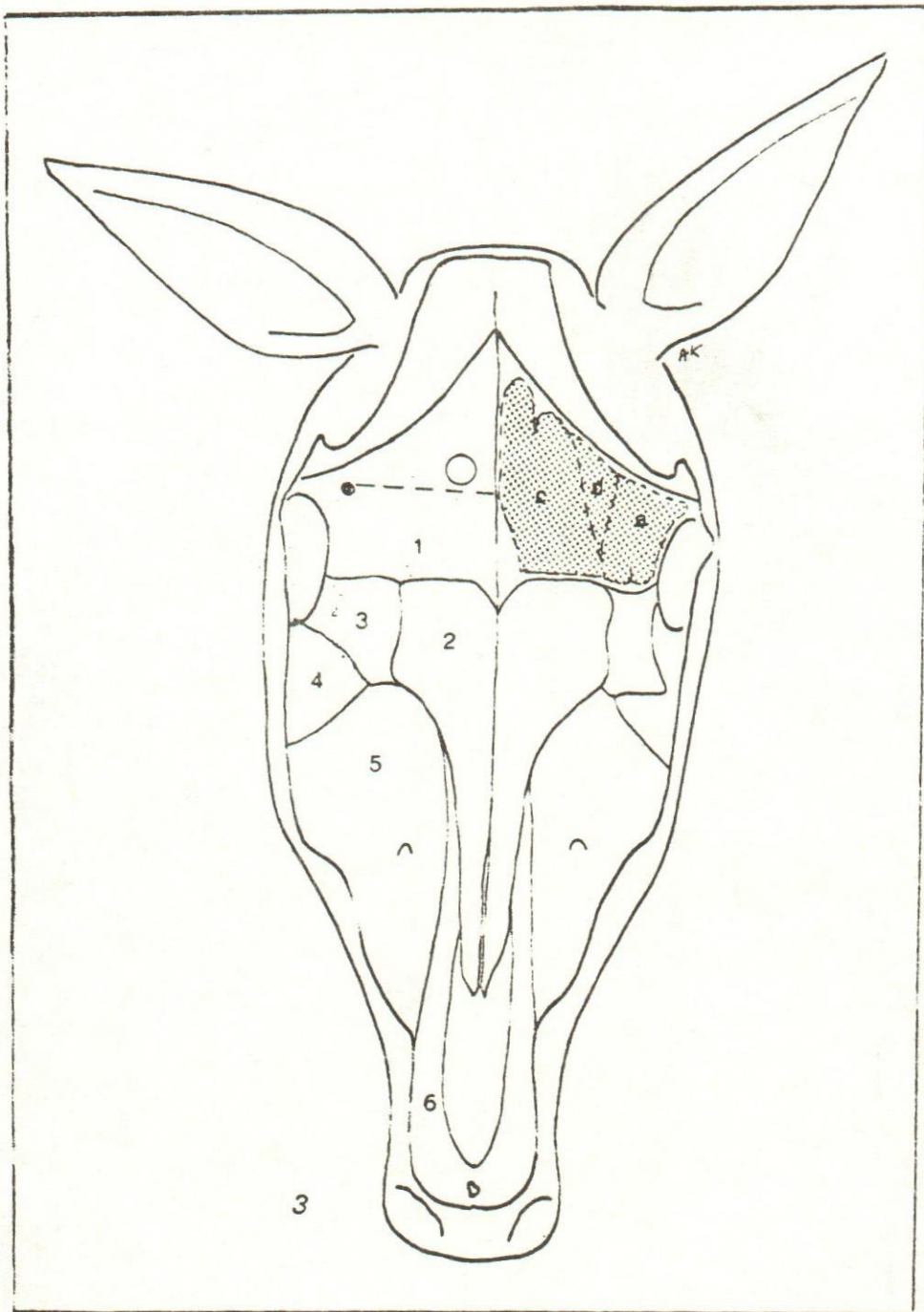
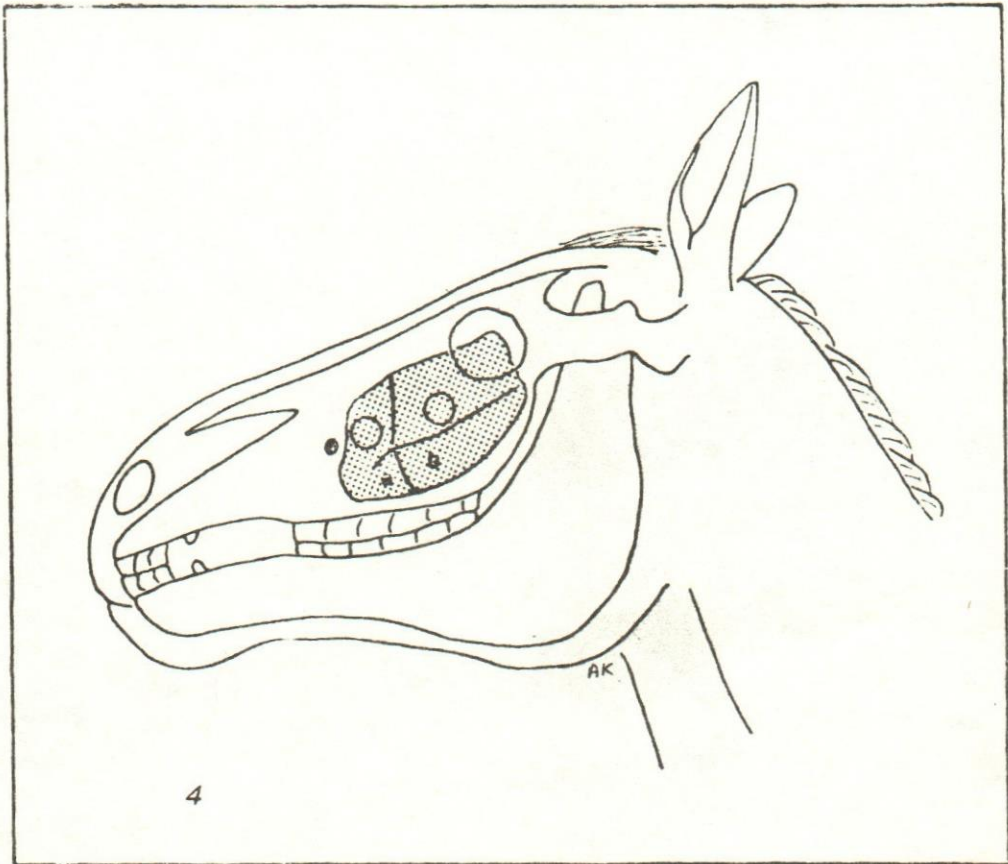


