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دراسات تشريحية على الجيب الجبهى والفكى العلوى
فى حيوانات المزرعة
٢ - فصيلة المجترات

محمود الجندى ، أحمد قناوى * ، سامية سليم

قام الباحثون باجراء دراسات تشريحية لكل من الجيب الجبهى والفكى العلوى فى فصيلة المجترات . وقد تم بيان التكوين العظمى لهذه الجيوب واجزائها وكذلك حد ود كل منها . كما تم بيان الاختلاف فى أجزاء هذه للجيوب فى حيوانات فصيلة المجترات 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 الأماكن باستخدام أسهل طريقة لاجراء عمليات التربية فى هذه الحيوانات .

Dept. of Surgery,
Faculty of Vet. Med., Assiut University,
Head of Dept. Prof. Dr. N.A. Misk.

**ANATOMICAL AND RADIOLOGICAL STUDIES ON
THE FRONTAL AND MAXILLARY SINUSES OF THE FARM ANIMALS
II- Family Ruminancia
(With 6 Figs.)**

By
M.H. EL-GUINDY; A.K. AHMED* and S.M. SELIM
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SUMMARY

The main anatomical features of the frontal and maxillary sinuses in cattle (*Bos taurus*); buffalo (*Bubalus bubalis*); sheep (*Ovis aries*) and goat (*Capra hircus*) 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 explained.

Radiographic pictures of the frontal and maxillary sinuses of the Family Ruminancia were obtained to know the most suitable positions and the correct factors for the best radiographic examination for the members of this family.

INTRODUCTION

The paranasal sinuses including the frontal and the maxillary were described in cattle by WILKENS (1958), while EL-HAGRI (1967), NICKEL/ SCHUMMER/ SEIFERLE (1973) and HILLMAN (1975) described the paranasal sinuses in ruminants except buffaloes. However, the general anatomical description of the sinuses in buffaloes was done by MOUSTAFA/ KAMEL (1971), AHMED (1974) and SAIGAL/ KHATRA (1977).

This study was carried out to describe a simplified method to determine the suitable positions for trephining the frontal and maxillary sinuses in small and large ruminants.

MATERIAL and METHODS

The anatomical and radiological studies were carried out on 7 heads of each; cattle, buffalo, sheep and goat. 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 Lipiodol injection; double and full contrast methods used before in Family Equidae.

The outer plates covering the examined sinuses were removed to study their boundaries and divisions. Wax casts were obtained by using a liquid mixture of paraffin, bee wax and stearic acid which were used in determination of the capacity, volume and shape of the examined sinuses.

* Dept. of Anatomy, Faculty of Vet. Med., Assiut University.

RESULTS

I - Sinus frontalis

The frontal sinus in cattle lies between the two plates of the frontal bone and extends partially into the parietal, interparietal, temporal and squamous part of the occipital bone. It roofs the cranial cavity completely dorsolaterally and caudally. The right and left sinuses are separated from each other by a complete median septum. Each is divided by an oblique septum into a small rostral and large caudal one (Fig. 1).

The rostral frontal sinus comprises 3 incompletely separated medial, intermediate and lateral portions. The medial rostral frontal sinus is related rostrally to the dorsal conchal sinus and has a small opening leading into the ethmoidal meatus. The intermediate and lateral rostral frontal sinuses may fuse completely, however, each has a separate aperture leading into the ethmoidal meatus.

The caudal frontal sinus is divided by a Y shaped oblique septum into a middle, caudomedial and caudolateral compartments. The middle caudal frontal sinus has 3 lateral and 3 ventral diverticulae in addition to the postorbital diverticulum. The caudomedial frontal sinus contains the nuchal diverticulum which forms the most caudal part of the frontal sinus. The caudolateral frontal sinus possesses the cornual diverticulum which is deep and extends into the core of the horn.

The capacity of the frontal sinus in adult cows is about 330-350 ml.

The frontal sinus in buffalo excavates the frontal, parietal, interparietal and the squamous part of the occipital bones. The right and left sinuses are completely separated from each other and cover the dorsolateral and caudal aspects of the cranium. The frontal sinus is divided by a complete septum into a small medial and large caudolateral frontal sinuses (Fig. 2).

The medial frontal sinus is bounded rostrally by the dorsal conchal sinus and caudally by the nuchal diverticulum.

The caudolateral frontal sinus is limited rostrally by the lacrimal sinus, where it communicates with the nasal cavity through an aperture situated medial to the lacrimal sinus. It contains the following diverticulae:

- Postorbital diverticulum of about 6.5 cm depth.
- Cornual diverticulum which forms the main cavity of the cornual process of the frontal bone and has 12 cm depth, however the depth differs according to the age.
- Nuchal diverticulum which forms the most caudal part of the caudolateral frontal sinus and comprises 3 lacunae separated by two incomplete septa.

