

curve (Fig. 3524, 5) outward and upward to reach the foramen in the transverse process of the atlas, and bending backward, runs in the deep groove on the upper surface of the atlas.

Immediately above the clavicle this vessel lies very deeply between the scalenus anticus and longus colli muscles. It has frequently been ligatured here for the relief of epilepsy; the operation is a difficult one, owing to the many important structures in close relation with the vessel. An incision is made along the posterior border of the sternomastoid muscle immediately above the clavicle, the transverse process of the sixth cervical vertebra (carotid tubercle) is now searched for, and the artery is found lying between the scalene and longus colli muscles.

Drs. Bright and Ramskill state that disease of the vertebral artery, immediately before it enters the skull, may lead to pain at the back of the head. The fact that the artery is here in close relation with the suboccipital nerve, which communicates with the great occipital nerve, may explain this symptom. (Treves.)

The vertebral artery is sometimes wounded by stabs in the neck; not a few cases are reported in which the artery was injured by stabs below the mastoid process. Dr. King (*Lancet*, November, 1885) records a case of injury of this artery in a young man, aged twenty-five, due to a deep wound below the left mastoid process; there was severe bleeding, so the wound was enlarged and the transverse process of a cervical vertebra was found broken; the finger placed between two transverse processes stopped the hemorrhage; the wound was plugged with strips of oiled lint, and in four weeks the patient had perfectly recovered. The plug was removed on the fourth day.

Hemorrhage from wounds of the vertebral artery between two transverse processes is difficult to arrest; wooden plugs have sometimes succeeded; occasionally the artery has been successfully tied by snipping away

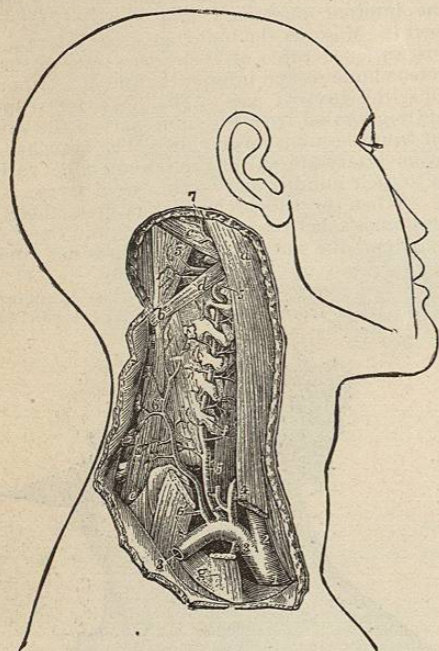


Fig. 3524.—Deep Dissection of the Neck, showing the Course and Origin of the Vertebral Artery (5). (Tiedemann.)

the transverse process and applying a ligature. If this cannot be done the bleeding vessel may be secured by artery forceps, which should be left in the wound.

Traumatic aneurisms of the vertebral artery may occur after a stab in the neck; the writer on one occasion saw

this follow a wound of the vessel between the second and third cervical transverse processes. These aneurisms are commonly mistaken for aneurism of one of the branches of the carotid—as, for instance, the occipital—and the common carotid has been tied on this supposition, without avail, of course. The mistake has arisen from the surgeon finding that pulsation in the aneurism ceased on compressing the carotid in the neck. Of course, if it is compressed below the “carotid tubercle,” the circulation in the vertebral is arrested as well as in the carotid; and even if pressure is applied at this point, the vertebral may be compressed, for it frequently fails to enter the foramen in the transverse process of the sixth cervical vertebra.

The ligature placed on the carotid should be first tightened, and, if this arrests the pulsations in the aneurism, the ligation may be completed; but if pulsation is not arrested, then it is probable that the vertebral is the artery affected, and ligature of the carotid is a useless proceeding.

The treatment of such aneurisms is very unsatisfactory; cases of cure are reported from continuous compression with shot-bag, but if this fail operative measures are of little avail; it is useless to ligature the artery low down, as the anastomosis above is so free; and if the aneurism is cut down upon, ligature at the seat of the aneurism is rarely satisfactorily completed. The writer once saw the carotid tied for vertebral aneurism due to a stab with a knife below the mastoid, and afterward the sac of the aneurism cut down upon; but the hemorrhage could not be arrested by plugging, or otherwise, and the patient died. In this case pressure on the carotid against the sixth cervical transverse process arrested pulsations in the aneurism, and it was supposed that the affection was connected with the occipital artery.

The inferior thyroid artery is sometimes ligatured at the same time as the superior thyroid for enlarged thyroid in exophthalmic goitre (Graves' disease). Any of the arteries may be temporarily ligatured during an operation by tying the ligature over a piece of rubber tubing placed on the vessel. The writer has done this with both the carotid and the subclavian arteries with success.

