УДК 611.2/.12/.4
Д91

Авторы:

Гайворонский Иван Васильевич — доктор медицинских наук, профессор, заведующий кафедрой морфологии медицинского факультета Санкт-Петербургского государственного университета и кафедрой нормальной анатомии Военно-Медицинской академии им. С. М. Кирова;

Курцева Анна Андреевна — кандидат медицинских наук, доцент кафедры анатомии человека Курского государственного медицинского университета;

Гайворонская Мария Георгиевна — доктор медицинских наук, доцент кафедры морфологии Санкт-Петербургского государственного университета и ассистент кафедры челюстно-лицевой хирургии и хирургической стоматологии Военно-медицинской академии им. С. М. Кирова;

Ничипорук Геннадий Иванович — кандидат медицинских наук, доцент кафедры морфологии Санкт-Петербургского государственного университета

Дыхательная система. Сердце. Эндокринная система: учебное
Д91 пособие для медицинских вузов / И. В. Гайворонский, А. А. Курцева, М. Г. Гайворонская, Г. И. Ничипорук. — Санкт-Петербург : СпецЛит, 2017. — 72 с.

ISBN 978-5-299-00864-7

УДК 611.2/.12/.4

Данное пособие является английской версией учебника профессора И. В. Гайворонского «Нормальная анатомия человека», который был издан в России 9 раз и одобрен Министерством образования Российской Федерации.

Структура пособия соответствует современным стандартам медицинского образования в России и важнейшим европейским стандартам. Английская и латинская терминология приведены в соответствии с Международной анатомической номенклатурой.

Компьютерная верстка *Габерган Е. С.*
Подписано в печать 13.06.2017. Формат 70×100 $^{1}/_{16}$.
Печ. л. 4,5. Тираж 1000 экз. Заказ №

ООО «Издательство „СпецЛит“».
190103, Санкт-Петербург, 10-я Красноармейская ул., 15
Тел./факс: (812) 495-36-09, 495-36-12
http://www.speclit.spb.ru

Отпечатано в издательско-полиграфической фирме «Реноме»,
192007, Санкт-Петербург, наб. Обводного канала, д. 40

ISBN 978-5-299-00864-7

CONTENTS

LIST OF ABBREVIATIONS

Art., art., — articulatio
Artt., artt., — articulationes
For., for. — foramen
Lig., lig. — ligamentum
Ligg., ligg. — ligamenta
M., m. — musculus
Mm., mm. — musculi
N., n. — nervus
Nn., nn. — nervi
R., r. — ramus
Rr., rr. — rami
S., s. — sulcus

PREFACE

The creation of the manual “Respiratory System. Heart. Endocrine System” in English meets the requirement of modern Russian medicine and education. Nowadays many English-speaking oversea students study in Medical Universities of Russia. Besides, many Russian school leavers have a good command of the English language so they will be able to use this manual taking into consideration the fact that many Russian specialists in medicine work abroad after graduating from the universities or take part in different international conferences and symposiums.

The English version of the manual is based on the Russian manual by professor I. V. Gayvoronskiy “Normal Human Anatomy” which has been published in Russia 9 times and is approved by the Ministry of education of Russia.

This manual introduces the main principles of Russian Anatomy School such as: detailed study of the general aspects and items of Anatomy including the development of organs and anomalies of the development. If we compare theoretical approaches to Anatomy in Russia and in other countries we`ll see that our approach is based on the system descriptions of organs, i.e. we describe separately Skeletal system, Articulations, Muscular system etc. Moreover, we use Latin terminology while describing the organs and discuss clinicoanatomical and functional problems. As for the manuals in other countries many of them describe Anatomical systems in accordance with the regional and topographical principles.

The structure of our manual meets the requirements of modern standards of medical education in Russia which in their turn correspond to the major European standards. After each chapter we give test questions and clinicoanatomical problems. The English and Latin terminology is given in accordance with International Anatomical Nomenclature.

The authors strongly believe that the manual will allow future doctors to form the morphological foundation for the further study of theoretical and clinical disciplines. We also hope that it will be of great help to Anatomy teachers.

