

# Anatomic and Histological Study of Maxillary Sinus in Albino Rat

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Histotopography of the maxillary sinus in the nasal compartment of the rat head was studied. Anatomical parameters of the sinus were determined, histological structure of the mucosa described, and similarity with organization of human maxillary sinus was revealed.

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**Key Words:** *rat; maxillary sinus*

Published reports about the anatomy and histology of the accessory sinuses in rodents are scanty. G. S. Yakhnin reported the presence of maxillary sinus in albino rats [6] and compared it with human maxillary sinus. A monograph about rats [3] gives no data about this anatomical formation.

We studied nasal compartment in rats in order to determine the morphological parameters of the maxillary sinus.

## MATERIALS AND METHODS

Experiments were carried out on 10 male Wistar rats (180-200 g). The anatomic topographic structure of the maxillary sinus was studied by preparation of the animal head. Histological studies of the sinus mucosa were carried out on micro- and macrotopographic sections of decalcinated maxilla. The total preparations of the sinus mucosal membrane were stained with toluidine blue. X-Ray anatomy of rat head was studied by visigraphy, computer-aided, and magnetic resonance tomography.

Visigraphy of the rat head was carried out on Evolution X3000 2C X-ray device (ASEPTI) with a SCHICK computer pickup. The photographs were made in the horizontal plane (0.08 sec exposure) at

tube voltage of 40 kV and 25 mAs; the data were processed using SCHICK software.

Computer tomography was carried out on a Somatom AR Spiral (Siemens) tomographer by the standard method. The tomographic layer was 1 mm thick, the information was processed by the multiplanar and volume surface reconstruction program in the Inner Ear modof tomographic sections scanning at tube voltage of 110 V and 120 mAs.

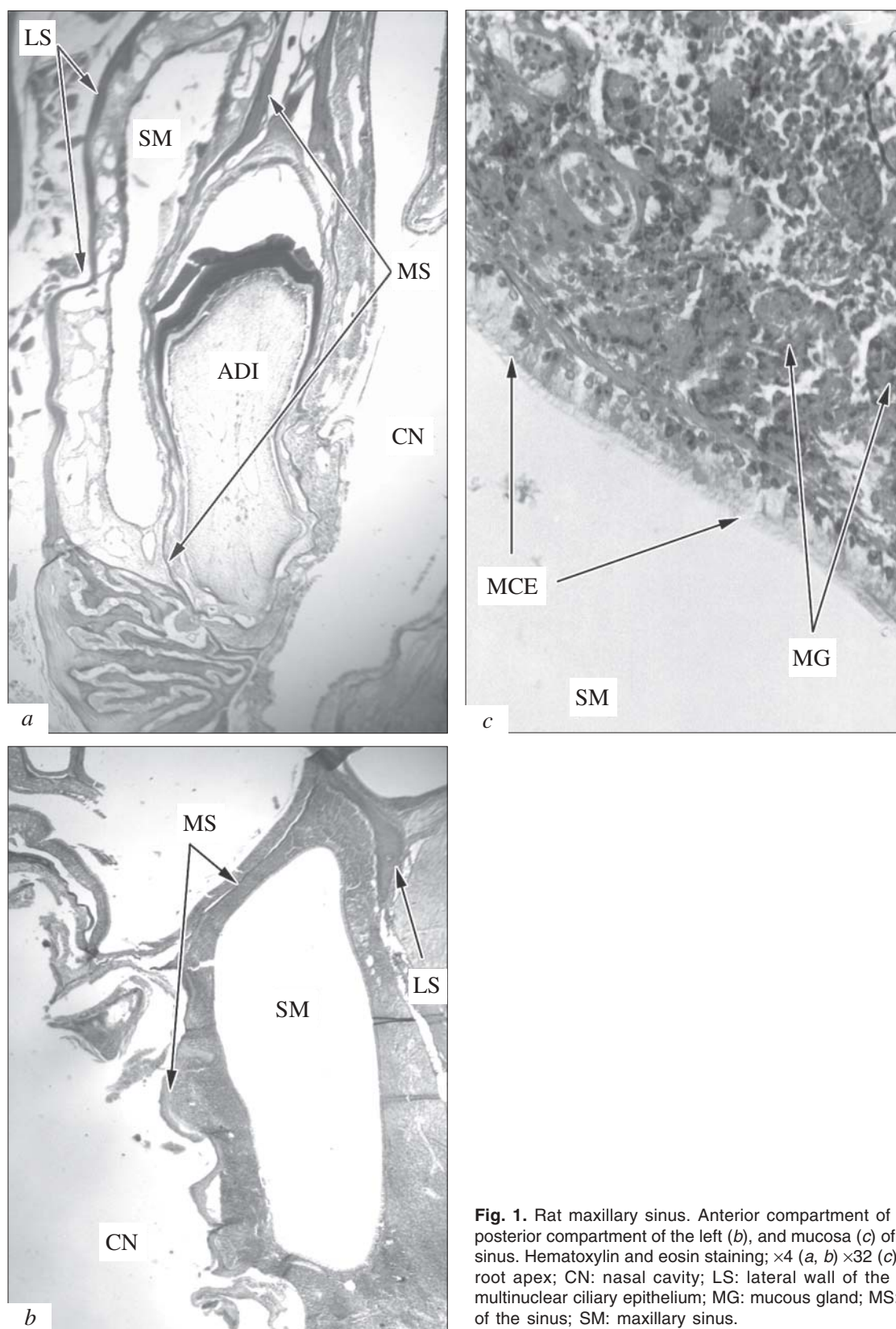
Magnetic imaging was carried out at the Pacific Institute of Organic Biochemistry on a PharmaScan US 70/16 device (Bruker). Laminar sections in the frontal, sagittal, and horizontal planes providing T2 tomograms and proton density weighed tomograms were carried out using RARE 8, MSME, and GEFI pulse sequences.