VEINS OF THE NECK.—The anterior jugular vein has already been mentioned as lying along the inner border of the sternomastoid. It varies somewhat as to its course, and is sometimes double. Occasionally, the veins of the two sides are connected by a large transverse branch, which is a source of trouble in the operation of tracheotomy. The anterior jugular, if large and placed nearer the median line than usual, is liable to be wounded in tracheotomy. It might also be wounded in tenotomy of the sternomastoid for wry-neck. The two anterior jugulars may be replaced by a single trunk.*

In front of the trachea and thyroid gland is a large vein, the inferior thyroid (vena thyroidea ima), which, when large, complicates operations on the trachea.

The external jugular vein corresponds to a line drawn from the angle of the jaw to the middle of the clavicle; it runs beneath the skin and platysma and over the sternomastoid muscle, and ends by piercing the deep fascia above the clavicle to join the subclavian vein. In the operation of tying the subclavian in its third part, it (the vein) must be held aside or ligatured.

The internal jugular vein lies to the outer side of the common carotid artery, and when distended partially overlaps it. In operations for the removal of tumors or enlarged glands of the neck, this vessel may be wounded; ligature in such accidents is the proper procedure, and is not attended by any evil after-effects. The writer has on three occasions ligatured the internal jugular with the most happy results.

The subclavian vein is a continuation of the axillary, and is in close relation with the clavicle; it lies in front of and below the subclavian artery, from which it is

* The anatomy of this region has been ably described by Dr. Pilcher in the *Annals of Anatomy and Surgery*, vol. iii., 1881.

separated by the anterior scalenus muscle. On the left side the thoracic duct empties into it. The point of junction of the subclavian and internal jugular veins is opposite the sternoclavicular articulation. The wall of

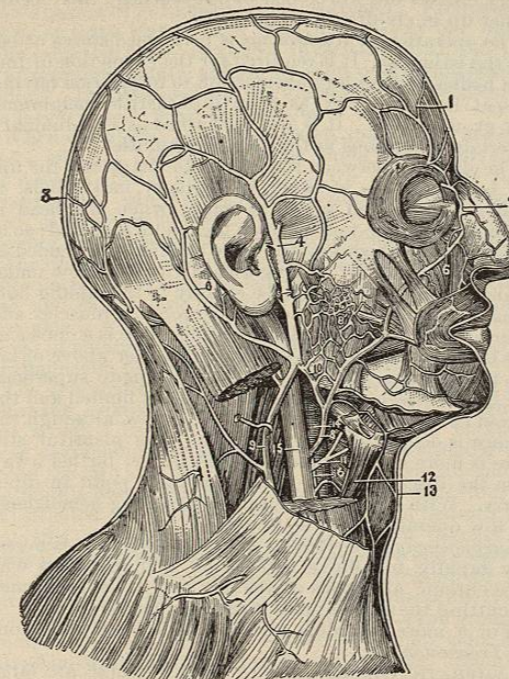


Fig. 3525.—Superficial Veins of the Face, Head, and Upper Part of the Neck. (From Testut.) 1, frontal veins; 2, parietal veins; 3, occipital veins; 4, superficial temporal vein; 5, internal maxillary vein; 6, mastoid vein; 7, angular vein; 8, facial vein; 9, external jugular vein; 10, point where the latter anastomoses with the facial vein; 11, lingual vein; 12, superior thyroid vein; 13, anterior jugular vein; 14, carotid artery; 15, internal jugular vein; 16, pneumogastric nerve.

the subclavian vein adheres closely to the fascial sheath by which it is invested; this sheath is connected anteriorly with the costocoracoid membrane and the clavicle, and when the shoulder is carried forward the vessel becomes expanded. (Quain.) In operations at the root of the neck great care should be taken to avoid wounding the large veins, for air is very apt to be sucked in during inspiration. These veins are so firmly united to the bones and muscles, that when wounded they do not collapse, but, on the contrary, gape. It should be remembered that the risk of air entering is increased by movements of the upper limb, which still further open the wounded vein.

THYROID BODY.—This is a highly vascular organ consisting of two lateral lobes, one on each side of the larynx and trachea, connected by an isthmus which crosses the second and third rings of the trachea. The lobes are pear-shaped, and reach from the fifth and sixth rings of the trachea to the upper border of the thyroid cartilage; the lateral lobes are covered in front by the depressions of the hyoid bone, and posteriorly are in contact with the sheath of the great vessels of the neck. Each lateral lobe measures about two inches in length, one and one-fourth inch in breadth, and from three-fourths to one inch in thickness. The weight of the thyroid body is from one to two ounces, and is greater in females than in males. The isthmus is occasionally absent, the lateral lobes being connected by fibrous tissue only, as is the case in some animals, viz., the horse, donkey, etc.

