LANDMARKS AND SURFACE MARKINGS OF THE HUMAN BODY

RAWLING

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BY

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WITH THIRTY-SIX ILLUSTRATIONS

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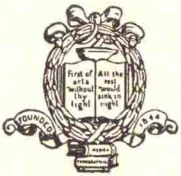

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PREFACE

TO THE EIGHTH EDITION

THE time has come for me to give way on the question of terminology. I have had so many requests to adopt the British Revision of the B.N.A. Terminology, now generally in use, from anatomists and medical students, that I asked Messrs. H. K. Lewis & Co. to make inquiries. Their reply was entirely in favour of such a change.

I have compromised in the case of some older terms which are classical, or which still retain their place in surgical descriptions. They are either given in brackets after the new term, or mentioned as an alternative.

I am much indebted to Dr. J. M. Mungavin for his many valuable suggestions, and for the revision of the proofs. My thanks are also due to the Publishers for their courtesy and patience in the preparation of this new edition.

L. BATHE RAWLING.

March, 1940.

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LANDMARKS AND SURFACE MARKINGS OF THE HUMAN BODY

CHAPTER I

THE HEAD AND NECK

Cranio-cerebral Topography

Only those landmarks and surface markings will be given which are of practical value, and, as far as possible, each landmark will be rendered independent of any other, as by such means any given structure can be rapidly depicted on the surface, the important question of time and of space rendering the more complicated systems, in which it is necessary to map out a network of intersecting lines in order to fix the position of any single structure, of little surgical value. It is necessary, however, to recognize first certain important bony points, etc.

The *nasion*, situated at the base of the nose at the central point of the naso-frontal suture. **Fig. i, 1.**

The *inion*, or *external occipital protuberance* —a projection, variable in size, which can be felt on the occipital bone, immediately above the nuchal furrow. **Fig. i, 2.**

A line uniting these two points over the vertex of the skull corresponds in direction to the *longitudinal fissure of the brain*, to the upper attached margin of the *falx cerebri* and to the *superior sagittal venous sinus*. This sinus originates in the region of the foramen cæcum, just anterior to the crista galli of the frontal bone, broadening out as it passes backwards to the internal occipital protuberance, which corresponds, on the outer aspect of

the skull, to the inion. The sinus then turns sharply to the right, forming the right *transverse sinus*. The left sinus derives its blood mainly from the *straight sinus*, which receives, at the anterior margin of the tentorium cerebelli, the great cerebral vein (Galen) and the inferior sagittal sinus which is contained in the free margin of the falx cerebri. The line, drawn as above from the nasion to the inion, also corresponds in direction to the occasionally persistent *metopic* suture between the two halves of the frontal bone, and to the *sagittal* suture between the two parietal bones.

The frontal bone is separated off from the two parietal bones by the *coronal* suture, and the point of junction of the coronal and sagittal sutures is known as the *bregma*, the site of the fœtal anterior fontanelle, an opening which should be closed before the end of the second year. Between the parietal and occipital bones the *lambdoid* suture lies ; and at the junction of the sagittal and lambdoid sutures the posterior fontanelle is situated, closed at or soon after birth. The point of junction of the last two sutures is known as the *lambda*. This point lies about $2\frac{1}{2}$ inches above the inion or external occipital protuberance. About 1 inch from its posterior superior angle, and close to the sagittal suture, the parietal bone is perforated by a small foramen—the parietal foramen—for the transmission of an emissary vein. A line uniting the two foramina crosses the sagittal suture at a point known as the *obelion*. The parietal bone is outwardly bulged at a point rather above its centre, forming the *parietal eminence*—this is more pronounced in the fœtal skull, and indicates the point at which the single ossific nucleus makes its appearance.

Fig. i, 13.

Fig. i, 11.

Turning now one's attention to the lateral aspect of the skull, the *temporal lines* should be examined. They are two in number, superior and inferior, crossing the parietal bone rather below the junction of the middle and lower thirds, cutting off the vault proper above from the temporal fossa below. The ridges are often so feebly developed in this region that it may be necessary to verify their position by tracing them backwards from the zygomatic process of the frontal bone, at which level the upper line is always well marked. The temporal muscle arises from the inferior temporal line and from the temporal fossa below, whilst the overlying fascia, the temporal fascia, gains attachment to the *superior temporal line*—a feebly developed ridge which runs above and parallel to the inferior line.