## RESULTS

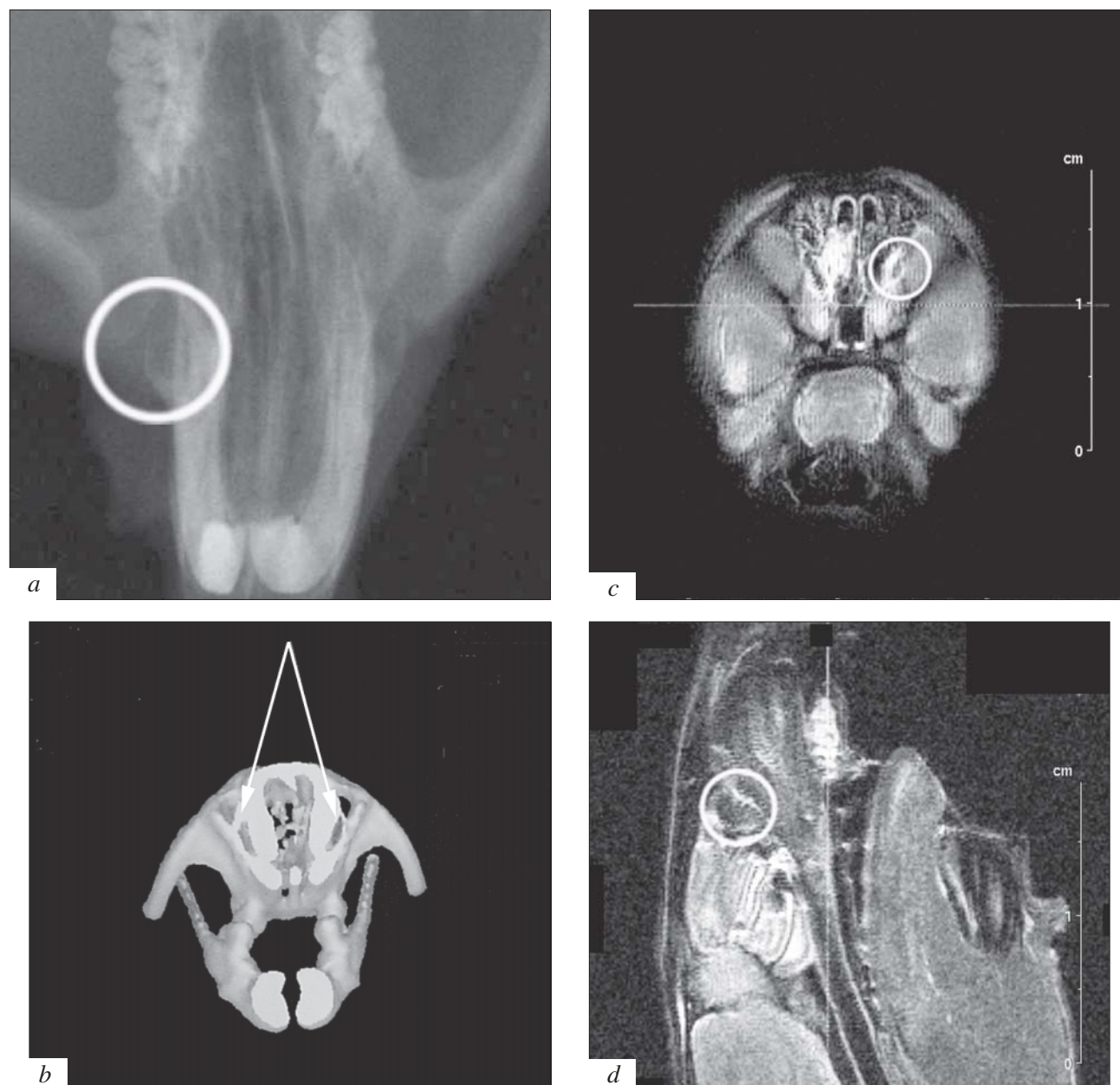
After removal of soft tissues of the nasal compartment, the lateral surface of the maxilla and the intermaxillary (canine) bone were exposed. Very thin lateral wall of the maxillary sinus presenting as an oval-shaped backward elongated bone eminence (0.39-0.40 cm high and 0.28-0.30 cm wide) was seen at the external surface of the maxilla to the front of the infraorbital foramen. Virtually flat medial wall serves as the external wall of the nasal cavity and is connected to it through the maxillary opening in the anteroinferior sector under the apex of the canine root. The walls of the sinus form a slit-like space elongated in the sagittal plane and widening backward. The cavity is lined with