The capacity of the frontal sinus in adult buffalo is about 400-420 ml.

The frontal sinus in sheep (*Ovis aries*) excavates completely the frontal bone and divides into a small medial and large caudolateral sinuses. The medial frontal sinus communicates directly with the nasal cavity through an opening situated medial to the lacrimal sinus. The caudolateral frontal sinus contains the postorbital, cornual and nuchal diverticulae (Fig. 3 B).

The capacity for the frontal sinus in adult unhorned sheep is about 35-40 ml.

The frontal sinus in goat (*Capra hircus*) excavates completely the frontal bone and extends rostrally till the level of the frontonasal suture and caudally till the root of the cornual process. The frontal sinus divides into a small medial and a large caudolateral portions (Fig. 3 A). In horned specimens the frontal sinus possesses the postorbital, cornual and nuchal diverticulae.

FRONTAL AND MAXILLARY SINUSES

The capacity of the frontal sinus in adult unhorned goat is about 40-45 ml.

Site of trephining:

In cattle the rostral frontal sinus is operated 2 cm lateral to the median plane on a transverse line connecting the supraorbital foraminae. The caudal frontal sinus is trephined 2 cm lateral to the median plane on a transverse line drawn just rostral to the roots of the two horns.

In buffalo the medial frontal sinus is trephined 1.5 cm lateral to the median plane on a transverse line drawn just rostral to the roots of the horns. The caudolateral frontal is operated 5 cm lateral to the median plane on the same line.

In sheep and goat the frontal sinus is trephined 2 cm lateral to the median plane on a line drawn parallel to the caudal margin of the orbit.

II- Sinus maxillaris:

The maxillary sinus in cattle excavates the maxilla, lacrimal bulla and zygomatic bones. It extends from the bulla caudally till about 2 cm caudal to the infraorbital foramen (Fig. 4). It communicates caudodorsally with the lacrimal sinus and with the palatine sinus through a wide communicating opening found over the osseous infraorbital canal. It connects also with the nasal cavity together with the palatine sinus.

The capacity of the maxillary sinus in adult cow measures 140-150 ml.

The maxillary sinus in buffalo excavates the maxilla, zygomatic, lacrimal bulla and partly the temporal process of the zygomatic bone. It communicates caudodorsally with the lacrimal sinus and with the palatine sinus over the osseous infraorbital canal. The maxillary and palatine sinuses communicate together with the nasal cavity (Fig. 5).

The capacity for the maxillary sinus in adult buffalo reaches 150-160 ml.

In sheep and goat the maxillary sinus excavates the maxilla, lacrimal bulla and zygomatic bones. It extends to about 1 cm caudal to the infraorbital foramen. The communications of the maxillary sinus in sheep and goat are similar to those found in large ruminants i.e. the lacrimal and palatine sinuses and the nasal cavity (Fig. 6).

The capacity of the maxillary sinus in adult sheep and goat is about 30-35 ml.

Site of trephining:

The maxillary sinus in cattle is trephined in a position 4 cm rostral to the medial angle of the eye and 2 cm ventral to it.

A line is drawn in buffalo from the infraorbital foramen till the medial angle of the eye, the operation is done on this line 6 cm caudal to the level of the foramen.

In sheep and goat the maxillary sinus is trephined 1.5 cm rostral to the medial angle of the eye and 1 cm ventral to it.

Radiological studies:

The lipidol injected specimens showed no clear pictures of the studied sinuses, however, the full contrast method was also not clear. The best results were recorded by using the double contrast method with the oblique lateral and the dorsoventral positions on x- raying the studied sinuses.

The factors used in cattle and buffalo to x- raying the frontal and maxillary sinuses at the oblique lateral position were: 50 kv, 90 mas and 1 s at 90 FFD*, the same factors but with

* Kilovoltage (kv), Milliampere (mas), Exposure time (s), distance between the film and focus (ffd).

45 kv were used for sheep and goat. At the dorsoventral position, the factors used are 55 kv for cattle and buffalo and 50 kv for small ruminants, however, the other factors are the same used at the oblique lateral position.

DISCUSSION

The general anatomical description of the boundaries and relations of the frontal and maxillary sinuses in small and large ruminants described in this work is similar to the description given by EL-HAGRI (1967); NICKEL *et al.* (1973) and HILLMAN (1975) in cattle, sheep and goat and MOUSTAFA/ KAMEL (1971), AHMED (1974) and SAIGAL/ KHATRA (1977).

