ANATOMY FOR ANAESTHETISTS

HAROLD ELLIS

STANLEY FELDMAN

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Third Edition

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INTRODUCTION

The anaesthetist requires a peculiarly specialized knowledge of anatomy. Some regions of the body, for example the respiratory passages, the major veins and peripheral nerves, he must know with an intimate detail which rivals that of the surgeon; other areas he may all but ignore.

This book was originally written to help candidates sitting the Primary FFARCS when anatomy was one of the three principal subjects. Today questions on those aspects of anatomy relevant to the practice of anaesthesia are more likely to be asked in the Final examinations. The changing emphasis in the teaching of anaesthetics is reflected in the major alterations made to the third edition of this book. In view of this change in emphasis, this third edition has been very extensively re-written and re-illustrated. Dr Stanley Feldman has joined the original author in order to provide expert guidance on specialist applied anatomy. We would stress that we have not designed a textbook on local and regional anaesthetic techniques; there are excellent standard works already available in this field. Rather we have attempted to provide the detailed anatomical knowledge which an anaesthetist needs as a background to his daily work.

H. E.
S. F.

1976

ACKNOWLEDGMENTS

The first two editions of this textbook were prepared in collaboration with that skilled medical artist Miss Margaret McLarty, who has now retired. The majority of her original drawings still form a major part of our illustrations. Most of the new figures have been skilfully executed by Mr John Staunton. We are grateful to Lord Brock for permission to reproduce Figs. 45, 46, 47 and 48 from *Lung Abscess*, Professor R. H. Harrison for Fig. 65 from *A Text-book of Human Embryology* and Mr Miles Foxen for Fig. 33 from *Lecture Notes on Diseases of the Ear, Nose and Throat*.

We give grateful thanks to Miss Gill Baker for her painstaking secretarial assistance and finally we wish to thank Mr Per Saugman and his staff for guiding this book through its production.

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THE MOUTH

The mouth is made up of the vestibule and the mouth cavity, the former communicating with the latter through the aperture of the mouth.

The vestibule is formed by the lips and cheeks without and by the gums and teeth within. An important feature is the opening of the

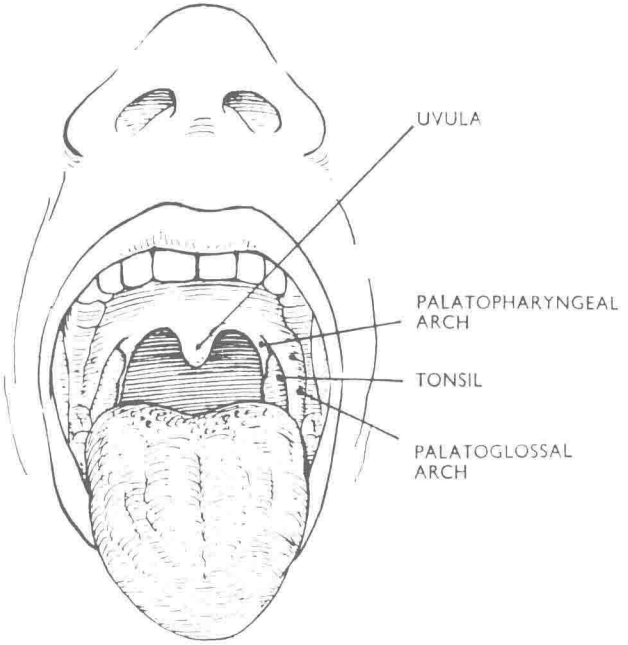

FIG. 1. View of the open mouth with the tongue depressed.

parotid duct on a small papilla opposite the 2nd upper molar tooth. Normally the walls of the vestibule are kept together by the tone of the facial muscles; a characteristic feature of a facial (VII) nerve paralysis is that the cheek falls away from the teeth and gums, enabling food and drink to collect in, and dribble out of, the now patulous vestibule.

