THE ANTERIOR INFERIOR CEREBELLAR ARTERY
ITS VARIATIONS, PONTINE DISTRIBUTION, AND SIGNIFICANCE
IN THE SURGERY OF CEREBELLO-PONTINE ANGLE TUMOURS*

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The anterior inferior cerebellar artery arises constantly from the basilar artery on each side at the junction of its lowest and middle thirds and passes laterally and downwards to cross the cerebello-pontine angle and the eighth cranial nerve. At this point the internal auditory artery is usually given off, passing almost immediately into the internal auditory meatus. Either immediately before or immediately after crossing the eighth nerve, the main artery divides into two. (1) One branch passes laterally and downwards on the medial and anterior border of the cerebellar hemisphere. After about a centimetre or so of tortuous course it sends a constant branch of very variable size posteriorly along the medial surface of the hemisphere to anastomose with a cerebellar branch of the posterior inferior cerebellar artery. Reference will be made to this anastomosis later. (2) The other branch of the anterior inferior cerebellar artery passes directly laterally and curls round the upper edge of the flocculus, where it lies on the surface of the middle cerebellar peduncle, and it then passes on to the cerebellar hemisphere proper and anastomoses with all three main cerebellar arteries. This latter branch of the main artery which passes immediately laterally gives off small arteries which supply the middle cerebellar peduncle and adjoining part of the pons. The main artery itself also sends small vessels into the pons, supplying chiefly its lateral part as far superiorly as the junction of the upper and middle thirds and extending down to supply the lateral third of the upper part of the medulla oblongata.

Plate IIa is taken from a specimen of the basilar arterial system which has been injected post-mortem with red latex. The anterior inferior cerebellar artery on each side will be seen as described, and most significant is that part of the artery which crosses the cerebello-pontine angle, for here it lies immediately anterior to the eighth nerve and in this portion does not give off any branches. There are therefore two parts of the artery which are responsible for pontine blood supply—the main part of the vessel proximally and the lateral branch which winds round the flocculus distally. In the past few years, Dr. J. G. Greenfield has pointed out that those cases of acoustic neurofibromata which come to necropsy after operation frequently have had occlusion of the anterior inferior cerebellar artery on the tumour side by a clip or a thrombus. He also noted that this was associated with infarction of the pons on that side. In the past it has been thought that such a lesion was the result of laceration of the pons by the surgeon—in spite of his usual denial; or it has been called malacia pontis.

It was therefore with this problem in mind that a series of normal hind-brains was injected with dyed gelatin solutions in various ways designed to illustrate (1) exactly which area was supplied by the anterior vessel in the pons; (2) which areas could be apportioned to the proximal and distal parts of that vessel as far as the pons itself was concerned, and (3) which anastomoses from the superior and the posterior inferior cerebellar arteries could take over the anterior inferior cerebellar arterial supply. The second question was considered the most important, because only by answering it would it be possible to ascertain the effect on life of placing a clip on the artery as it crossed the eighth nerve, that is, at the point where in effect the acoustic nerve tumour would tend to displace the vessel most away from the angle.

Variations in the Anterior Inferior Cerebellar Artery

It has repeatedly been observed that there is a considerable variation in the size and therefore in the importance of the anterior inferior cerebellar artery. Fig. 1 shows the variations and findings in a series of consecutive necropsies, and it will be seen that not only may each case be different but there is usually a difference between either

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Fig. 1.—Variations of the branches of the basilar artery.

(1) The "classical" and a fairly common arrangement.

(2) The anterior varying inversely with the posterior inferior artery (common).

(3) Both posterior vessels small, their areas of supply being chiefly fed by the anterior vessels (uncommon).

(4) Both anterior vessels small, their areas of supply being chiefly from the posterior vessels (uncommon).

(5) Anomalous importance of vessel from the junction of vertebral arteries.

(6) Rare—posterior vessel being continuation of vertebral artery.

(7) Pathological—long-standing thrombosis of lower third of basilar, vertebral, and posterior arteries. Both area of supply of posterior vessels supplied by right anterior inferior artery. (Patient died from other causes.)

Pc.—posterior cerebral artery; Sc.—superior cerebellar artery; A.I.C.—anterior inferior cerebellar artery; P.I.C.—posterior inferior cerebellar artery; B.—basilar artery; V.—vertebral artery; Sp.—spinal artery; A.—internal auditory artery; VIII.—acoustic nerve; An.—anastomotic vessel; Anom.—anomalous vessel.
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PLATE I a, b, c.—Pontine distribution of anterior inferior cerebellar artery. Blue represents distal distribution of anterior cerebellar artery (of its lateral division); red, the proximal distribution (of the main stem of the artery). a and c represent the superior aspects of two sections of brain stem, b, the inferior aspect of another section, all of the same specimen.

PLATE I d.—Acoustic tumour in situ.
PLATE II a.—The basilar arterial system.