The division of the frontal sinus into rostral and caudal parts was mentioned by WILKENS (1958), EL-HAGRI (1967) and NICKEL *et al.* (1973) ie. minor and major compartments by SISSON/ GROSSMAN (1968). The caudal frontal sinus in cattle divides into middle, caudomedial and caudolateral portions, however, EL-HAGRI (1967) and NICKEL *et al.* (1973) described only the caudomedial and caudolateral parts.

A position for trephining the frontal sinus in cattle was described by BERGE/ WESTHUES (1966) similar to that given in the present study, moreover, the same position was described by O'CONNOR (1965) in addition to another 2 positions for opening the continuation of the sinus into the horn core. However, the essential result of this work is the simplified method for trephining the frontal and maxillary sinuses in buffalo, sheep and goat, in addition to cattle.

The double contrast method using a thin film of barium sulphate together with the air already present in the studied sinuses appear to be the best method for applying such study. The full contrast method which was applied by AHMED (1974) gave less clear pictures, moreover, radiographing the affected sinuses using only the air as reported by MORGAN (1972) is not sufficient for such purpose. The best radiographic pictures were obtained by using the oblique lateral position as mentioned also by AHMED (1974) and NIGAM/ SINGH/ CHANDNA (1981).

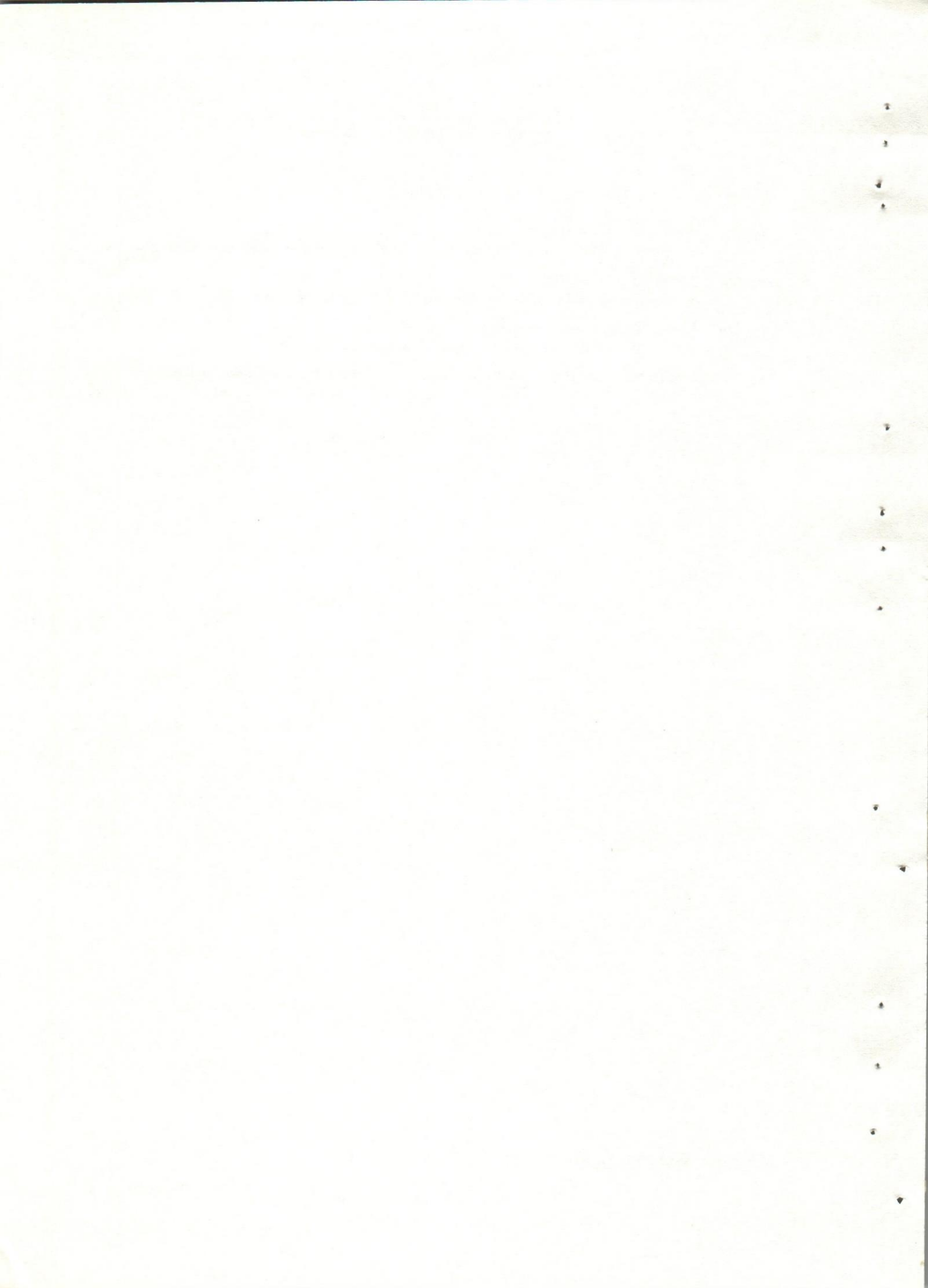
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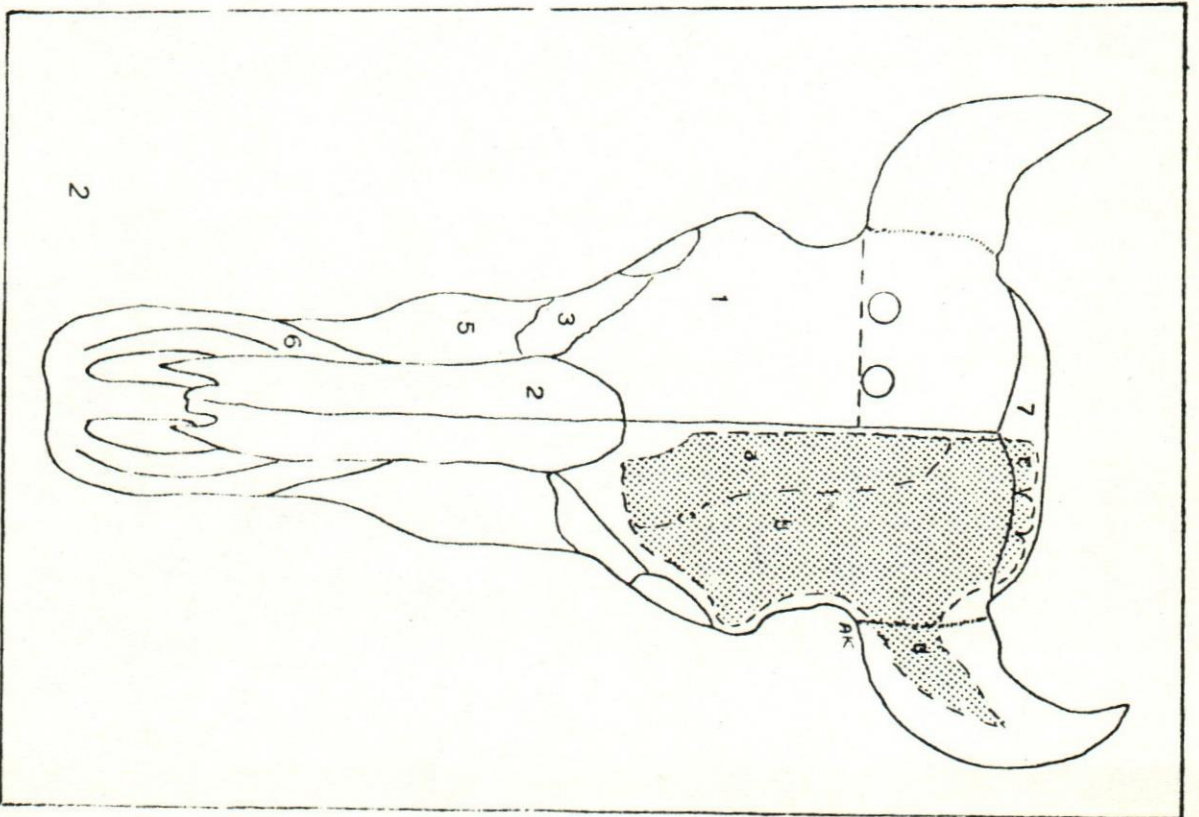
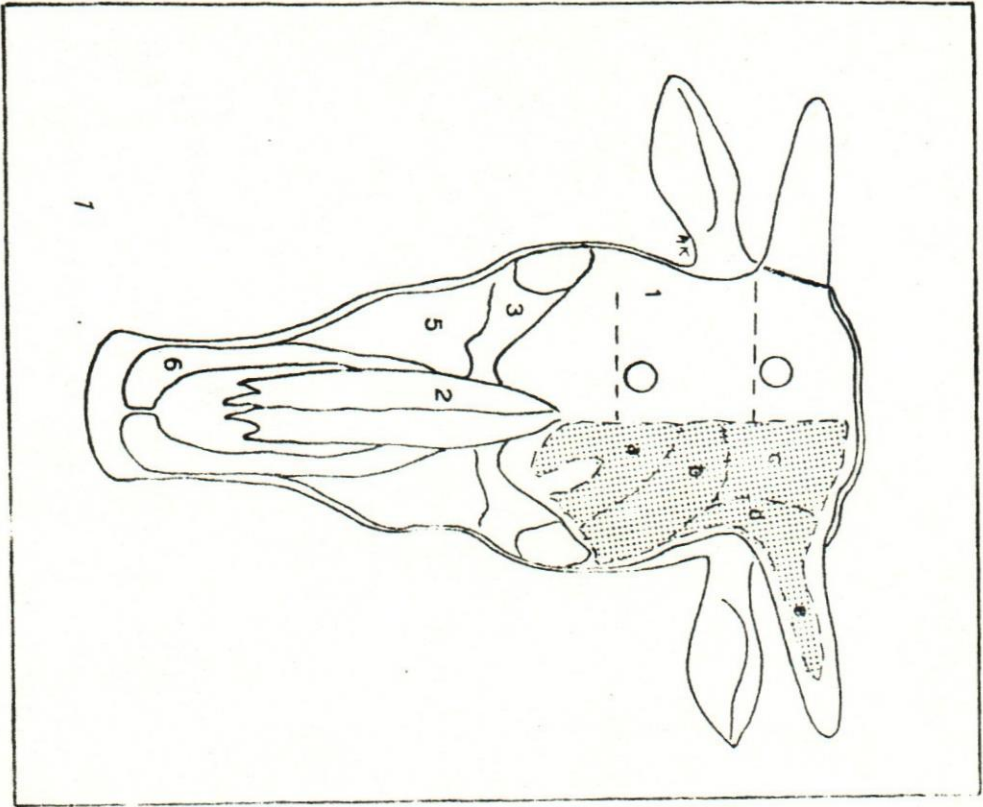
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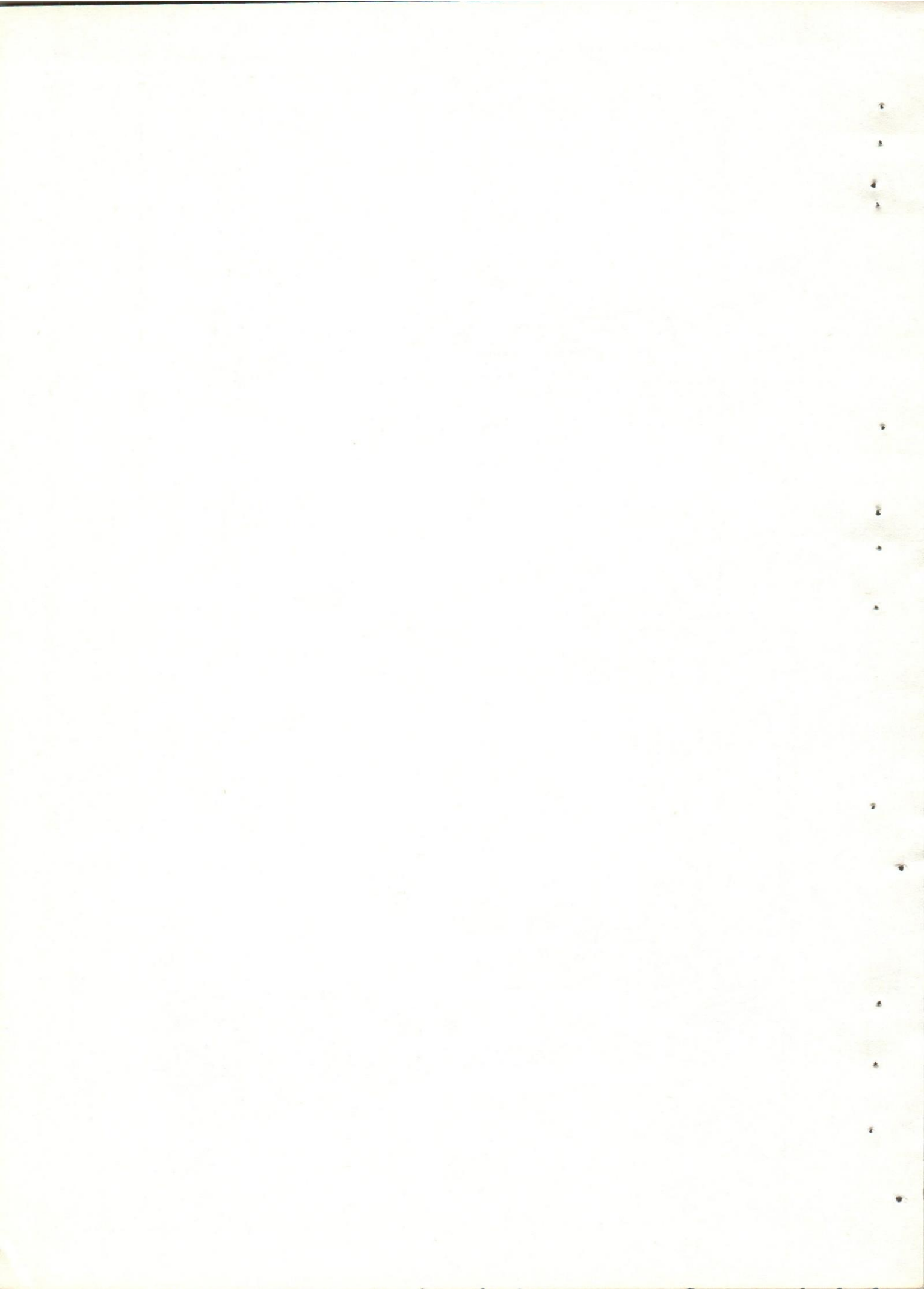
FRONTAL AND MAXILLARY SINUSES

