

third part of the subclavian lies near the skin in those who are thin and have slender and long necks, with lean and pendent shoulders; it is, on the contrary, deeply hidden in persons who have short, thick necks and muscular shoulders.*

Occasionally the subclavian artery pierces the scalenus anticus instead of going behind it, and more rarely passes entirely in front of the muscle; of the first variety I have seen five cases in two hundred and fifty subjects (three on the left and two on the right side); of the second, in the same number of subjects examined, I have seen only one example.

The vein may pass with the artery behind the anterior scalenus, and in very rare cases their normal positions may be reversed. The trapezius may cover the third part of the subclavian, or it may have in front of it the omo-hyoid muscle. These conditions, however, will be more fully described under *Muscles, Anomalies of*.

Variations of Branches.—It is important, surgically speaking, that the position of the various branches given off from the subclavian should be considered.

The branches given off from the first part do not, as a rule, vary much in their arrangement, but several may be transferred to the second or third portions. The left vertebral may arise from the arch of the aorta instead of from the first part of the left subclavian, and the branches of the thyroid axis may be given off separately.

The first part of the right subclavian, having been occasionally ligated, it is necessary to know at what distance from the innominate the branches arise. In the majority of cases this is from 1.25 cm. (half an inch) to 2.4 cm. (one inch) (R. Quain); but it often exceeds this, and is frequently 2.4 cm. (one inch) to 3.8 cm. (one inch and three-quarters). In a small minority of cases the distance is under 1.2 cm. (half an inch).

In the *second portion of the artery*, one branch, as a rule, is given off, the superior intercostal; occasionally no branches are seen here, and again, not infrequently, there are two or three.

The *third portion*, in a little more than half the cases, gives off no branch, in a little less than half, one branch, occasionally two, and in very rare cases three and four.

Vertebral Artery.—Origin: The right vertebral, in those rare cases in which the right subclavian arises from the arch of the aorta, is given off from the common carotid of the right side. The right vertebral has been seen coming from the arch.* The left vertebral not infrequently is given off from the arch of the aorta, generally between the left carotid and left subclavian. I have seen this arrangement twelve times in two hundred and fifty subjects. I have once seen it come off from the left common carotid. The vertebral has been seen with two, and even three roots (R. Quain).

Course: This vessel may fail to enter the transverse process of the sixth cervical vertebra, but continue up the neck between the inferior thyroid artery and vein to enter the transverse process of any of the vertebrae from the fifth to the second. It is not uncommon for it to enter the transverse process of the fourth or fifth vertebra, but it is only very occasionally that it passes up as high as the third and second before entering the foramen. Again, it may enter the transverse process of the seventh cervical vertebra, instead of the sixth.

Size: The left vertebral is frequently much larger than the right, especially in those cases in which it is given off directly from the arch of the aorta. Sometimes the vertebral is nearly as large as the common carotid, at other times as small as the ascending cervical branch of the inferior thyroid.

Branches: The vertebral may, as a very rare occurrence, give off the inferior thyroid or superior intercostal

* Mr. A. M. Paterson (Jour. Anat. and Phys., April, 1884) records a case of right vertebral arising from the aortic arch beyond the left subclavian, and reaching the vertebral-arterial canal by passing behind the trachea and oesophagus; in fact, following exactly the course of the subclavian when it arises from the back part of the arch, as figured above. Mr. Paterson regards this anomaly as a persistence of the right aortic root, with obliteration of the connection between the subclavian and vertebral arteries where they cross.

artery. I have seen two examples of the first variety occurring on both sides of same subject. Its inferior cerebellar branch is frequently absent on one side.

The *thyroidea ima* has been observed in rare cases to come off from the right subclavian.

The upper end of the vertebral artery occasionally divides into two branches, which unite a little higher up, thus forming a loop through which pass filaments of the hypoglossal nerve. I have seen this anomaly in two instances.

Thyroid Axis.—This trunk occasionally arises beyond the scalenus anticus muscle (according to R. Quain twice in two hundred and seventy three cases). It not infrequently gives origin to the internal mammary. It is sometimes absent, its branches being given off separately from the subclavian.