Owing to the fact that the thyroid body lies over the

great vessels of the neck, when enlarged it derives from them a visible pulsation, and a distinct thrill may be felt. Such pulsating tumors have been mistaken for aneurism, but as the thyroid body is closely connected with the larynx and trachea, it rises and falls in deglutition, and so is easily diagnosed from aneurismal or other tumors, which are not disturbed by deglutition. When hypertrophied the tumor resulting from an enlarged thyroid is called a “bronchocele” or goitre. When a goitre grows rapidly respiration is often interfered with, and operation has to be undertaken for its relief. It is not necessary to remove the whole gland to relieve the obstructed respiration, for division and removal of the isthmus only often gives very good results. Mr. Sidney Jones (*Lancet*, vol. ii., 1888) reports cases in which excision of the isthmus not only relieved the dyspnoea, but a month after the operation the lateral lobes had almost disappeared.

Since the advent of antiseptic surgery the extirpation of large bronchoceles by the knife has become most common, but the operation, owing to the very important structures in relation to it, is always a most formidable one. It is very important in this operation first to ligate the vessels supplying the gland, viz., the superior thyroid above, and the inferior thyroid below, and if present, the middle thyroid. In ligating the inferior thyroid artery, care must be taken not to injure the inferior laryngeal nerve, which winds among the branches of that artery. Simple cysts may be removed by enucleation. Owing to the conditions which follow complete removal of the thyroid, viz., myxedema, and cachexia strumipriva, partial removal is the more common operation except in cases of malignant disease or when the growth becomes dangerous from pressure.

The ESOPHAGUS commences opposite the cricoid cartilage; it lies between the trachea and the vertebral column. At the lower end of the neck it inclines a little to the left, and for this reason cesophagotomy is performed on the left side. Strictures most commonly occur at its upper part, and foreign bodies are most apt to be arrested behind the larynx. Foreign bodies, such as fish bones, mutton or beef bones, have occasionally ulcerated through the esophagus and perforated some of the large vessels with which it is in contact.

In performing cesophagotomy for the removal of an arrested foreign body, the incision is made between the sternomastoid and trachea, the middle point being opposite the cricoid cartilage. The inferior thyroid artery and recurrent laryngeal nerve must be carefully avoided. The carotid artery is in no danger of being wounded if proper care be taken.

In cesophagostomy, when a stricture exists high up, the in-

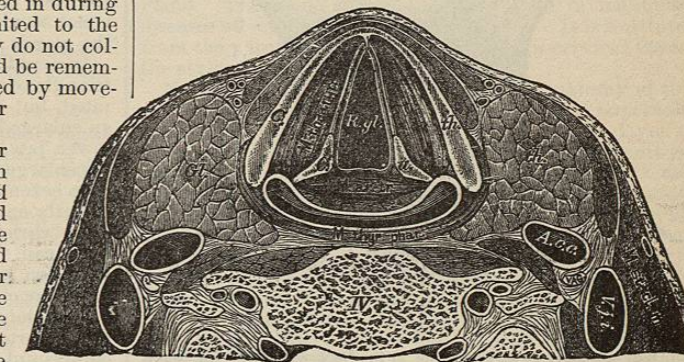


Fig. 3526.—Transverse Section of Neck, Opposite Fourth Cervical Vertebra, showing Thyroid Body (Gl. th.).

cision into the esophagus is made for the purpose of feeding the patient by a tube, and so avoiding gastrostomy. The fact that the operation is performed low down makes it much more dangerous than cesophagotomy, and nearly all the reported cases have ended in death within a short time of the operation from diffuse inflammation of the neck.

HYOID BONE.—This is one of the most important landmarks in the neck, and one which can always be felt in the stoutest neck. It is the best guide for ligature of the lingual. In old age the different portions of the bone become ossified into one piece, and in consequence it is more easily broken by direct violence due to blows or throttling. Cases are reported of fracture of the hyoid from yawning and sudden extension backward of the head. The symptoms of fracture are pain, difficulty in speaking, in movements of the tongue, and in swallowing.

LARYNX AND TRACHEA.—The *larynx* is connected above with the hyoid bone by means of the thyrohyoid membrane, and is continuous below with the trachea. Posteriorly it helps to form the wall of the pharynx. It consists of several parts, which are closely connected together by ligamentous structures, muscles, and mucous membrane; these parts are the thyroid cartilage, epiglottis, cricoid, and arytenoid cartilages. On the upper margin of the thyroid cartilage is a bursa which prevents friction as the larynx ascends beneath the hyoid bone in deglutition. This bursa is sometimes enlarged, and has to be incised. The larynx is occasionally wounded in cases of attempted suicide by cutting the throat. Between the lower border of the thyroid and cricoid cartilages is the cricothyroid membrane, where the operation of laryngotomy is performed. A small lymphatic gland is occasionally found here, which may become enlarged. (For description of interior of larynx see *Larynx*.)

Foreign Bodies.—Children not infrequently swallow articles which are sucked into the larynx during inspiration; these may be arrested by the cords at the rima, or may lodge in one of the ventricles. If they pass the rima they usually lodge in the right bronchus. These bodies can frequently be seen with a laryngoscope and extracted with forceps, but very often the operation of tracheotomy is necessary to remove them.