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**Fig. 1.** Rat maxillary sinus. Anterior compartment of the right (a), posterior compartment of the left (b), and mucosa (c) of the maxillary sinus. Hematoxylin and eosin staining;  $\times 4$  (a, b)  $\times 32$  (c). ADI: canine root apex; CN: nasal cavity; LS: lateral wall of the sinus; MCE: multinuclear ciliary epithelium; MG: mucous gland; MS: median wall of the sinus; SM: maxillary sinus.



**Fig. 2.** Facial compartment of rat head. *a*) visigram in horizontal plane; *b*) computer-aided tomography with multiplanar reconstruction of sections through maxillary sinuses; *c*) magnetic imaging (frontal section); *d*) magnetic imaging (sagittal section). Circles and arrows show maxillary sinuses.

mucosa (monolayer multinuclear and ciliary cylindrical epithelium with clearly pronounced mucociliary system identical to that in the nasal cavity). The lamina propria of the mucosa contains numerous lymphoid elements and common alveolar glands (Fig. 1, *c*). Normally it contains many mast cells.

Visiograms show paired closed bone cavities (Fig. 2, *a*). Computer tomograms show a cavity with clear-cut interface situated on the lateral surface of the maxilla. The cavity was seen in 3 projections, but best of all on frontal sections. It looked like an elongated

semicircle turned outside with its convex side (Fig. 2, *b*). A clarified oval-shaped area extended backwards with even contours situated to the front of the infra-orbital foramen was seen on the sagittal sections. Bone cavity situated on the lateral surface of the maxilla more proximal than the eyeballs was seen on magnetic imaging tomograms in 3 projections. The most clear-cut image of the maxillary sinus was seen on the sagittal sections (Fig. 2, *c*, *d*).

Hence, we got similar results by different diagnostic methods. Presumably, the rat maxillary sinus is a

full-value anatomical formation of the upper respiratory tract system. The general structure of its mucosa does not differ from that of human maxillary sinus [1,2]. These data can be used in experimental studies of the reparative processes in traumatized maxillary sinus, which was never yet done for human facial traumas [2,4,5].

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