Inferior Thyroid.—This artery frequently arises as an independent branch from the subclavian. It has been seen to arise from the common carotid, and not infrequently from the vertebral. It varies considerably in size, and when small its place is taken by the superior thyroid. In cases of enlarged thyroid gland (bronchocele) it is often nearly as large as the carotid. Two inferior thyroids have been found on the same side, one having the normal course beneath the carotid artery, and the other reaching its destination by passing superficially to that vessel (Fig. 294). Its branches of division are closely connected with the recurrent laryngeal nerve, which may pass beneath or above them, a point to be borne in mind in extirpation of the thyroid gland. The inferior thyroid

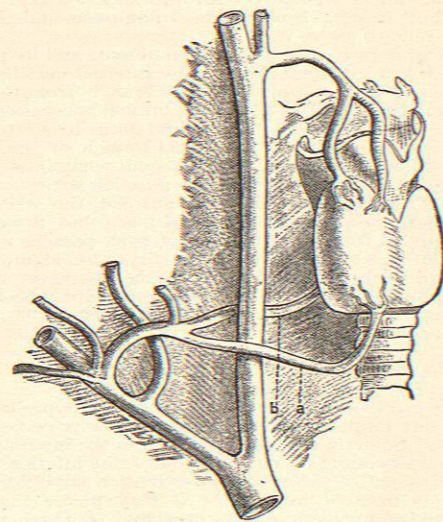


FIG. 294.—Inferior Thyroid Artery Dividing into Two Branches, one of which (a) passes in front of the carotid sheath, the other (b) behind it. (Anderson: Jour. Anat. and Phys., vol. xiv.)

may be wanting altogether, its place being supplied by an enlarged superior thyroid of the same side.

The *ascending cervical* branch of the inferior thyroid may be derived directly from the subclavian or one of its branches. It is occasionally of large size, and may take the place of the occipital.

Suprascapular.—This artery is usually derived from the thyroid axis, but not infrequently has a different origin. It is often given off directly from the subclavian. It may be given off from the internal mammary. I have several times seen it derived from the subscapular and also from the axillary. It is often very small.

Transverse Cervical.—This artery when given off from

the thyroid axis divides into two terminal branches, viz., the superficial cervical and posterior scapular. Very often the superficial cervical only is given off from the thyroid axis, the posterior scapular coming off as a separate branch from the second or third part of the subclavian, rarely from the first part. It is well, when ligaturing the third part of the subclavian, to remember that the posterior scapular comes off from it about once in every three cases. When the posterior scapular artery is given off from the third part of the subclavian I have not infrequently seen it pierce the fibres of the scalenus medius muscle, and occasionally go between the cords of the brachial plexus. The posterior scapular artery may be given off from the axillary, or it may end near the scapula in a small branch, its place being supplied by branches from the suprascapular. The superficial cervical may come off from the subclavian as a separate branch, the posterior scapular alone being derived from the thyroid axis. When the posterior scapular is a branch of the third part of the subclavian it often gives off a large branch to supply the trapezius, which represents the greater part of the superficial cervical, the latter artery in such cases being very small or absent.

The transverse cervical artery is occasionally given off from the subclavian as a separate branch.

Internal Mammary.—This is a large and very regular branch of the subclavian, generally arising from the lower part opposite the vertebral. It may arise from the thyroid axis, axillary, or innominate, or even from the arch of the aorta. It may also form a common trunk with either of the scapular arteries, and be given off from the second or third part of the subclavian. Hyrti describes a case in which the trunk of this artery crossed in front of the fifth right costal cartilage, coming out of the thorax through the fourth interspace and re-entering it by the fifth. In one case the author saw the phrenic nerve pierced by this artery.

A branch is sometimes given off from the upper part of the internal mammary, called by Henle the *A. mammaria interna lateralis*, which crosses the inner surface of the upper four to six ribs and intercostal spaces at right angles, about midway between the spine and sternum, anastomosing in its course downward and outward with the intercostal arteries. In penetrating wounds of the thorax, fractured ribs, and other injuries, this lateral branch might be wounded and give rise to dangerous hemorrhage. It might also be wounded in the operation for evacuating an empyema.

Superior Intercostal.—Sometimes arises from the thyroid axis or vertebral. I have seen it arise from the internal mammary. It may be of considerable size, and may supply three or four intercostal spaces. It in some cases passes between the neck of the first or second rib and the corresponding transverse process of the dorsal vertebra. It is very rarely absent.

Deep Cervical.—This artery is generally a branch of the preceding, but occasionally is derived directly from the subclavian, in the proportion of 1 in 20 subjects (R. Quain). In rare cases it arises from the posterior scapular and internal mammary. It is not infrequently of small size, its place being taken by the deep cervical branch of the occipital, a branch of the inferior thyroid, the ascending cervical or a posterior cervical branch of the transverse cervical (Henle).

It may pass between the transverse processes of the fifth and sixth cervical, first and second dorsal, or second and third dorsal instead of between the seventh cervical transverse process and first rib.

There is sometimes an accessory branch accompanying it.