The **TRACHEA** extends from opposite the sixth cervical vertebra to its bifurcation opposite the third dorsal, where it is crossed by the arch of the aorta. It measures from four to five inches in length, and from three-fourths to one inch in breadth. It is covered by the depressors of the hyoid bone, and has on each side at its upper end the

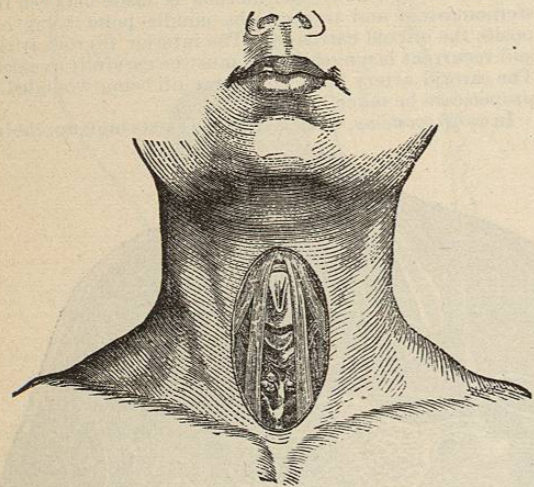


FIG. 3527.—Dissection of the Space in the Neck where the Operation of Tracheotomy is Performed. The trachea is exposed, having on each side of it the sternohyoid muscle, and lying on it below the inferior thyroid veins. (Roser.)

thyroid body. It is crossed by the isthmus of the thyroid gland opposite its second and third rings, and has also in front the inferior thyroid veins, and sometimes a transverse branch connecting the two anterior jugulars. When the middle thyroid artery is present it also lies upon the trachea in its course up to the isthmus of the

thyroid. In children the thymus gland covers its lower portion. Laterally the trachea is in relation with the carotid artery and recurrent laryngeal nerve; posteriorly it is in contact with the esophagus. The innominate artery crosses the lower end of the trachea; this occurs higher up in children than in adults.

The operation of *tracheotomy* is performed above or below the isthmus. It is required for the extraction of foreign bodies and for any obstruction to respiration having its seat in the larynx, as from diphtheritic membrane, new growths, etc. It is also performed as a preliminary to certain operations in the neck and mouth.

The distance between the cricoid cartilage and the upper border of the sternum, in ordinary individuals, is about one inch and a half (4 cm.); when the head is thrown back three-fourths of an inch more is gained; so in performing tracheotomy the neck should be extended as much as possible by placing a hard round pillow under it, and the incision should be exactly in the middle line, so as to come between the two sternohyoid muscles and anterior jugular veins. In operating there is a choice as to where the trachea is to be opened, either above or below the isthmus. Above, the parts are more superficial and blood-vessels fewer, but the space is limited and the cricoid cartilage has often to be cut; below, although the trachea is deeper and the veins are more plentiful, still there is more room for incision, and we get farther away from the disease, which is an important point in diphtheria. With our present means of arresting hemorrhage the low operation is to be preferred.

Laryngotomy is performed in cases in which it is necessary rapidly to relieve suffocation, and in adults who have chronic affections of the larynx. It is performed by cutting the cricothyroid membrane transversely.

(For a more complete description of these operations see *Tracheotomy*.)

LYMPHATIC GLANDS OF THE NECK.—These are large and numerous. They frequently enlarge and become inflamed, and if not excised break down and suppurate, leaving unsightly scars. In scrofulous subjects the glands of the neck are the ones most frequently enlarged. The enlargement is always the result of some irritation, either of the mucous membrane of the throat, nose, ear, etc., or of the skin of the scalp, face, or neck. The glands are more liable to enlarge in persons of a scrofulous diathesis, and in them the amount of involvement of the glands is out of all proportion to the irritating cause; this may be an eczema of the scalp or a simple sore throat. In non-scrofulous individuals the glands are frequently enlarged from some special irritating cause, as a diseased tooth, tonsillitis, malignant disease of the tongue, lip, etc., but in these individuals the enlargement is so great, and the glands do not tend to suppurate.

In syphilitic the *glandulae concatenatae* in the posterior triangle of the neck are frequently enlarged and indurated, but they do not tend to suppurate. In tonsillitis an enlarged gland is always felt beneath the angle of the lower jaw; this is erroneously supposed by many to be the enlarged tonsil which cannot be felt from the outside. In eczema of the scalp the glands of the neck are frequently enlarged, especially if the eczema be of the pustular variety. In delicate children pediculi not only often cause an eczema of the nape of the neck, but the irritation frequently causes enlargement of the glands in the suboccipital and mastoid regions.

Occasionally a single gland becomes enlarged over the carotid artery, and this has been mistaken for aneurism on account of the strong pulsation communicated to the tumor by the artery; these tumors, however, cannot be emptied by lateral pressure, and when lifted away from the artery all pulsation, of course, ceases.