The mouth cavity (Fig. 1) is bounded by the alveolar arch and teeth in front, the hard and soft palate above, the anterior two-thirds of the tongue and the reflection of its mucosa forward onto the mandible below, and the oropharyngeal isthmus behind.

The mucosa of the floor of the mouth between the tongue and mandible bears the median *frenulum linguae*, on either side of which are the orifices of the submandibular salivary glands (Fig. 2). Backwards

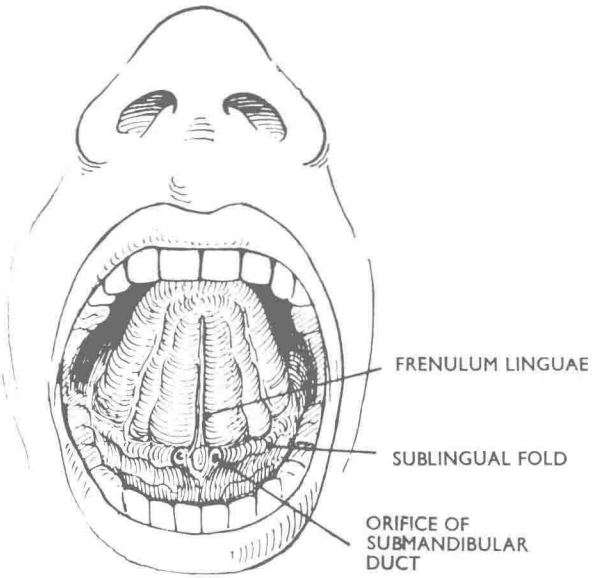

FIG. 2. View of the open mouth with the tongue elevated.

and outwards from these ducts extend the sublingual folds which cover the sublingual glands on each side (Fig. 3); the majority of the ducts of these glands open as a series of tiny orifices along the overlying fold, but some drain into the duct of the submandibular gland (Wharton's duct).

The Palate

The hard palate is made up of the palatine processes of the maxillae and the horizontal plates of the palatine bones. The mucous membrane

covering the hard palate is peculiar in that the stratified squamous mucosa is closely connected to the underlying periosteum, so that the two dissect away at operation as a single sheet termed the mucoperiosteum. This is thin in the mid-line, but thicker more laterally due to the presence of numerous small palatine salivary glands, an uncommon but well-recognized site for the development of mixed salivary tumours.

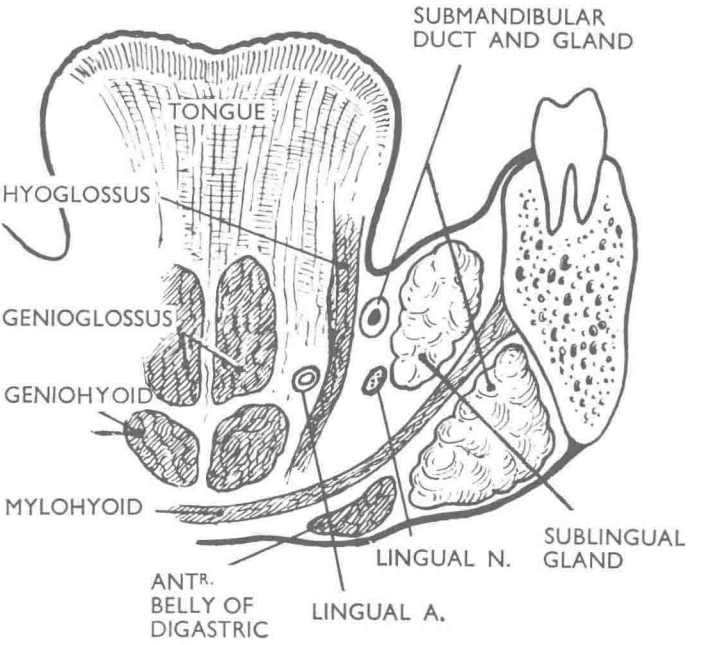

FIG. 3. Coronal section through the floor of the mouth.