AXILLARY ARTERY.—The most important anomaly of this vessel is its early division into two trunks, one of which may give off all or most of the branches, or may be a high origin of the radial, ulnar, or even the interosseous artery (Fig. 295). When one of the trunks gives off all or most of the branches it is nearly always surrounded by the brachial plexus of nerves and embraced

by the two heads of the median. The branches given off from this common stem may vary. I have seen it give origin to the acromial thoracic, long thoracic, anterior and posterior circumflex, subscapular, and one or both of the profunda arteries of the arm; the anterior and posterior scapular with the subscapular arteries not infrequently come from a common stem. This arrangement of the branches of the axillary occurs normally in many animals, e.g., the

lemur, tapir, peccary, dolphin, etc., and much resembles that which takes place in the lower extremity, viz.: the common femoral dividing into a superficial and a deep branch, the deep giving off all the branches, and the superficial going down the extremity branchless. According to Richard Quain, this variation occurred 28 times in 506 arms examined. I have met with it only 15 times in 500 arms in which the arrangement of the axillary was observed. Quain gives the proportion of cases in which one of the arteries of the forearm is derived from the axillary as 23 in 506; Gruber, 21 in 1,200. I have found this condition to exist 12 times in 500 arms examined.

The radial is the branch most frequently given off in these cases, next the ulnar, and very rarely the interosseous. I have only once seen the interosseous arise from the axillary.

An aberrant artery is occasionally found arising from the axillary; it generally courses down the arm alongside the brachial, which it joins near the elbow. Sometimes this aberrant vessel joins the radial, ulnar, or interosseous artery near the wrist. One remarkable case came under my observation some years ago in which this aberrant artery passed down the arm superficial to the fascia, in the forearm followed the course of the median nerve, communicated with the radial by several transverse branches, and finally ended by taking the place of the superficial volar, completing the superficial palmar arch (Fig. 296).

The most constant branch of the axillary is the long thoracic or external mammary; this, or a representative of it, is nearly always seen running along the lower border of the pectoralis minor muscle; it, however, not infrequently arises from the thoracic axis and occasionally from the subscapular. There may also be an accessory external mammary. The subscapular and circumflex branches frequently arise together. The dorsalis scapulae, instead of being derived from the subscapular, may arise directly from the axillary.

The posterior circumflex occasionally fails to enter the quadrilateral space (formed by the humerus, subscapularis muscle, long head of triceps, and teres major), but reaches the deltoid muscle by winding round the lower border of the tendons of the latissimus dorsi and teres major muscles. It not infrequently arises from the superior profunda, and is sometimes double. In rare cases the internal mammary, posterior scapular, or suprascapular may arise from the axillary.

BRACHIAL ARTERY.—The variations in the course, re-

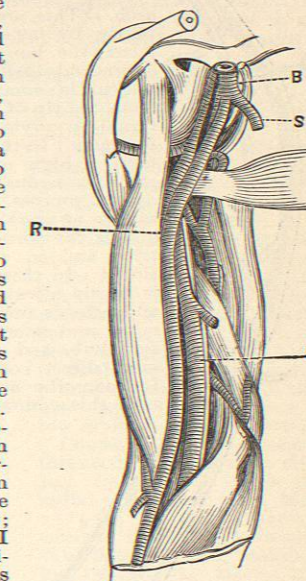


FIG. 295.—Origin of Radial (R) from the Axillary (B). (After Reeves.)

lations, and distribution of this artery are very numerous and of special surgical interest.

Course: The brachial artery sometimes, accompanied by the median nerve, courses down the arm to the internal condyle of the humerus, and thence regains its normal position at the bend of the elbow, by passing forward under a fibrous or bony arch. This arch is formed, usually, partly by bone and partly by ligament; the bony process is called the supracondyloid and the foramen, which is completed by a ligament from the tip of the process to the internal condyle, the supracondyloid foramen. In these cases it is usual to have a high origin of the pronator radii teres muscle from the supracondyloid process. This arrangement is said to be more common in dark races, and is the normal one in all the cat tribe and in monkeys, lemurs, and sloths. In these animals the foramen is nearly always completed by bone, and affords protection to the median nerve and artery during flexion of the fore-limb, and also affords them a more direct course to the fore-limb. In man the artery may occasionally take this course without there being present a supracondyloid process; there may be only a high origin of the teres muscle.