When one or several glands of the neck have become enlarged and show no tendency to diminish, it is much better to remove them with the knife. This can be easily done before the gland breaks down and suppurates, and so forms inflammatory adhesions to the surrounding parts. In cases of "scrofulous necks," in which nearly all

the glands are enlarged, their removal is advisable, for if left to themselves they break down and suppurate, and after months and perhaps years of discomfort, heal, leaving unsightly scars. An argument in favor of early excision is that foci of infection are removed, and the patient's chance of good health is much greater. Frequently thirty or forty glands have been removed at one operation, and the result is almost invariably good, the patient recovers rapidly, and the amount of scarring is very trifling. In dissecting out the glands in close relation to the large vessels, great care should be taken.

When the glands have suppurated and sinuses are left which will not heal, scraping the sinus and removal of the remains of the gland with a sharp spoon give very good results. Mr. Treves recommends puncture of softened caseous glands with a cautery; he also advises opening gland abscesses by the cautery highly heated.

The lymphatics of the neck are enlarged, with those of other parts of the body, in leukæmia and Hodgkin's disease, and care should be taken not to confound scrofulous glands with enlarged glands in these diseases. Removal of enlarged glands in Hodgkin's disease is, except for diagnostic purposes, of course, perfectly useless.

The lymphatic glands of the neck are arranged in the following groups: *Submaxillary* (ten to twelve in number), situated beneath the base of the inferior maxilla; these also include the *suprahyoid*, which are situated between the two anterior bellies of the digastric muscle in the middle line of the neck. *Superficial cervical* (four to six) situated along the external jugular vein beneath the platysma and deep fascia. *Deep cervical* (twenty to thirty). These are subdivided into *superior* and *inferior*. The *superior* are situated about the bifurcation of the common carotid, and reach to the base of the skull, lying along the internal jugular vein. The *inferior* are grouped around the lower part of the internal jugular vein, and extend outward into the supraclavicular fossa, becoming continuous below with the axillary and mediastinal glands.

The following table, from Sir F. Treves' book on "Scrofula and Its Gland Diseases," showing the relation certain glands bear to the periphery, will be found useful:

Scalp: Posterior part = suboccipital and mastoid glands; frontal and parietal portions = parotid glands; vessels from the scalp also enter the superficial cervical set of glands.

Skin of Face and Neck = Submaxillary, parotid, and superficial cervical glands.

External Ear = Superficial cervical glands.

Lower Lip = Submaxillary and suprahyoid glands.

Buccal Cavity = Submaxillary and deep superior cervical glands.

Gums of Lower Jaw = Submaxillary glands.

Tongue: Anterior portion = suprahyoid and submaxillary glands; posterior portion = deep cervical glands (superior).

Tonsils and Palate = Deep cervical glands (superior).

Pharynx: Upper part = parotid and retropharyngeal glands; lower part = deep cervical glands (superior).

Larynx, Orbit, and Roof of Mouth = deep cervical glands (superior set).

Nasal Fossa = Retropharyngeal glands and deep cervical (superior). Some lymphatics from the posterior part of the fossa enter the parotid gland.

PAROTID GLAND.—This gland lies on the face in front of the ear, and extends deeply into the space behind the lower jaw; its inferior portion is situated partly in the neck behind the angle of the jaw, lying on the digastric muscles in the submaxillary region. It is connected with very important structures, being pierced by the external carotid artery and facial nerve. This gland not infrequently becomes inflamed and suppurates after fevers (as typhoid) and operations on the abdominal viscera. Cases are reported in which it has become inflamed after ovariectomy, and the writer has twice seen abscess of the parotid follow severe blows on the abdomen. These abscesses are very painful, owing to the tension caused by the in-

vesting fibrous capsule. In opening abscesses here the incision should be transverse, to avoid cutting the facial nerve, and should be in front of the line of the carotid artery. Abscesses of the parotid gland frequently burst

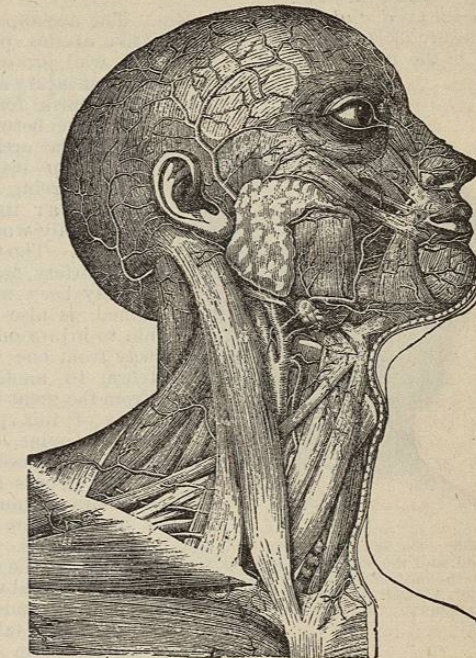


FIG. 3528.—Dissection of the Neck, showing the Triangles and their Contents. (Tiedemann.)

into the external auditory meatus. There are a number of lymphatic glands in relation with the parotid, which receive vessels from the scalp, pharynx, etc. Tumors are not infrequently found in this region, the extirpation of which gives rise to very severe hemorrhage. The facial nerve is frequently unavoidably injured in the removal of these tumors, and the external carotid artery sometimes requires ligature.