The soft palate hangs like a curtain suspended from the posterior edge of the hard palate. Its free border bears the *uvula* centrally and blends on either side with the pharyngeal wall. The anterior aspect of this curtain faces the mouth cavity and is covered by a squamous epithelium. The posterior aspect is part of the nasopharynx and is lined by a ciliated epithelium under which is a thick stratum of mucous and serous glands embedded in lymphoid tissue.

The 'skeleton' of the soft palate is a tough fibrous sheet termed the *palatine aponeurosis*, which is attached to the posterior edge of the hard palate. The aponeurosis is continuous on each side with the tendon of tensor palati and may, in fact, represent an expansion of this tendon.

The muscles of the soft palate are five in number: tensor palati, levator palati, palatoglossus, palatopharyngeus and musculus uvulae. (See Fig. 13.)

Tensor palati arises from the scaphoid fossa at the root of the medial pterygoid plate, from the lateral side of the Eustachian cartilage and the medial side of the spine of the sphenoid. Its fibres descend lateral to the superior constrictor and the medial pterygoid plate to end in a tendon which pierces the pharynx, loops medially around the hook of the hamulus to be inserted into the palatine aponeurosis. Its action is to tighten and flatten the soft palate.

Levator palati arises from the under surface of the petrous temporal bone and from the medial side of the Eustachian tube, enters the upper surface of the soft palate and meets its fellow of the opposite side. It elevates the soft palate.

Palatoglossus arises in the soft palate, descends in the palatoglossal fold and blends with the side of the tongue. It approximates the palatoglossal folds.

Palatopharyngeus descends from the soft palate in the palatopharyngeal fold to merge into the side wall of the pharynx: some fibres become inserted along the posterior border of the thyroid cartilage. It approximates the palatopharyngeal folds.

Musculus uvulae takes origin from the palatine aponeurosis at the posterior nasal spine of the palatine bone and is inserted into the uvula. Injury to the cranial root of the accessory nerve, which supplies this muscle, results in the uvula becoming drawn across and upwards towards the opposite side.

The tensor palati is innervated by the mandibular branch of the trigeminal nerve via the otic ganglion (see page 308). The other palatine muscles are supplied by the pharyngeal plexus, which transmits cranial fibres of the accessory nerve.

The palatine muscles help to close off the nasopharynx from the mouth in deglutition and phonation. In this they are aided by contrac-

tion of the upper part of the superior constrictor which produces a transverse ridge on the back and side walls of the pharynx at the level of the 2nd cervical vertebra termed the *ridge of Passavant*.

Paralysis of the palatine muscles, for example following diphtheria, results (just as surely as a severe degree of cleft-palate deformity) in a typical nasal speech and in regurgitation of food through the nose.