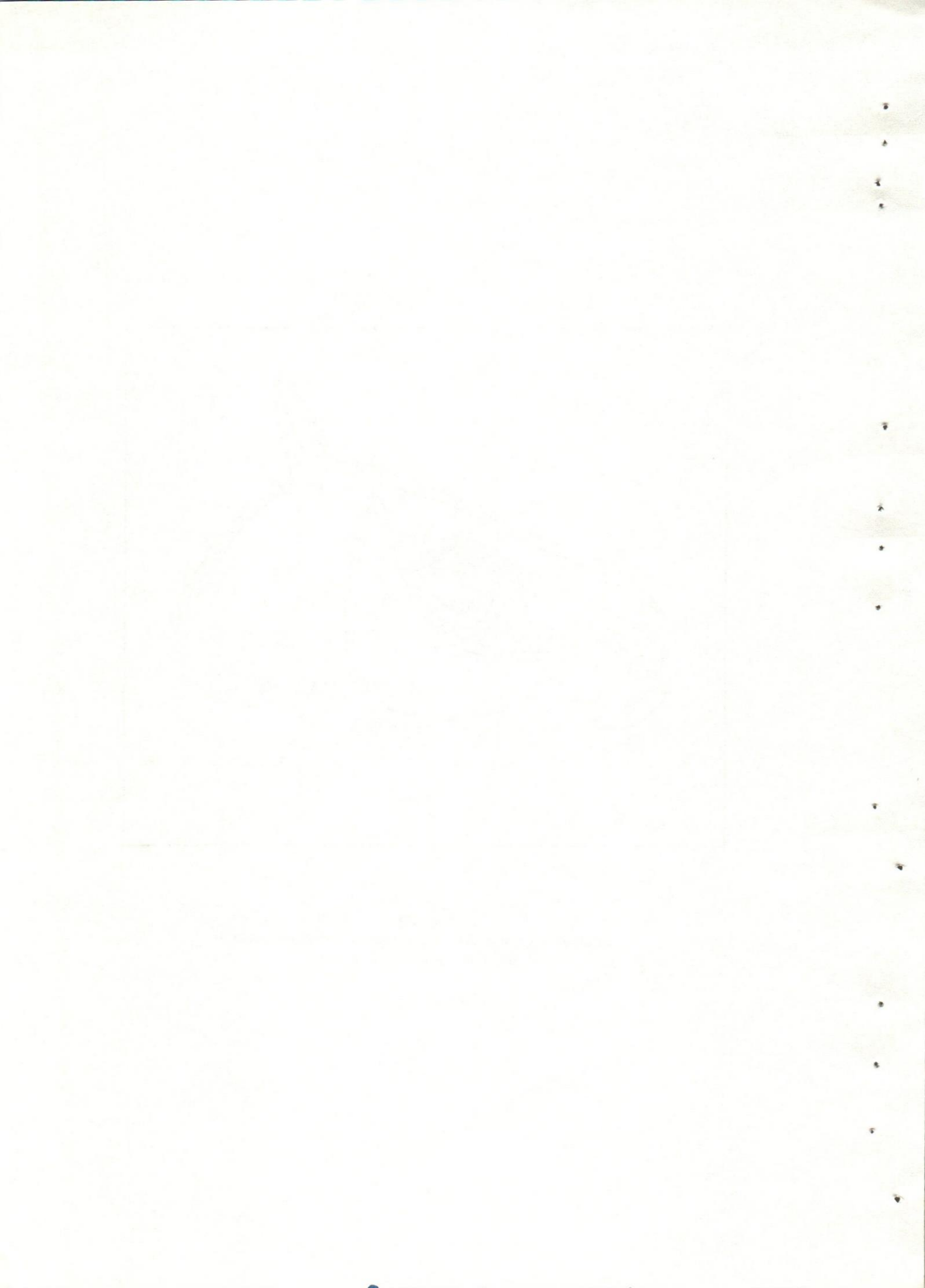
Fig. (3)
Frontal sinus in donkey
(note two rostral diverticulæ in a and two caudal ones in c).