ПРЕДИСЛОВИЕ

Создание учебного пособия «Дыхательная система. Сердце. Эндокринная система» на английском языке является требованием современной системы медицинского образования в России. В настоящее время в медицинских университетах нашей страны обучаются студенты из различных регионов дальнего зарубежья. Кроме того, многие выпускники российских школ хорошо владеют английским языком, поэтому они также смогут пользоваться данным пособием, принимая во внимание, что зачастую русские специалисты в медицине после окончания университета уезжают работать за рубеж или принимают участие в различных международных конференциях и симпозиумах.

Английская версия пособия базируется на русском учебнике профессора И. В. Гайворонского «Нормальная анатомия человека», который был издан в России 9 раз и одобрен Министерством образования Российской Федерации.

Данное пособие познакомит читателей с главными принципами Русской анатомической школы, которые заключаются в подробном изучении общих вопросов, в том числе развития органов и аномалий развития. В России преподавание анатомии ведется с функционально-клинических позиций и основано на описании органов по системам, т. е. отдельно изучаются опорно-двигательная система, артросиндесмология, миология и другие системы. Также при описании строения органов акцентируется внимание на латинской терминологии. Что касается зарубежных руководств по анатомии человека, многие из них основываются на регионально-топографическом принципе без использования латинской терминологии.

Структура данного пособия соответствует современным стандартам медицинского образования в России, которые, в свою очередь, соответствуют важнейшим европейским стандартам. После каждой главы мы приводим контрольные вопросы и ситуационные клинические задачи. Английская и латинская терминология приведена в соответствии с Международной анатомической номенклатурой.

Авторы выражают уверенность, что данное пособие позволит будущим докторам сформировать морфологический фундамент для последующего изучения теоретических и клинических дисциплин. Мы также надеемся, что оно принесет определенную пользу и преподавателям анатомии человека.

1. RESPIRATORY SYSTEM

The respiratory system (*systema respiratorium*) comprises the respiratory tract (airways) and respiratory organs proper, the lungs.

Because of the vertical position of the human body the respiratory tract is divided into upper airways and lower airways. The upper airways include the nasal cavity, nasopharynx and oropharynx; the lower airways include the larynx, trachea, bronchi (together with their intrapulmonary branching, i.e. bronchial tree).

The respiratory tract represents the system of tubes, having an osseous or cartilaginous skeleton, due to which they can not contract to close the lumen of the airways. The lumen of the respiratory tract opens constantly, and despite of the abrupt change of the pressure from positive to negative, the air circulates freely to both sides during inspiration and expiration.

The inner surface of the airways is lined by the mucous membrane which is covered by ciliated columnar epithelium and contains numerous glands secreting the mucus. Due to this the inspired air is cleaned, humidified and warmed. Among the respiratory organs the larynx is the most complex organ, performing the function of phonation. The air passes through the airways to the lungs where the exchange of gases between the air and blood (by diffusion of oxygen and carbon dioxide) occurs in the alveoli.

1.1. Nose

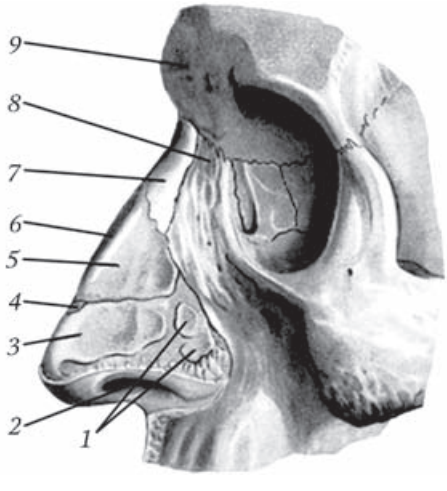

Fig. 1.1. Skeleton of external nose:

1 — minor alar cartilages (*cartilagines alares minores*); *2* — nostrils (*nares*); *3* — accessory nasal cartilages (*cartilagines nasi accessoriae*); *4* — lateral nasal cartilage (*cartilago nasi lateralis*); *5* — lateral nasal cartilage (*cartilago nasi lateralis*); *6* — septal nasal cartilage (*cartilago septi nasi*); *7* — nasal bone (*os nasale*); *8* — frontal process of maxilla (*processus frontalis maxillae*); *9* — frontal bone (*os frontale*)

The nose includes the external nose and the nasal cavity (internal nose).