Fig. i, 6.

Fig. i, 5.

The *zygomatic process of the frontal bone* articulates with the corresponding process of the zygomatic bone, and the articulation between the two processes is easily felt at the upper and outer border of the orbital cavity.

Fig. ii, 16.

The *marginal tubercle*, a small prominence to be felt along the posterior border of the frontal process of the zygomatic bone, a short distance below the fronto-zygomatic suture.

Fig. i, 12.

The *zygomatic process* of the temporal bone should be traced backwards towards the ear, and an examination of the skull will show that this process divides in front of the ear into three roots, the anterior merging into the articular eminence, the middle helping in the formation of the post-glenoid tubercle, whilst the posterior or upper root sweeps backwards above the external auditory meatus to become continuous with the supra-meatal and supramastoid crests, and to blend

Fig. ii, 13, 14.

Fig. i, 17.

with the posterior curved end of the temporal line. The *suprameatal crest* is of special surgical importance, as it forms the upper boundary of Macewen's suprameatal triangle (aural operations), and also indicates fairly accurately the lower level of the cerebrum in this situation.

The *transverse sinus*.—Draw a band, $\frac{1}{2}$ inch in width, from the inion, or external occipital protuberance, to a point $\frac{3}{4}$ inch behind the external auditory meatus, so curved that the highest point of the convexity lies about $\frac{3}{4}$ inch above Reid's base-line.

Fig. i, 16. Fig. ii, 9.

The *lower limit of the cerebrum* can be mapped out in the following manner: A point is taken in the median antero-posterior line about $\frac{1}{2}$ inch above the nasion, and from this point a line is drawn outwards which lies about $\frac{1}{2}$ inch above, and follows the curve of the upper border of the orbit. This line is carried backwards as far as the level of the zygomatic process of the frontal bone, then curving upwards and backwards towards the *pterion* (see next page). The temporo-sphenoidal lobe now sweeps downwards and forwards towards the posterior border of the zygomatic bone, and then lies practically on a level with the upper border of the zygomatic process of the temporal bone. At and behind the ear the cerebrum lies flush with the suprameatal and supramastoid crests, and subsequently follows the curve of the transverse sinus from the base of the mastoid process to the external occipital protuberance.

Fig. i, 17, 17, 17.

The transverse sinus is, to a large extent, walled in by the *tentorium cerebelli*, a membrane separating the cerebrum above from the cerebellum below. The *sinus curve*, therefore, corresponds not only to the position of the transverse sinus, but also represents the outer attachment of the tentorium cerebelli, and the interval between the cerebrum above and the cerebellum below.

Reid's base-line.—A line is drawn backwards from the lower border of the orbit to the middle of the external auditory meatus, and, when further produced, the line will be found to fall just below the level of the inion, and to lie almost entirely below the level of the tranverse sinus. This line is utilized by some surgeons in trephining the skull, distances being measured along this line and points taken above or below, according to the seat of the lesion.

Fig. i, 19, 19. Fig. ii, 1, 1.

The Sylvian point represents the site of divergence of the three rami of the *lateral cerebral sulcus* (Sylvius). It corresponds on the surface to a point known as the *pterion* which is situated $1\frac{1}{4}$ inches behind the zygomatic process of the frontal bone, and $1\frac{1}{2}$ inches above the upper border of the zygomatic process of the temporal bone. The main posterior ramus of the sulcus passes backwards and upwards from the Sylvian point to a second point situated $\frac{3}{4}$ inch below the most prominent part of the parietal bone (parietal prominence).

Fig. i, 7. Fig. i, 10, 11.

The anterior ascending ramus is directed upwards for about $\frac{3}{4}$ inch, whilst the anterior horizontal ramus passes forwards for about the same distance.

Fig. i, 8, 9.