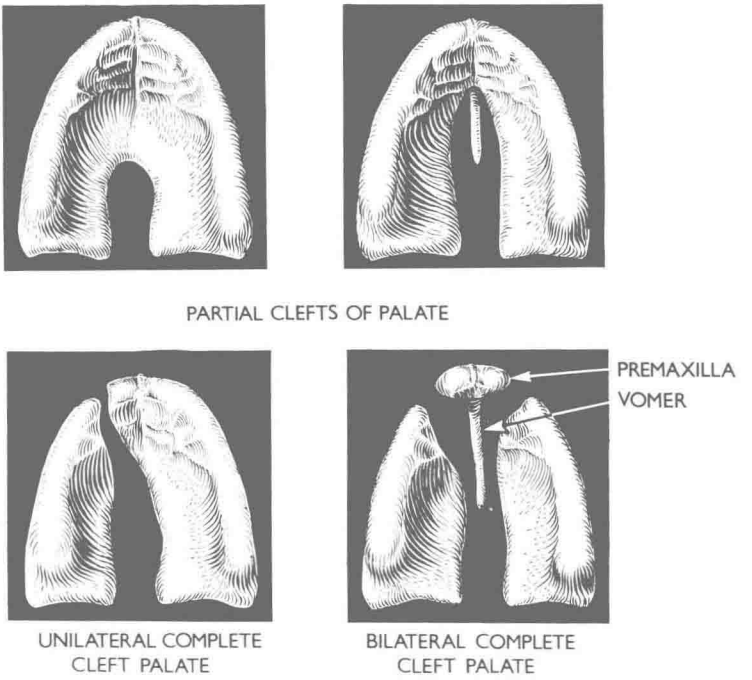

FIG. 4. Types of cleft-palate deformity.

Cleft Palate

The palate develops from a central premaxilla, and a pair of lateral maxillary processes: the former usually bears all four (occasionally only two) of the incisor teeth. All degrees of failure of fusion of these three processes may take place. There may be a complete cleft, which passes to one or both sides of the premaxilla; in the latter case the premaxilla prolapses forwards to produce a hideous deformity. Partial clefts of the

posterior palate may involve the uvula only (bifid uvula), the soft palate, or may encroach into the posterior part of the hard palate (Fig. 4).

THE NOSE

The nose is divided anatomically into the external nose and the nasal cavity.

The external nose is formed by an upper framework of bone (made up of the nasal bones, the nasal part of the frontal bones and the frontal processes of the maxillae), a series of cartilages in the lower part, and a small zone of fibro-fatty tissue which forms the lateral margin of the nostril (the *ala*). The cartilage of the nasal septum comprises the central support of this framework.

The cavity of the nose is subdivided by the nasal septum into two quite separate compartments which open to the exterior by the *nares* and into the nasopharynx by the posterior nasal apertures or *choanae*. Immediately within the nares is a small dilatation, the *vestibule*, which is lined in its lower part by stiff straight hairs.

Each side of the nose presents a roof, a floor and a medial and lateral wall.

The roof first slopes upwards and backwards to form the bridge of the nose (the nasal and frontal bones), then has a horizontal part (the cribriform plate of the ethmoid), and finally a downward-sloping segment (the body of the sphenoid).

The floor is concave from side to side and slightly so from before backwards. It is formed by the palatine process of the maxilla and the horizontal plate of the palatine bone.

The medial wall (Fig. 5) is the nasal septum, formed by the septal cartilage, the perpendicular plate of the ethmoid and the vomer. Deviations of the septum are very common, in fact they are present to some degree in about 75 per cent of the adult population. Probably nearly all are traumatic in origin, and result from quite minor injuries in childhood or even birth. The deformity does not usually manifest itself till the second dentition appears, when rapid growth in the region produces deflections from what had been an unrecognized minor dislocation of the septal cartilage. Males are more commonly affected

than females, a distribution which would favour this traumatic theory. Both nostrils may become blocked, either from a sigmoid deformity of the cartilage or from compensatory hypertrophy of the conchae on the opposite side. The deviation is nearly always confined to the anterior part of the septum.

The lateral wall (Fig. 6) has a bony framework made up principally of the nasal aspect of the ethmoidal labyrinth above, the nasal surface of