External nose, *nasus externus* (in Greek *rhis*, *rhinos*) is the projection of the facial skull, having the shape of an irregular trihedral pyramid. It comprises the root, dorsum, apex and alae (wings). The form and length of the nasal dorsum, position of nasal root depend on individual and age features.

The root of nose, *radix nasi*, is in the upper part of the face and is separated from the forehead by a depression known as the glabella, *glabella*. The lateral sides of the external nose join along the midline to form the dorsum of nose, *dorsum nasi*, and the inferior parts of the lateral sides form the alae of nose, *alae nasi*. Downwards, the nasal dorsum is continuous with the apex of nose, *apex nasi*. The alae limit the nostrils, *nares*, which transmit the air into the nasal cavity and from it. Along the midline the nostrils are separated by the mobile (membranous) part of the nasal septum.

The ossesous skeleton of the upper part of the nose is formed partially by the frontal and nasal bones, and laterally, on either side it is supplemented by the frontal process of

the maxilla. The bony structures of the external nose are continuous with its cartilaginous frame (fig. 1.1). The basic cartilage of the external nose`s cartilaginous part is a lateral nasal cartilage, *cartilago nasi lateralis*. It has a triangular form. Its upper edge is connected to the nasal bone and upper part of the maxillary frontal process. The medial edge is fused with the opposite lateral nasal cartilage to form the continuation of the nasal dorsum. The inferior edge adjoins the major alar cartilage, *cartilago alaris major*. The latter is paired and has a shape of an oval plate, from which the medial and lateral crura arise. The medial crura are fused together from the opposite sides, forming the continuation of the nasal dorsum, and below they form the apex of nose. The lateral crura limit the borders of the nasal openings (nostrils). Usually in the connective tissue between the lateral nasal and major alar cartilages there are one or two accessory nasal cartilages, *cartilagines nasi accessoriae*.

Besides the major cartilages, the nasal alae contain the connective tissue providing the changeability of alae shape. One-two minor alar cartilages, *cartilagines alares minores,* lie in the posterior areas of this connective tissue. The connective tissue limits the lower parts of the nostrils.

The osseo-cartilaginous skeleton of the external nose is covered from outside by thin skin which is closely linked with underlying mimic muscle, the nasalis. The latter is partly covered by the levator labii superioris. The nasalis arises from the maxillary alveolar process near the canine and lateral incisor teeth and is divided into transverse and alar parts. The transverse part is formed by the lateral fascicles of the nasalis, which rise and bridge the cartilaginous part of the nasal dorsum. The nasalis is connected with the opposite muscle by the tendinous aponeurosis. During contraction, the fibers of the transverse part compress the nose, i.e. narrow the nostrils. The alar part is formed by the medial fascicles which are attached to the skin of the nasal ala. During contraction, it depresses the nasal ala.

The nasal cavity, *cavitas nasi*, is between the anterior cranial fossa (above), the oral cavity (below) and orbits (laterally). The nasal septum, *septum nasi*, divides the nasal cavity into two halves, unequal in size. Anteriorly, the nasal cavity opens outward through the nasal openings named the nostrils, *nares*. Posteriorly, it communicates with the nasopharynx by means of the openings termed choanae, *choanae*.

The nasal cavity has three walls: superior, lateral and inferior.

The superior wall (roof) is constituted by the nasal bones, partially by the frontal bone, by the cribriform plate of ethmoid bone and the anterior and inferior walls of the sphenoidal body. The cribriform plate of ethmoid bone is perforated by about 30 openings transmitting the olfactory nerves.

The lateral wall of the nasal cavity is formed by the frontal process and nasal surface of maxilla, the lacrimal bone, ethmoidal labyrinth, inferior nasal concha, perpendicular plate of the palatine bone and the medial plate of the sphenoidal pterygoid process. The lateral wall shows three elevations: the superior, middle and inferior nasal conchae, separating the superior, middle and inferior nasal meatuses. The superior and middle nasal conchae are the parts of the ethmoid bone, while the inferior nasal concha is an individual bone (fig. 1.2).