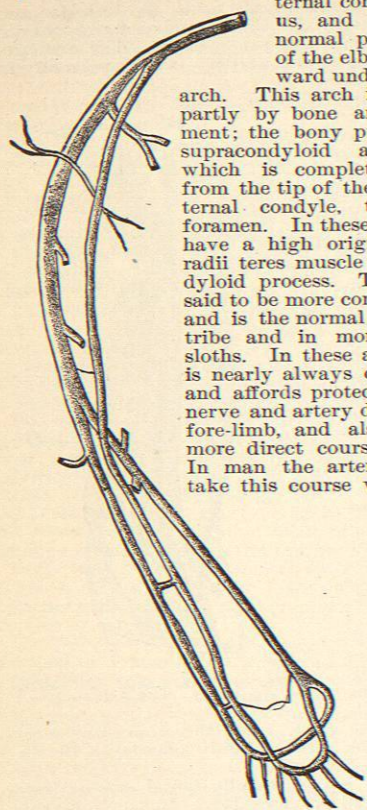


FIG. 296.—Example of an Aberrant Artery from Axillary, Going to Complete the Superficial Palmar Arch, Taking the Place in the Hand of the Superficial Volar.

low division (that is, below usual place) only once. Gruber, in 1,200 arms examined, found a high division in 82. In 500 arms examined by myself, I found a high division in only 27, and in one case the brachial divided below the pronator teres.

Adding to these the cases in which the division takes place in the axilla, in 481 arms examined by Quain two arteries existed in the arm in 94 cases, or 1 in about 5. My statistics are quite different from the above, and I cannot account for the great diversity. The same class of people were examined, and they were of the same race. In 500 arms I found that two arteries existed in only 43 cases. This is made up as follows: division of axillary, 12; division of brachial, 27; aberrant arteries, 4—total, 43, or 1 in 11.6 cases. W. Gruber, in 1,200 arms, found a high division in 103, or 1 in 11.6, the same proportion exactly as in my own cases.

The point of division is in most cases in the upper third of the arm. It is also seen in the middle and lower thirds, but much less frequently. The artery which is given off thus prematurely is generally (three cases out of four) the radial; this vessel is most frequently to the ulnar side, and subsequently crosses to the radial. Next in frequency comes the ulnar, which often, in these cases, passes superficially down the forearm and gives off no

branches, the interosseous coming from the radial (Fig. 298). In rare cases the interosseous is the branch having the high origin (Fig. 299), and still more rarely it is a vas aberrans.

Three branches have been seen in the arm, viz., the radial, the ulnar, and a vas aberrans.

The position of the two branches in the arm when a high division occurs is of surgical importance. They are usually in the ordinary position of the brachial trunk and lie close together, but the radial, as mentioned above, often arises from the inner side, and, after accompanying the large vessel for some distance, crosses over it at the bend of the elbow.

The ulnar artery, when having a high origin, may incline toward the internal condyle, this, however, occurs only when it nears the elbow. When there is a high division of the brachial the ulnar-interosseous branch may pass through the supracondyloid foramen mentioned above, and under a high origin of the pronator teres.

The aberrant arteries, which are given off occasionally, are long, slender arteries, which are derived from the brachial or axillary, and end by joining the radial most frequently and sometimes the ulnar and interosseous. They are loop lines, so to speak, and in cases of ligature of the brachial their occasional occurrence must be borne in mind by the surgeon (Fig. 300). The two arteries in the arm are in some instances connected together by anastomosing transverse branches. These branches may number two or three, or even four.

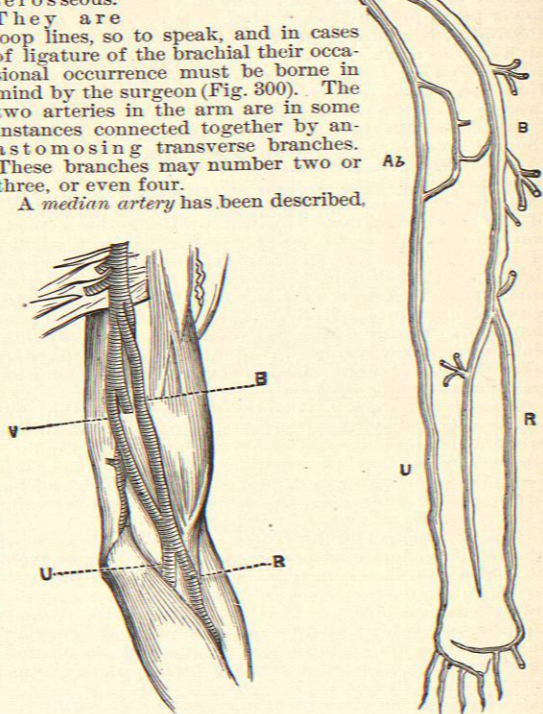


FIG. 297.—Brachial Dividing High up, Reuniting at Elbow, and Then Almost Immediately Dividing into the Radial and Ulnar. V, Vas aberrans. (After Reeves.)