SUBMAXILLARY GLAND.—The submaxillary gland is situated in the submaxillary region, between the anterior and posterior bellies of the digastric muscle. It lies partly on the mylohyoid and partly beneath it. The facial artery grooves the back part and upper border of the gland. The gland is sometimes involved in malignant diseases affecting the mouth and tongue. It is separated from the parotid gland by a fold of deep cervical fascia, the stylomaxillary ligament.

NAPE OF THE NECK.—The superficial anatomy of this region has already been described. The most superficial muscle is the trapezius, which is covered by a layer of thick and tough fascia and is pierced by the great occipital nerve. To the outer side of the trapezius, and separated from it as it descends, is the sternomastoid muscle; crossing obliquely the interval between them are the splenius capitis and colli muscles. On removing the trapezius, which in this region is usually very thin, the complexus muscle comes into view, also pierced by the great occipital nerve; deeper down still are seen the muscles bounding the suboccipital triangle (rectus capitis anticus major, superior and inferior oblique), where are seen the suboccipital nerve and vertebral artery. In the central line is the ligamentum nuchæ. It extends from the seventh cervical spine to the external occipital protuberance. In some animals this ligament is a very powerful elastic band which suspends the head; to it are attached muscles and fascia. The occipital artery becomes superficial midway between the mastoid process and external occipital protuberance. It runs along the outer border of the superior oblique, and is

accompanied by the great occipital nerve. The lesser occipital nerve winds round the posterior border of the sternomastoid, and supplies the lateral region of the occiput; the suboccipital, being a purely motor nerve, rarely reaches the skin.

Spinal Cord and Vertebral Column.—The accompanying figure (3530) shows well the situation of the spinal cord in the neck vertebrae. It is not so well protected

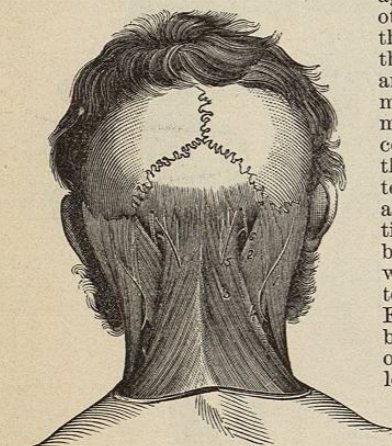


FIG. 3529.—The Skin and Fascia have been Removed, and the Superficial Muscles Exposed. 1, Sternomastoid; 2, splenius capitis; 3, trapezius; 4, small occipital nerve; 5, great occipital nerve; 6, occipital artery. (After Roser.)

against injury as in other parts, for in the space between the several arches, any sharp instrument piercing the muscular tissue could easily wound the cord. The vertebral artery, as has already been mentioned, is also liable to injury on its way from one vertebra to another. From the great mobility of this part of the spine dislocation occasionally occurs and death is caused by pressure on the cord. In caries of the upper cervical vertebrae, sudden death has taken place from the destruction of the ligaments between the atlas and axis. When this occurs—the head with the atlas inclining forward and leaving the axis in its proper position—the medulla oblongata is crushed against the odontoid process, and so instant death is the result. (Hilton.)

Caries of the spine in the cervical region is not uncommon. In its early stages the symptoms are somewhat obscure, the chief complaint being of pain in the course of the great occipital nerve, due to its implication in inflammatory exudation. The peculiar stiff way in which the patient carries his head, and the presence of a slight prominence which is excessively tender, enables the surgeon to recognize the disease. These cases occasionally result in a post-pharyngeal abscess, which has to be opened. This may easily and safely be done by an incision along the posterior border of the sternomastoid. Some advise tapping it with a trocar through the mouth.

BRANCHIAL FISTULE AND CYSTS.—In the mammalian embryo, at the fourth week, there are on each side of the head, behind the oral cavity, four fissures which communicate with the anterior part of the alimentary canal. These are the homologues of the clefts found in branchiate vertebrates. The third and fourth fissures in the human embryo disappear about the sixth week, and only the first remains at the end of the ninth week. This persists as the Eustachian tube, tympanic cavity, and external auditory meatus. The structures developed in the folds between the clefts (branchial arches) are as follows:

First Arch (Mandibular): Meckel's cartilage, the anterior portion of which is developed into the lower jaw, and the mandibular arch is completed by the malleus bone of the ear.

Second Arch (Hyoid): Incus, stapes (Parker), styloid process, stylohyoid ligament, and lesser cornu of the hyoid bone.

Third Arch: Great cornu and body of the hyoid bone.

Fourth Arch: No permanent remains. Sometimes the clefts between these arches remain more or less open, and this fact explains the occurrence of congenital fistulae of the neck, as well as that of cysts and diverticula from the oesophagus and larynx.