The inferior wall (floor) is formed by the palatine processes of both maxillae and horizontal plates of both palatine bones. At the anterior end of the nasal floor there is an incisive canal which transmits the nasopalatine nerve passing from the nasal cavity into the oral cavity. The horizontal plates of palatine bones limit the choanae from below.

The nasal septum is termed by clinicians the medial wall of the nasal cavity. It is constituted by the perpendicular plate of ethmoid bone, sphenoidal crest and rostrum, vo-

mer, by the nasal crests of maxilla and of palatine bone. The posterior edge of the vomer bounds the choanae from the medial side. The septal nasal cartilage, *cartilago septi nasi*, quadrilateral, is connected to the anterior parts of the ethmoidal perpendicular plate. The posteroinferior edge of the cartilage is placed in the grooves of the vomer and of the maxillary nasal crest. Its anterosuperior edge is connected to the nasal bones to form the anterior part of the nasal dorsum. The nasal septum`s osseous part is 2–3 mm thick and the cartilaginous part is 3–7 mm thick.

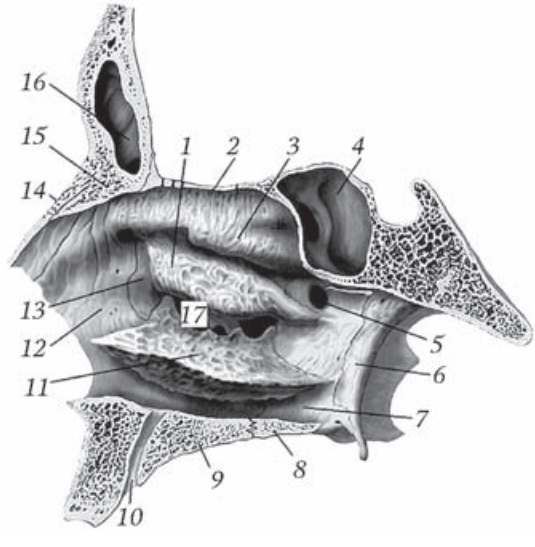

Fig. 1.2. Lateral wall of nasal cavity (sagittal section):

1 — middle nasal concha (*concha nasalis media*); *2* — cribriform plate (*lamina cribrosa*); *3* — superior nasal concha (*concha nasalis superior*); *4* — sphenoidal sinus (*sinus sphenoidalis*); *5* — sphenopalatine foramen (*foramen sphenopalatinum*); *6* — medial plate of pterygoid process (*lamina medialis processus pterygoidei*); *7* — perpendicular plate of palatine bone (*lamina perpendicularis ossis palatini*); *8* — horizontal plate of palatine bone (*lamina horizontalis ossis palatini*); *9* — palatine process of maxilla (*processus palatinus maxillae*); *10* — incisive canal (*canalis incisivus*); *11* — inferior nasal concha (*concha nasalis inferior*); *12* — frontal process of maxilla (*processus frontalis maxillae*); *13* — lacrimal bone (*os lacrimale*); *14* — nasal bone (*os nasale*); *15* — nasal spine of frontal bone (*spina nasalis ossis frontalis*) ; *16* — frontal sinus (*sinus frontalis*); 17 — maxillary hiatus (*hiatus maxillaris*)

The nasal cavity is divided into the vestibule, *vestibulum nasi*, and nasal cavity proper, *cavitas nasi propria*. The boundary between these parts is an elevation, the limen nasi, *limen nasi*, situated on the lateral nasal wall. The nasal vestibule is lined by the skin bearing special hairs (vibrissae).

The nasal cavity proper has four nasal meatuses: common, inferior, middle and superior.

The common nasal meatus, *meatus nasi communis*, is a space between the nasal septum from the medial side, nasal conchae from the lateral side, nasal roof from above and nasal floor from below. Other three nasal meatuses are in the lateral parts of the nasal cavity.

The inferior nasal meatus, *meatus nasi inferior*, is between the inferior nasal concha above and nasal floor below. On the lateral wall of this meatus, about 10 mm behind the