FIG. 298.—High Origin of the Ulnar Artery (U). Ab, aberrant artery; R, radial, giving off the interosseous arteries.

as arising from the brachial and passing down over the muscles of the forearm and supplying the fingers to which is distributed the median nerve.

The brachial artery may in some part of its course (more frequently near the elbow) be covered by a muscular slip. The median nerve sometimes passes behind

instead of in front of the artery, especially in those cases in which the two heads embrace a common trunk from which the axillary branches are given off.

Superior Profunda.—This is occasionally derived from a trunk common to it and several of the axillary branches, as mentioned above. It not uncommonly arises with the circumflex, and occasionally gives off the inferior profunda.

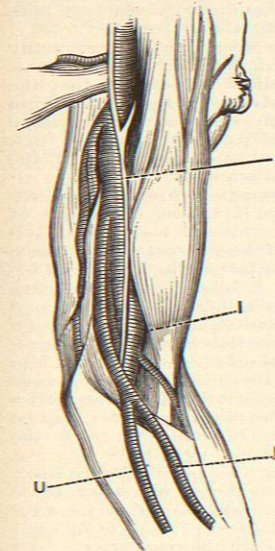


FIG. 299.—Anterior Interosseous (I) Given Off from the Brachial High up. (After Reeves.)



FIG. 300.—Aberrant Artery (3), separating from the brachial (1) at the middle of the arm, passing with the median nerve (d) through the internal intermuscular septum, and joining the regular ulnar (4) lower down. (Quain.)

Inferior Profunda.—This is often absent. It is frequently united with the superior profunda.

Anastomotica Magna.—Frequently of small size; its place is sometimes taken by the inferior profunda.

RADIAL ARTERY.—Origin: I have found that the radial has a high origin (Fig. 301) in 1 case in 21, but Quain reports the high origin to occur as often as 1 in 8. Gruber in 440 arms examined found the radial had a high origin in 26, or about 1 in 17 cases.

Course: The radial only very occasionally deviates from its usual course in the forearm. It has been found lying superficial to the fascia of the forearm, and the semilunar fascia of the biceps. It in rare cases courses down the forearm on the surface of the supinator longus instead of along its inner border. It not infrequently is superficial to the tendons of the extensor muscles of the thumb. It is occasionally joined by a vas aberrans. It may leave the front of the forearm near its middle, its place being taken by an enlarged superficial volar. This would cause a weak wrist pulse.

Size: It does not vary often in size. It is, however, sometimes much smaller than usual, its place being, to a considerable extent, taken by some other vessel, as the ulnar and anterior interosseous.

The radial has been described as absent by some anatomists. Quain never saw a case of absence of this artery, but such a case is described by Professor Otto, and I have seen one case.

Branches.—Radial recurrent: This vessel is sometimes of large size, or it may consist of several small branches. When the radial has a high origin the recurrent branch is given off from the ulnar-interosseous trunk.

Superficial volar: Very often of small size, so small that it terminates in the muscles of the thumb, and does not complete the superficial palmar arch. It is occasionally entirely absent. It may be of large size and furnish several digital branches (Fig. 302), and it may arise much higher than usual.

Once saw it arise as high as the middle of the forearm, and it was quite as large as the radial, from which it was derived; this is the normal arrangement in some monkeys. The first dorsal interosseous is, in some cases, of large size, and may supply several digits and end by completing the superficial arch.

The carpal and dorsal interosseous branches are often of very small size, their place being taken by the perforating arteries.

ULNAR ARTERY.—Origin: Quain found that this artery deviated from the usual origin in 1 case in 13, Gruber 1 in 29, myself 1 in 37.

Where the origin of the ulnar is unusual, it most commonly arises from the brachial in the arm, and less commonly from the axillary. In one case out of five hundred I found it coming off from the brachial below the pronator radii teres. In this case there was, of course, a low division of the brachial.

Course: In the forearm this artery is much more subject to variation than the radial. When it has a high origin it nearly always courses down the forearm superficial to the muscles, but beneath the fascia; but cases occasionally occur in which it is immediately beneath the skin and superficial to the fascia (Fig. 303). When the ulnar is superficial, it, as a rule, gives off no



FIG. 301.—Dissection of Right Arm. Showing an example of high separation of the radial artery (3) from the brachial (2); a large median artery (10) is seen in forearm. (From Quain's "Anatomy," after Tiedemann.)