Paget says (Proc. Royal Med. Soc., 1877): "Cervical

branchial fistulas occur as two or three minute orifices on one or both sides of the lower part of the neck, and they lead upward to the oesophagus and pharynx; the lowermost being near the sternal end of the clavicle in front of the sternomastoid muscle, the next opposite the thyroid cartilage, and the highest between the thyroid cartilage and hyoid bone." When two in number, they are often symmetrical; they vary in length from one-half to one and a half inches, and barely admit a probe. They have a smooth lining membrane, which secretes a clear mucous fluid. These fistulae can be cured by cauterizing them with the galvanocautery. It is probable that many cysts and so-called hydroceles of the neck are due to imperfectly closed embryonic fissures.

Sanguineous cysts of the neck are probably originally branchial cysts, which have communicated with the internal jugular vein. Cases are on record in which, before removal of the cyst, the vein had to be ligatured (Glück: *Deutsche med. Woch.*, No. 5, 1886).

BRANCHIAL DERMIDS.—These are occasionally seen in the neck, the most common situation being between the geniohyoglossi muscles, where the swelling projects into the submaxillary space and also into the mouth. They can usually be enucleated. A dermoid sometimes is seen under the deep fascia close to the carotid arteries.

THYROLINGUAL FISTULE AND CYSTS.—These are met with on the tongue, at the hyoid bone, and lower down over the thyroid cartilage, cricoid, and upper rings of the trachea. They grow slowly with the growth of the individual, and are very difficult to eradicate. The cyst wall is thin and lined with columnar epithelium, perhaps ciliated. Their contents are mucoid. They sometimes burst, leaving fistulous openings which are difficult to close. Unless the cyst be entirely removed, it will recur, for if any part of the epithelial lining be left it will secrete and cause a persistence of the trouble. Thyrolingual cysts and fistulae are the remains of the thyrolingual duct, which passes up the neck to the tongue

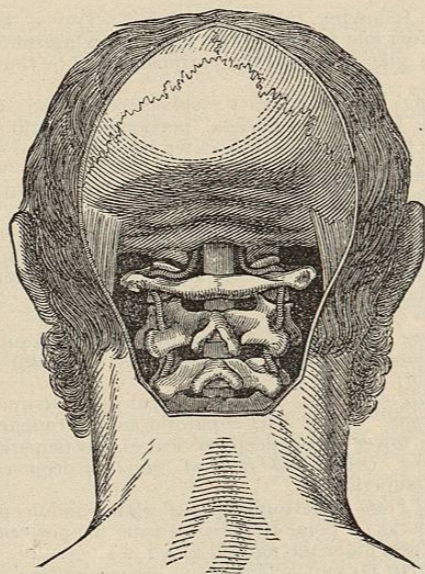


FIG. 3530.—The Superficial Tissues have been Removed to show the Vertebral Artery Passing Through the Transverse Processes of the Vertebrae, and also the Relation of the Cord to the Spinal Canal. (Roser.)

behind the hyoid bone. The lower part becomes the isthmus of the thyroid gland, while the upper part persists as the foramen cæcum of the tongue.

TUMORS OF THE NECK.—The neck is a favorite site for tumors, fibrous, sarcomatous, and others. Sarcomatous tumors in the early stages can be removed, but they nearly always recur. Tumors of the neck, which are

apparently so freely movable that their extirpation would seem to be an easy matter, are found, when cut down upon, to be intimately connected with the deep vessels and nerves. In these cases the tumor is freely movable laterally, the vessels going with them, but there is no freedom of movement in the vertical direction. It is remarkable with what impunity large tumors may be removed from the neck, especially if they are benign. It is not uncommon in these cases to ligature both the internal jugular vein and the carotid artery, and to cut through the sternomastoid muscle, and yet have the patient make a rapid recovery from the operation; the tumor, as mentioned above, if sarcomatous, almost invariably returns, for it is impossible in the neck in such cases to remove sufficient of the surrounding healthy structures.

Aneurismal tumors at the root of the neck are comparatively common, and although in many cases these tumors may have the appearance of being connected with the subclavian or innominate arteries, yet they almost invariably proceed from the aortic arch, and push their way upward under the clavicle into the neck. Fusiform aneurisms of the aorta frequently simulate aneurism of one of the great branches.

Tumors in connection with the thyroid gland have been alluded to in the description of that body.

Francis J. Shepherd.