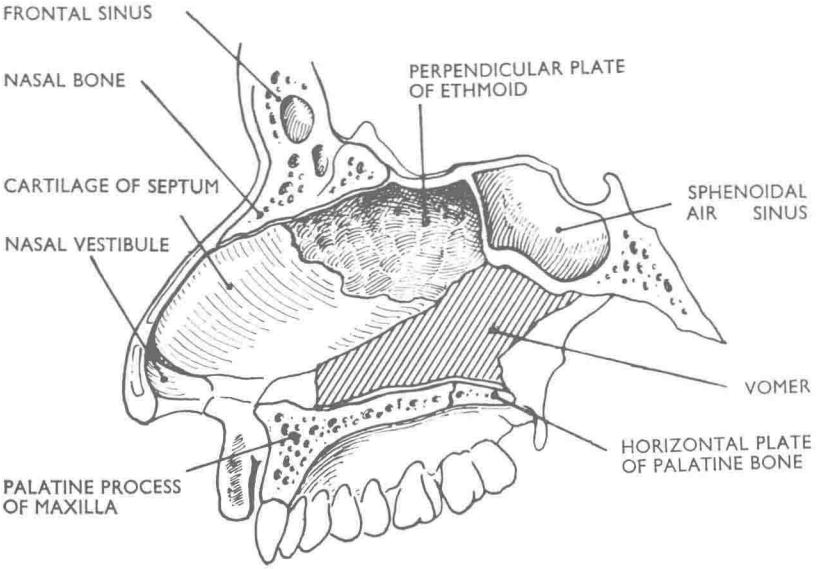

FIG. 5. The septum of the nose.

the maxilla below and in front, and the perpendicular plate of the palatine bone behind. This is supplemented by the three scroll-like *conchae* (or turbinate bones), each arching over a *meatus*. The upper and middle conchae are derived from the medial aspect of the ethmoid labyrinth; the inferior concha is a separate bone.

Onto the lateral wall open the orifices of the paranasal sinuses (page 11) and the nasolacrimal duct; the arrangement of these orifices is as follows: (Fig. 7).

The sphenoid sinus opens into the *spheno-ethmoidal recess*, a depression between the short superior concha and the anterior surface of the body of the sphenoid. The posterior ethmoidal cells drain into the superior meatus. The middle ethmoidal cells bulge into the middle meatus to form an elevation, termed the *bulla ethmoidalis*, on which they

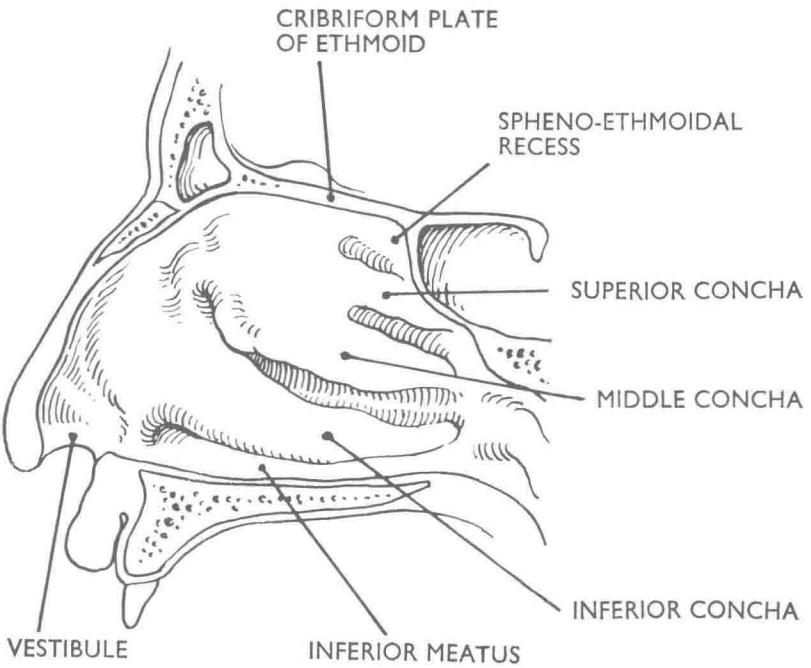

FIG. 6. The lateral wall of the right nasal cavity.

open. Below the bulla is a cleft, the *hiatus semilunaris*, into which opens the ostium of the maxillary sinus. The hiatus semilunaris curves forward in front of the bulla ethmoidalis as a passage termed the *infundibulum* which drains the anterior ethmoidal air cells. In about 50 per cent of cases the frontal sinus drains into the infundibulum via the frontonasal