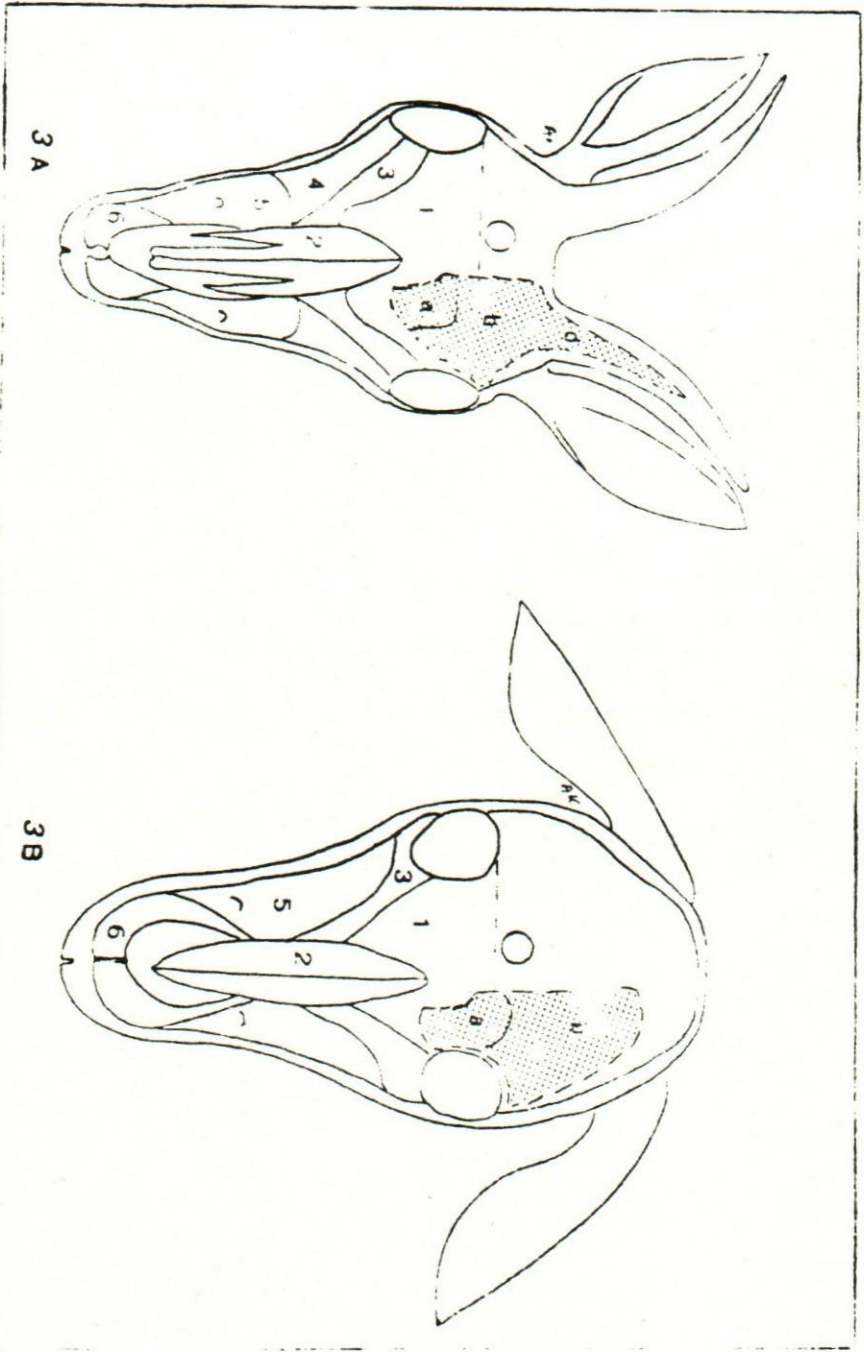
LEGENDS

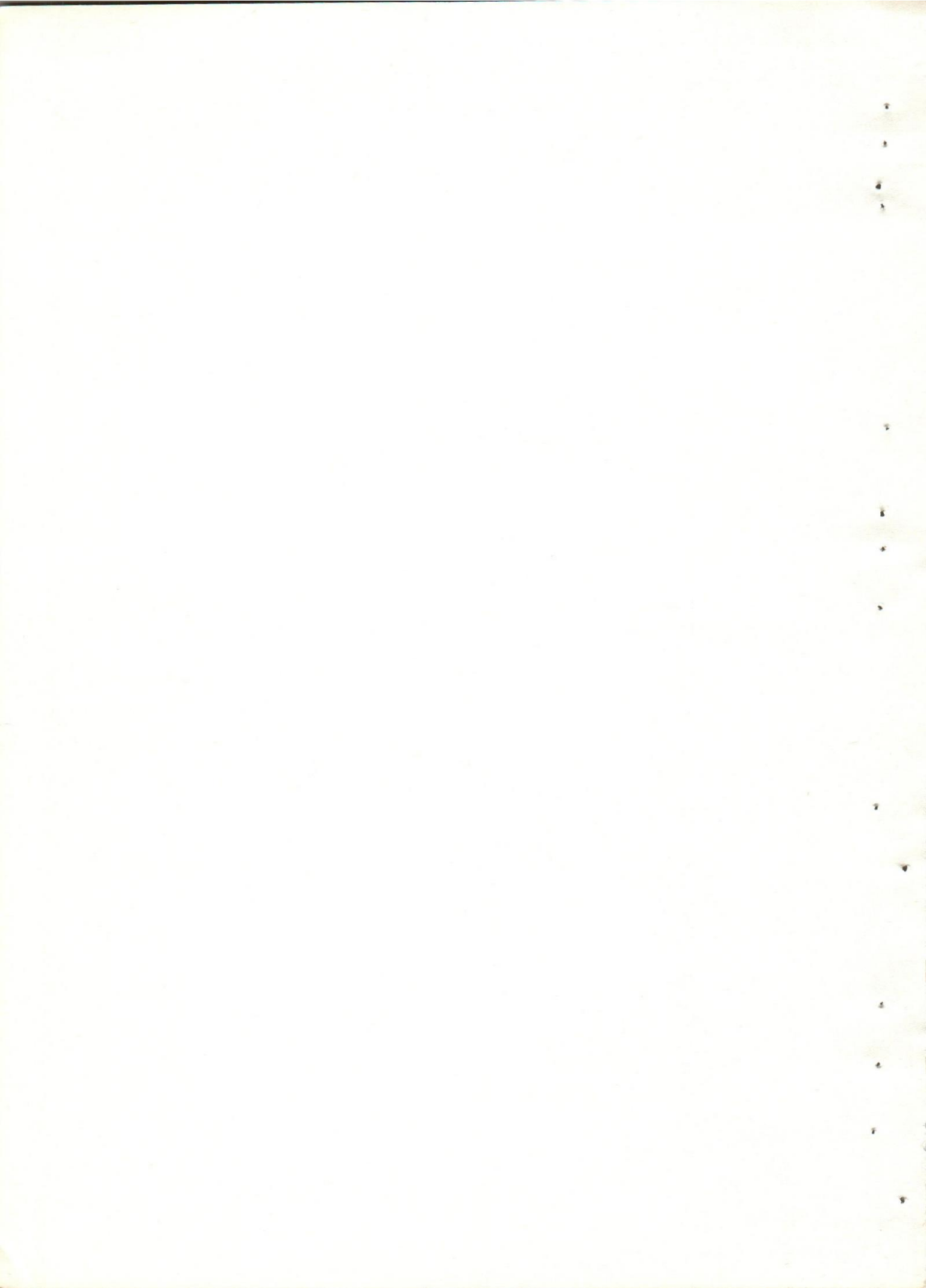
- Fig. (1):** Frontal sinus in cattle
a rostral, b middle, c caudomedial, d caudolateral frontal sinus, e cornual diverticulum.
- Fig. (2):** Frontal sinus in buffalo
a medial, b caudolateral frontal sinus, c nuchal, d cornual diverticulum.
- Fig. (3):** Frontal sinus in small ruminants, A goat, B sheep
a medial, b caudolateral frontal sinus, d cornual diverticulum.
- Fig. (4, 5, 6 A,B):** Maxillary sinus and site of trephining in cattle, buffalo, sheep and goat.
1 frontal, 2 nasal, 3 lacrimal, 4 zygomatic, 5 maxilla, incisive bone. 7 parietal bone.