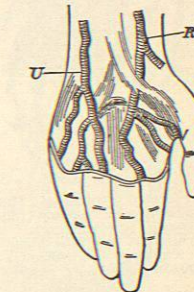


FIG. 302.—No Distinct Superficial Arch. Large superficial volar supplying thumb and index finger with half middle finger, and rest supplied by ulnar. (Reeves.)

branches in the forearm, these being given off from the radial-interosseous trunk—or the interosseous itself, which is invariably given off from the radial. The ulnar, in rare cases, has this superficial course when it arises in its usual situation.

Interosseous Artery.—This artery, in rare cases, arises from the axillary or brachial artery (Fig. 298), and gives off the recurrent radial and ulnar arteries. The anterior

and posterior interosseous may arise separately from the ulnar.

Median Artery (Fig. 304).—This branch, which accompanies the median nerve, is ordinarily of small size, but occasionally it is developed into quite an important vessel. It is usually derived from the anterior interosseous, but sometimes from the ulnar, and, in rare cases, it has been found coming from the axillary or the brachial. It accompanies the median nerve and reaches the hand beneath the annular ligament, but, according to Tiedemann, sometimes passes over the ligament. It may complete the palmar arch, or be distributed as digital branches to certain of the fingers, generally those supplied by the median nerve, which it accompanies. In

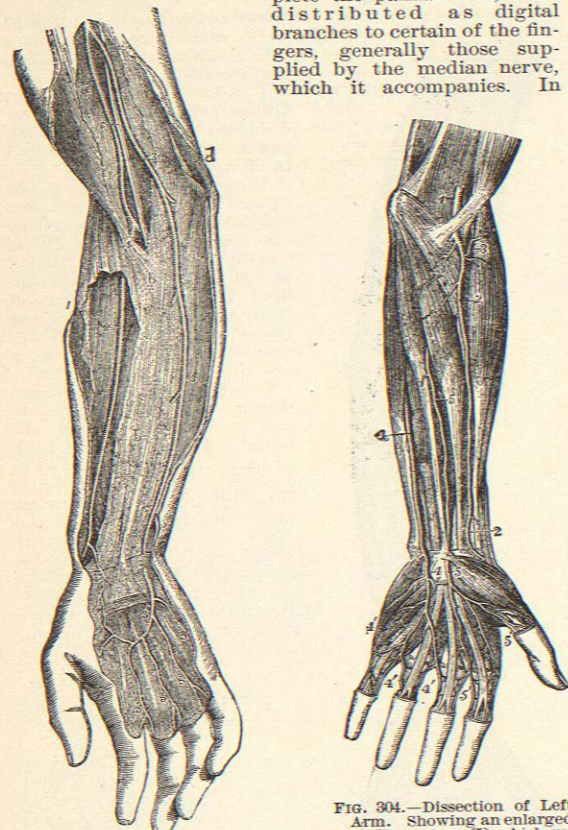


Fig. 303.—Abnormal Superficial Ulnar Artery (3, 3'), Rising Higher than Usual from the Brachial. (Quain's "Anatomy," after R. Quain.)

Fig. 304.—Dissection of Left Arm. Showing an enlarged median artery (5) which replaces the radial (2) and ulnar (3) arteries in the supply of the palmar digital arteries to half the fingers. (From Quain's "Anatomy," after Tiedemann.)

the cases which I have observed, the latter arrangement was the more frequent. I have occasionally seen this artery pierce the median nerve.

ARTERIES OF THE HAND.—The arteries of the hand are subject to many variations.

The superficial palmar arch is sometimes entirely wanting. It has been occasionally seen double. In the majority of cases the superficial volar branch does not complete the arch, but it is completed often by a large branch from the radial, which emerges between the thumb and forefinger, and I have sometimes seen it completed by a large branch from the radial, which, after coursing over the back of the hand, emerges on the palm between the index and middle fingers. The arch is also often completed by a transverse branch, which comes from the

muscles of the thumb and is derived from the princeps pollicis or radialis indicis branch of the radial (Fig. 305). A median artery may complete the arch (Fig. 306), or it may go to the digits on the radial side, and the ulnar to the digits on the ulnar side, and no regular arch be formed. The superficial volar sometimes has this arrangement (Fig. 306).

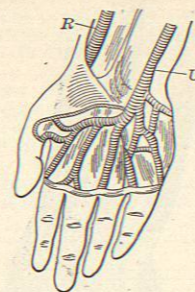


Fig. 305.—Superficial Arch Formed Entirely by the Ulnar and Joining the Princeps Pollicis Artery. (Reeves.)

The superficial arch may be very small and some of the digital branches be wanting, or it may be very large, supplying all the digital branches, both superficial and deep.