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Fig. (4)
Maxillary sinus and site of trephining in horse and mule
a rostral, b caudal maxillary sinus



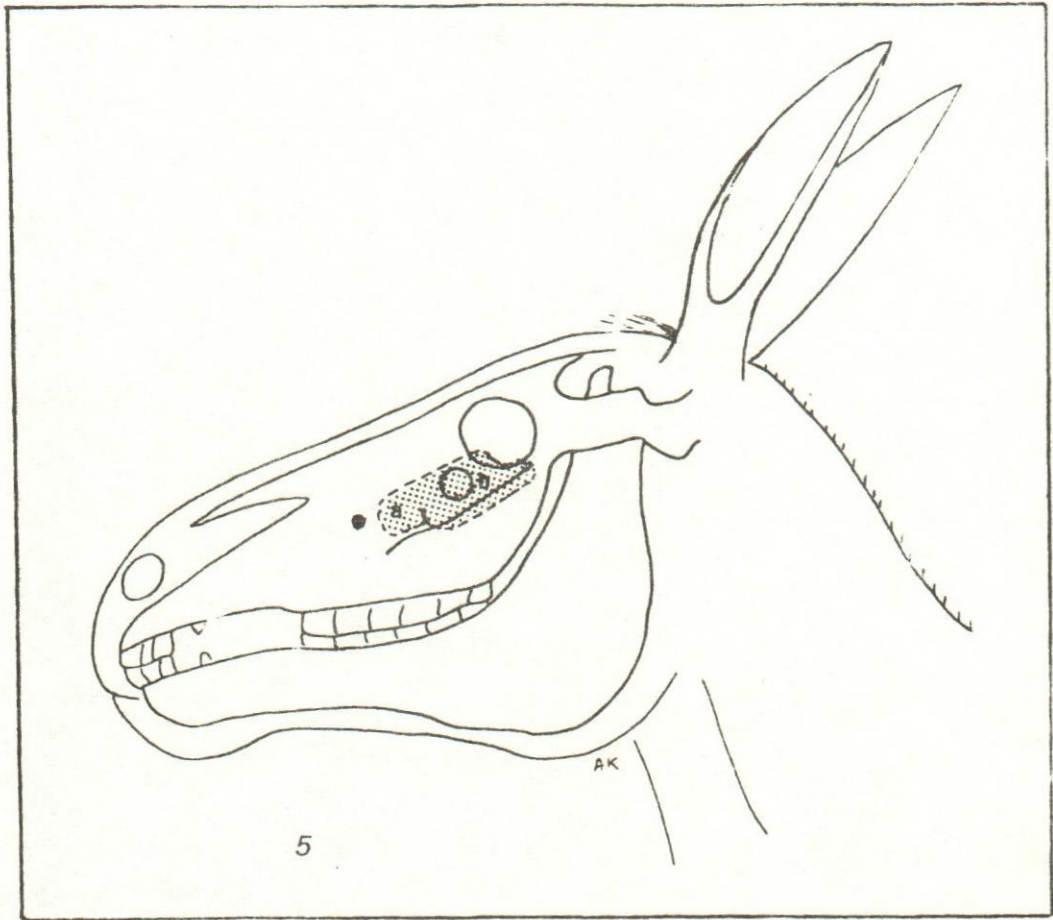


Fig. (5)

Maxillary sinus and site of trephining in donkey

a rostral, b caudal maxillary sinus

1 frontal, 2 nasal, 3 lacrimal, 4 zygomatic, 5 maxilla, 6 incisive bone.