NECROBIOSIS.—The gradual death of tissue due to slowly acting injurious agents is known as *necrobiosis* or *indirect necrosis*, in opposition to *direct necrosis* or *immediate death*. In necrobiosis the death of the cell is preceded by some other retrograde change, such as atrophy, cloudy swelling, mucous, hydropic or fatty degeneration, or by one of the pathological infiltrations. In the case of direct necrosis death of the tissue takes place rapidly without the occurrence of preceding abnormal changes in cellular structure. The preceding retrograde change in necrobiotic processes is by some writers regarded as constituting the necrobiosis; but a distinction should be made between the preceding atrophy, degeneration or infiltration, and the molecular disintegration which constitutes the essential feature of necrobiosis. The retrogressive changes preceding this disintegration usually occur so gradually, and in themselves present such definite characteristics, as to be classed by themselves. The use of the term necrobiosis is more theoretical than practical, inasmuch as a practical distinction between direct necrosis and necrobiosis is at times very difficult or impossible. Necrobiosis is, therefore, best conceived of as a slowly progressive or incomplete necrosis. The gross appearances of necrobiotic tissues vary according to the nature of the preceding retrograde change and the degree of necrosis present. Microscopically, in addition to the characteristic changes presented by the accompanying retrograde change, the nuclei of the affected tissue show karyorrhexis and a greater or less degree of karyolysis. The ultimate picture of necrobiosis is that of necrosis; if the necrobiotic process has been characterized by cloudy swelling, simple necrosis follows; if by fatty degeneration, soft caseation (fatty necrobiosis) occurs; if by hydropic degeneration, liquefaction necrosis results. The sequelae of necrobiosis are essentially those of necrosis: regeneration, repair, cicatrization, calcification, and cyst formation. Likewise the causes producing necrobiosis are the same as those leading to direct necrosis: mechanical, thermal, chemical, infectious, and nutritional. The injurious agents may act separately or coincidentally. As a general rule it may be stated that harmful agents of slight power but of long-continued action are more likely to produce necrobiosis than direct necrosis. Disturbances of blood supply, deficient nutrition and oxygenation, as in the case of chronic anæmia, are among the most important factors leading to necrobiotic processes. Chronic intoxications and infections also play a leading rôle in the production of necrobiosis. Clinically a neuropathic necrobiosis may be distinguished.

Aldred Scott Warthin.

NECROSIS, PATHOLOGY OF.—The condition of local death, the death of individual cells or groups of cells within the living body, is known as *necrosis*. If such local death occurs immediately or very quickly after the action of some injurious agent, it is termed *direct necrosis*; if, on the other hand, the death of tissue is of a slowly progressive nature preceded by other retrograde changes, the process is designated *necrobiosis* or *indirect necrosis*. The use of the word necrosis without modifying designation is usually taken as referring to direct necrosis.

Inasmuch as we have no definite knowledge, either chemical or histological, of the condition of cell life, the essential nature of cell death or necrosis is also unknown to us. The cellular change which marks the exact moment of the passage of life from the cell is at present beyond our knowledge; the slight histological changes taking place in cells at this moment do not permit us to determine with certainty the definite boundary between the states of cell life and cell death. Our conception of necrosis is, therefore, based upon the changes which follow necrosis rather than upon those taking place at the moment of cessation of life. The development of modern microscopical technique has, however, so perfected methods of tissue fixation that it is now possible to fix and preserve definitely the histological characteristics of the cells as they exist at the moment the tissue is placed in the fixing fluid. Our knowledge of the structure of normal living cells has been obtained from the study of cells killed and fixed by such means; and likewise our conceptions of pathological conditions are based upon the relative appearances of cells so treated.

As a result of such study certain pathological criteria have been created. Of these the condition of *necrosis* is that state of the cell which is characterized microscopically by the disappearance of the nucleus and certain molecular changes in the cytoplasm. The disappearance of the nucleus or its failure to respond to nuclear stains is to be taken as the most striking feature of necrosis, inasmuch as the nucleus is to be regarded as the most essential vital element of the cell. Cells may be dead and yet retain their nuclei, but necrosis becomes evident to us microscopically only when certain changes in cell structure have occurred to distinguish the dead cell from living ones. The loss of the nucleus may occur at the moment of death or subsequently; in either case it becomes the criterion of necrosis. To the disappearance of the nucleus and its loss of staining power the terms *karyolysis* and *chromatolysis* have been applied. These changes are very frequently preceded by fragmentation of the nuclear chromatin. This change is known as *karyorrhexis*; it has been shown to consist of regular and definite movements on the part of the chromatin elements. Small masses and granules of chromatin may leave the nucleus and pass into the cell body. With the disappearance of the cell membrane fine chromatin granules may be scattered throughout the cell detritus of the necrotic area. As a result of such diffusion of the chromatin areas of necrosis in the early stage may stain diffusely blue. In other cases the nucleus before its disappearance contracts and becomes smaller, at the same time staining more deeply than normal (*pyknosis*.) Very frequently the nucleus retains its normal form and size, but gradually loses its staining power and fades away, both nucleus and protoplasm being converted into a homogeneous hyaline mass.

Sooner or later, changes take place in the protoplasm of dead or dying cells. The normal granulation of the cytoplasm may disappear and the cell undergo a hyaline change. The cell membrane ultimately disappears and the outline of the cell becomes irregular or lost altogether. Often the cell protoplasm becomes coarsely granular, the cell ultimately breaking up into a granular debris. Vacuolation may take place and the cell become enlarged and swollen from the imbibition of fluid. As the result of such swelling, breaks in the continuity of the protoplasm may occur. On the other hand, the dead cells may under certain conditions become inspissated.