The deep arch is occasionally formed by the ulnar. It is sometimes so deficient that the digital arteries are derived from the superficial arch. A large metacarpal branch on the back of the hand may give off the digital branches.

ABDOMINAL AORTA.—According to R. Quain, in ten out of every thirteen bodies the division of the great artery took place within half an inch above or below the level of the iliac crest. Eckhard, Boinet, and Cruveilhier record cases of division as high up as the second lumbar. Two cases are on record (Quain, tenth ed.) of a large pulmonary branch which arose below the diaphragm, passed through the oesophageal opening, and divided into two branches which supplied the lungs near their bases.

COELIAC AXIS.—The branches of this artery may arise separately from the aorta. The phrenic arteries may be given off from it, and it may be connected with the superior mesenteric.

RENAL ARTERIES.—Now that the operation of nephrectomy has become so common, the variations of these arteries have been rendered important surgically. Professor Macalister has reported (*Journ. Anat. and Phys.*, vol. xvii.) most of the anomalies of the renal artery.

The renal artery may be replaced by two, three, four, and even six branches. The origin of these arteries is very various; they are usually derived from the aorta, and are separated, at their origin, by a larger or smaller interval; the lowest may arise quite near the bifurcation of the aorta, and the highest just below the coeliac axis. In some rare instances the renal artery has been described as arising from the common iliac, internal iliac, and middle sacral. The right and left renal arteries have been found coming from a common trunk; they may arise from the anterior or lateral part of the aorta. The suprarenal frequently gives off an upper renal, and it less frequently is derived from the upper lumbar, hepatic, and right colic. Frequently when the renal arteries come off from the aorta low down or the iliacs, the kidney on that side is misplaced; it is situated lower down than usual, opposite the bifurcation of the aorta and even between the two common iliacs. In such cases the hilum is usually placed on the anterior surface.

INFERIOR MESENTERIC.—It may be absent, its branches being given off from the superior mesenteric.

The branches of the renal artery, instead of entering the hilum, may penetrate the kidney at its upper or lower end. It is not uncommon to see the normal artery entering the hilum, and two or three supernumerary branches piercing the upper and lower end of the gland. In two subjects I found that the kidney was supplied by

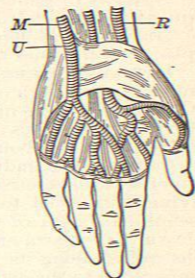


Fig. 306.—Large Median Artery (M), Taking the Place of the Radial in the Formation of the Superficial Arch and Giving Off Outer Digitals. (Reeves.)

two arteries arising from the aorta at some distance apart, one going to the extreme upper end, and the other to the extreme lower end of the kidney; no artery entered the hilum (Fig. 307). The vein and duct were normal. This variation I once met with while performing nephrectomy on the dead body. R. Quain met with a case of absence of the renal artery on one side. Multiple renal arteries occur normally in fishes, lizards, snakes, crocodiles, and birds, and in man are due to a persistent early fetal condition.

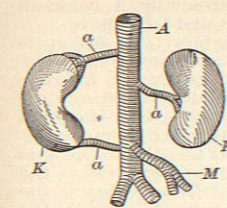


Fig. 307.—Abnormal Right Renal Arteries. An artery distributed to each extremity of the kidney, but none entering the hilum.

SPERMATIC ARTERY.—Sometimes double, not infrequently derived from the renal. Three spermatic arteries have been seen.

COMMON ILIAC ARTERIES.—The place of origin of these arteries depends on the place of division of the abdominal aorta. This may be as high as the upper border of the third, or as low as the lower border of the fifth lumbar vertebra. In three out of four cases the aorta divides opposite the lower border of the fourth lumbar.

The common iliac arteries vary considerably in length. I once saw them only 1.8 cm. (three-fourths inch) long in a negro, and, in another case, 2.5 cm. (one inch). In the large majority of cases, according to R. Quain, the length varies from 3.7 cm. (one inch and a half) to 7.5 cm. (three inches). The greatest length is about 10 cm. (four and a half inches).

The right and left common iliacs differ in length very often, the right, owing to the aorta dividing to the left side of the spinal column, being often the longer; but the left may be the longer, and in about one-third of the cases they are of equal length (R. Quain).

When the left is longer than or equal to the right, it is owing to the left artery descending to a lower level than the right. The artery has been seen dividing into internal and external iliacs as low down as the iliac fossa.

The common iliac on one side has been reported absent by Cruveilhier and Walsham. In this case the aorta divided into three branches, two on the right (external and internal iliac), as is seen in birds, and one on the left (common iliac). Surgically, these variations are of great interest.