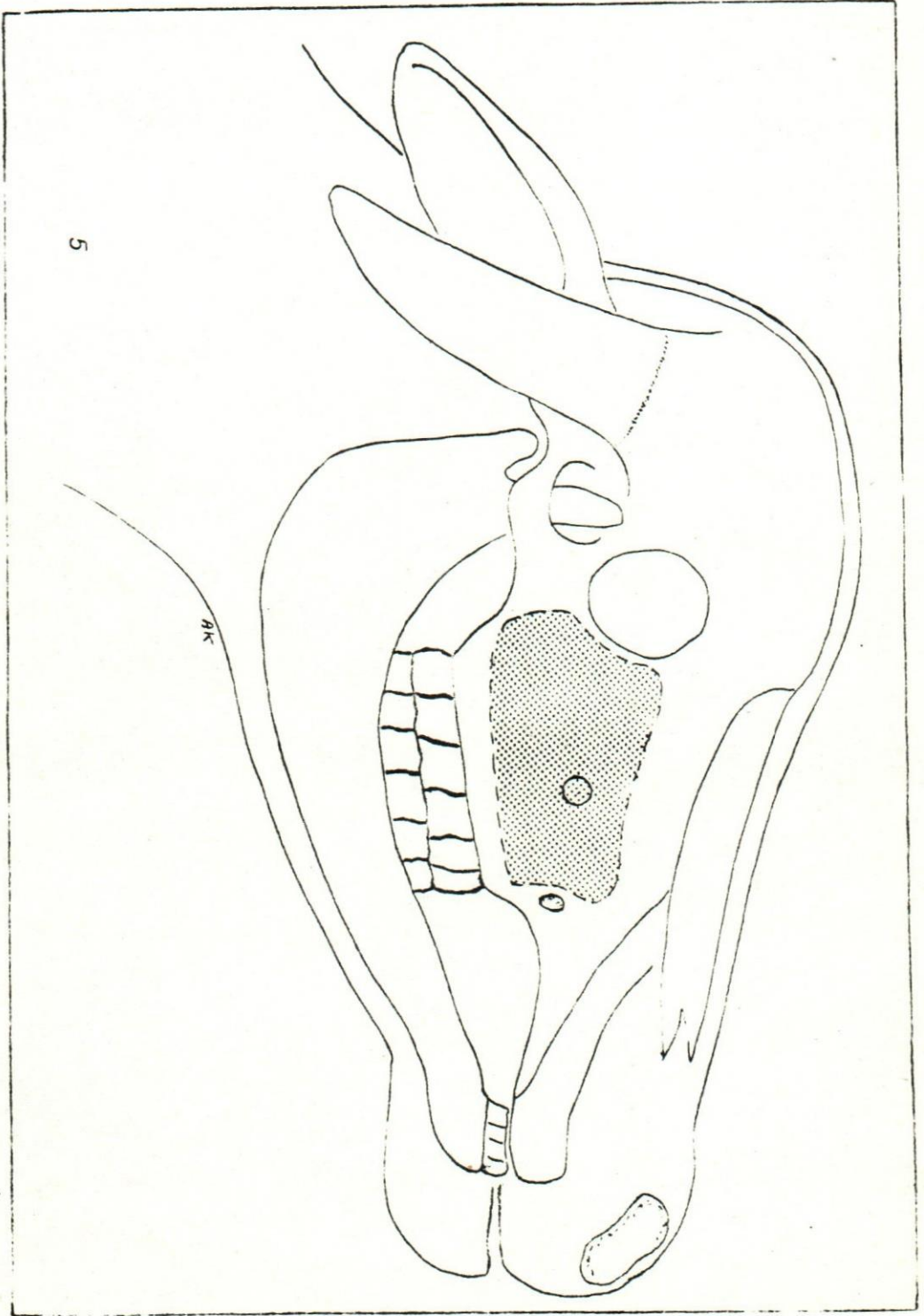












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