The pterion corresponds also to the anterior pole of the *insula* and to the *middle cerebral artery*, as that vessel lies deeply embedded in the anterior part of the lateral cerebral sulcus.

To mark out the *parieto-occipital* sulcus and the *superior temporal sulcus*, it is necessary to find two bony points —the marginal tubercle of the zygomatic bone and the lambda. A line uniting these two points corresponds in its posterior part to the parieto-occipital sulcus, and in its middle third to the superior temporal sulcus.

Fig. i, 12–15.

The *central sulcus* (*fissure of Rolando*).—Take a point ½ inch behind the centre of a line drawn across the vertex of the skull from the nasion to the inion, and from this point draw a line downwards and forwards for 3½ to 4 inches, at an angle of 67½° (three-quarters of a right-angle) to the median antero-posterior line. From a more practical point of view, it suffices to draw a line (for the required distance) from the above point towards the centre of the zygomatic process. In front of this sulcus is the precentral gyrus—an area better known as the *Rolandic* or *motor area.* The main centres here situated correspond, from above downwards, to the movements of the *lower limb*, *upper limb* and *face* of the opposite side of the body. Immediately posterior to the central sulcus lies the postcentral gyrus, the somaesthetic area, with a corresponding arrangement of cortical areas.

Fig. i, 4.

The superior temporal line cuts across the central sulcus at the junction of its lower and middle thirds. It may be regarded as the line of demarcation between the upper extremity area above and the face area below.

Fig. i, 5.

On the left side of the head, that part of the brain which is included in the obtuse angle between the anterior horizontal and the posterior rami of the lateral cerebral sulcus is known as *Broca's area* (the motor speech centre).

Fig. i.

The *middle meningeal artery*, a branch of the maxillary artery, enters the skull through the foramen spinosum, and divides, after a short and variable course across the middle fossa of the skull, into two main trunks. The seat of bifurcation usually corresponds to a point just above the centre of the zygoma.

Fig. ii, 3.

The anterior branch is not only the larger of the two

but it is also more liable to injury, since it is protected in the temporal region by a comparatively thin osseous covering.

Fig. ii, 4.

Fig. ii, 5, 5, 5. The danger zone in the course of this branch may be mapped out by taking three points :

(1) 1 inch behind the zygomatic process of the frontal bone and the same distance above the corresponding process of the temporal bone.

(2) 1½ inches behind and above the same processes.

(3) 2 inches behind and above the same processes—the *anterior meningeal point.*

A line uniting these three points represents the more vulnerable part of the artery.

The anterior division of the vessel will be exposed by trephining over any of these three points, but it is advisable to select the highest—the anterior meningeal point—as by such means the posterior border of the great wing of the sphenoid is avoided ; and, as an additional reason, it should be added that, in the position of points 1 and 2, the artery frequently runs in an osseous canal. After trephining over the upper point, the bone can be chipped away in a downward and forward direction, if such an exposure of the artery is deemed necessary.

Fig. ii, 6. The *posterior branch of the artery* passes almost horizontally backwards, parallel to the zygomatic process of the temporal bone and to the supramastoid crest, and it can be exposed by trephining over a point where a vertical line drawn upwards from the posterior border of the mastoid process cuts another line drawn backwards from the supra-orbital margin parallel to Reid's base-line—the *posterior meningeal point.*

Fig. ii, 7.

The *lateral ventricles.*—The inferior cornu of the lateral ventricle may be tapped by trephining immediately

above and behind the posterior meningeal point. The needle should be directed towards the summit of the opposite ear, the ventricle being reached within 2 inches from the surface (Keen).

Fig. ii, 8.

The *basic fossæ*.—"There is no external sign to indicate the situation of the fossæ of the skull. In general, however, it may be said that the anterior fossa extends as far back as the anterior end of the zygoma; that the middle fossa lies between this and the mastoid process, and the posterior includes all the base behind the process" (Eisendrath).