INTERNAL ILIAC.—The place of division of this vessel varies considerably; it may divide as low as the margin of the sacro-sciatic foramen and as high as the upper margin of the sacrum. The point of division is of importance surgically; when the trunk is short it is more deeply placed in the back part of the pelvis, but when it is of some length, then a part of the artery is likely to lie above the pelvic cavity, and therefore would be much more easily reached by the surgeon (R. Quain). It has been found as short as 1.2 cm. (half an inch), and as long as 8.2 cm. (three and a half inches). The branches are given off from this artery very variously. In many cases there is no division into anterior and posterior trunks. The artery occasionally gives off one, and sometimes two branches before it divides. The variations of most of the branches of this artery, being of no surgical importance, will not be discussed here.

OBTURATOR.—According to R. Quain, the obturator artery arises from the epigastric in 1 case in 3.5. His conclusions are derived from observations in 361 cases. I have observed 500 cases (250 subjects), and have found

this abnormal arrangement much less frequently than Quain. I have found the obturator coming from the epigastric in only 1 case in 9 (55 in 500). Quain found the obturator derived from the external iliac in 6 cases out of 361. I found it only 3 times in 500 cases. Quain found the epigastric giving off the obturator 23 times on both sides. I found this arrangement 11 times.

When the obturator arises from the epigastric or external iliac, it reaches the thyroid foramen by arching either to the inner or to the outer side of the femoral ring. If it arches to the inner side of the femoral ring, along the edge of Gimbernat's ligament, then, in case of strangulated hernia requiring operation, it would be in great danger of being wounded (Fig. 308); in fact, this accident has happened more than once.

In only 9 out of the 58 cases in which the obturator proceeded from the epigastric and external iliac did I see the artery going to the inner side of the femoral ring. In the remaining 49 cases it either crossed it, in a few cases, or held a position well to the outer side in the majority

(Fig. 309), so that in only about 1 case in 50 is there danger of wounding the obturator in the operation for strangulated hernia. The explanation of the origin of the obturator from the epigastric is simple enough. Normally, we have the pubic branch of the obturator anastomosing with the pubic branch of the epigastric; these vessels become enlarged, and the proper obturator branch of the internal iliac either remains undeveloped or becomes obliterated.

In four cases I have seen the obturator, epigastric, and internal circumflex arise together from the external iliac, and once these same arteries were seen to arise by a common trunk from the common femoral 2 cm. below Poupart's ligament. In one case the epigastric and obturator arose together from the femoral, a little below Poupart's ligament. In some cases, in which the obturator arises from the epigastric, there is a small branch, representing the obturator, derived from the internal iliac.

Internal Pudic Artery.—This vessel is occasionally of small size, and fails to supply all the usual branches; in such an event these are given off from an accessory pudic. The branches furnished by the accessory artery are usually those branches which go to the cavernous body and dorsum of the penis, the pudic itself ending as the artery of the bulb. In a few instances the pudic ends as the superficial perineal, the other branches coming from the accessory vessel.

The accessory pudic is, as a rule, given off from the deep pudic within the pelvis; it then passes alongside the bladder and prostate, and, after piercing the triangular ligament, supplies the dorsum of the penis and the cavernous body, and, perhaps, the bulb. It may be given off from the obturator in the pelvis, or from the epigastric.

The pudic artery has been seen passing up to the perineum midway between the tuberosity of the ischium and the coccyx, and ending as the superficial perineal and artery of the bulb (Fig. 310).

Artery of the Bulb.—Is sometimes of large size, placed farther back than usual, and ascends obliquely to the

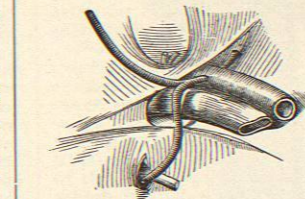


Fig. 308.—Obturator Given Off from the Internal Epigastric, and Passing to the Inside of the Crural Ring to Reach the Obturator Foramen. (After Gray.)

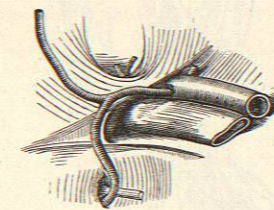


Fig. 309.—The Same, Passing to the Outside of the Ring. (After Gray.)

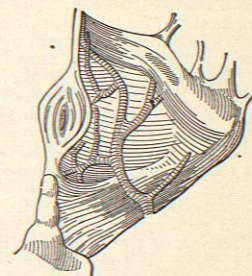


Fig. 310.—Abnormal Internal Pudic Artery, Which Has a Course Midway between the Ischial Tuberosity and the Coccyx. (After Henle.)