The *tympanic antrum* may be exposed by trephining in *Macewen's suprameatal triangle*, a space which is bounded above by the backward continuation of the posterior root of the zygoma (the supramastoid crest), behind by a vertical line drawn upwards from the posterior border of the external auditory meatus, and below and in front by the *suprameatal spine*, a prominent bony process which assists in the formation of the posterior superior quadrant of the external auditory meatus. In this triangle there is usually a well-marked depression—the *suprameatal fossa*. The supramastoid crest not only indicates the uppermost possible limit of the tympanic antrum, but, as has already been stated, it corresponds also to the level of the base of brain in this situation. The crest, therefore, represents the level of the *tegmen tympani*, and, in mastoid explorations, the field of operation must be confined to an area below this crest. In the adult the antrum usually lies at a depth of $\frac{1}{2}$ to $\frac{3}{4}$ inch from the surface. In the child it is much nearer the surface.

Fig. ii, 12a.
Fig. ii, 12.
Fig. ii, 13.

The *transverse venous sinus* lies posterior and nearer to the surface, whilst the *facial nerve* pursues its course in front and on a deeper plane.

Fig. ii, 9.
Fig. ii, 12b.

The *parotid gland* occupies the space which is bounded above by the zygomatic arch, behind by the auricle and the mastoid process, and below by a line drawn from the angle of the jaw to the apex of the mastoid process. In front, the gland extends a variable distance over the anterior surface of the *masseter* muscle. This muscle passes downwards and backwards from the lower border of the zygomatic arch to be attached to the outer surface of the descending ramus and angle of the lower jaw. When the teeth are clenched, the anterior border of the muscle is easily defined, a well-marked line of demarcation being so formed between the masseter muscle behind and the buccinator in front.

Fig. iii, 2.

Parotid (*Stenson's*) *duct*, the duct of the parotid gland, corresponds to the middle third of a line drawn from the lower border of the tragus of the ear to a point situated half-way between the ala of the nose and the red line of the upper lip. At the anterior border of the masseter muscle the duct dips inwards, through the buccinator muscle, to open on the buccal mucous membrane, opposite the second molar tooth of the upper jaw.

Fig. iii, 3.

The *transverse facial artery*, a branch of the superficial temporal, runs forwards parallel to and immediately below the zygoma, lying above the level of the parotid duct.

Fig. iii, 4.

The *facial nerve*, after emerging from the stylo-mastoid foramen, curls round the neck of the mandible, and traverses the substance of the parotid gland, in which part of its course it divides into numerous branches. The general transparotid course of the nerve and the direction of its buccal branch may be indicated by a line drawn forwards parallel to and below the parotid duct from the lobule of the ear.

Fig. iii, 5.

The *mandibular nerve* may be represented by a line drawn from the midpoint of the zygoma downwards towards the mandibular foramen—a point midway between the anterior and posterior margins of the ramus of the lower jaw, just below the level of the alveolar border, then forwards to the mental foramen (see below).

The *borders of the bony orbit.*—The following bones assist in the formation of the orbital margin :

Superior, the frontal bone.

Laterally, the zygomatic process of the frontal bone and the corresponding process of the zygomatic bone.

Inferior, the zygomatic bone and the maxilla.

Medially, the frontal process of the maxilla and the internal angular frontal process.

The *medial palpebral ligament* (*tendo oculi*) *and nasolacrimal duct.*—By alternate forcible closure and opening of the lids, the medial palpebral ligament can be felt passing to its insertion into the frontal process of the maxilla. Immediately below the tendon, at the junction of the medial and inferior walls of the orbital cavity, is the depression for the lacrimal sac, which sac narrows below into the *nasolacrimal duct.* The duct passes from the inner canthus in a downward, backward and slightly outward direction to open into the anterior part of the inferior meatus of the nose under cover of the inferior concha. It is about $\frac{1}{2}$ inch long.

Fig. ii, 17.

Fig. ii, 18.

The *supra-orbital, infra-orbital, and mental foramina.*—At the junction of the inner and middle thirds of the supra-orbital margin, the supra-orbital notch or foramen may be felt, and a line drawn downwards from this foramen through the interval between the two lower bicuspid teeth will pass through both infra-orbital and mental foramina. The former foramen lies

Fig. v, 1, 2, 3.