PLATE II b.—Case 1. Infarction of pons. Section through lower third of pons.
PLATE III.—Case 2. Sections of mid-brain, pons, and medulla (stained by Loyez method).
Plate IV.—Case 3. Sections of mid-brain, pons, and medulla (stained by Loyez method).
PLATE V a, b.—Case 4.
Sections of mid-brain and pons.

PLATE V c, d, e.—Case 5.
Sections of mid-brain, pons, and medulla (stained by Loyez method).
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PLATE VI a.—Case 6. Section through mid third of pons (stained by Pickworth method to show vascular damage in the lateral tegmental area). Upper right corner shows fourth ventricle.

PLATE VI b, c, d, e.—Case 6. Sections of pons (stained by Loez method).
PLATE VII a, b, c. — Case 7. Sections through mid-brain, pons, and medulla.

PLATE VII d, e, f. — Section of brain-stem of same case (see Plate I d) showing distribution of anterior inferior cerebellar artery after the latter's injection with blue dye.
side in the individual case. It was also found that usually this variation in size was in inverse proportion to the size of the posterior inferior artery and sometimes to that of the vertebral artery. An anastomotic vessel between the anterior inferior and the posterior inferior vessels was found constantly on the medial aspect of the cerebellum and was large where there was any marked degree of difference between these arteries on each side; its possible importance in surgery will be mentioned later. Here too was a factor that had to be eliminated in the injection of the anterior inferior artery when we attempted to outline its pontine distribution. Hemostatic clips were placed on the cerebellar cortical anastomosing vessels, and the main proximal stem of the artery and the lateral branch were injected, after perfusing the whole basilar system with normal saline to which 1 per cent. sodium nitrate had been added. Various dyes were used to portray the areas of supply of (1) the proximal part of the artery; (2) the lateral part or branch passing round the flocculus, and (3) the remainder of the basilar system. In later investigations the areas of the posterior inferior and the superior cerebellar arteries were also. injected. Plate I illustrates the area of supply of the anterior inferior cerebellar artery.

**Areas of Supply**

It will be seen (Plate I a, b, c) that the anterior inferior artery has two separate areas of supply—the proximal stem supplies the lateral area of the pons; and the lateral branch, after crossing the eighth nerve, supplies the middle cerebellar peduncle and an area of variable size in the lateral segmental region of the lower two-thirds of the pons. Plate VII d, e, f represents a constant finding when the two parts of this artery are injected. We consider that the tegmentum transmits autonomic impulses which are important for cardiovascular control. This conclusion is reached from physiological evidence to be given later and from a study of other pontine pathways which can be allocated to other functions already established. A clip on the artery as it crosses the eighth cranial nerve will immediately deprive the lateral part of the tegmentum of blood supply if no anastomosis exists via the posterior inferior or the superior cerebellar arteries or the usually very small but occasionally larger (Fig. 1, No. 5) branch which may come off the basilar near its origin from the junction of the vertebrals. Further, such a clip may well initiate thrombosis in the main proximal stem of the artery and so impair the whole of the artery's pontine distribution. Moreover, we have found that, while there are numerous surface anastomoses between the cerebellar arteries over the cerebellar cortex, injection of the anterior inferior cerebellar artery from the basilar artery always stains the artery's distribution selectively. This is comparable with Bolton's (1939) work on the anterior spinal artery. She found that dye injected into a segmental spinal artery passed chiefly in a caudal direction along the anterior spinal artery, and, although a little passed rostrally by anastomosis, it did not penetrate into the capillary distribution of arteries entering at a more rostral level.

Again, it is widely held that when a main artery is injured all its tributaries and the collateral anastomoses go into spasm for a variable time. Finally, at most operations on acoustic tumours where removal is attempted, retraction of the cerebellum is invariably sufficient to produce a softening of at least part of the cortex. A certain number of anastomoses will be occluded in this manner.

**Historical**

Wallenburg (1901) appears to have been the first to record a lesion of the anterior inferior cerebellar artery. A clinical diagnosis of hemorrhage from the *ramus centralis arteriae radicularis nervi faciae dextri*, a branch of the anterior inferior cerebellar artery, was made. The patient lived seven years and at necropsy the right side of the pons appeared smaller than the left. Section revealed a hemorrhagic cyst in the tegmentum of the pons extending to the floor of the fourth ventricle. Caudally, it reached the anterior end of the olive (inferior), and rostrally the lingula of the cerebellum. It destroyed the motor nucleus, as well as part of the sensory nucleus and some of the sensory roots of the right fifth nerve. The nuclei of the sixth and seventh nerves on the right side were destroyed, as were the nuclei of Deiters and Deiters, parts of the restiform body and posterior longitudinal bundle, the dorsal fibres of the cochlear nucleus as they passed to the trapezoid body, and part of the spino-thalamic and spinal-tectal tracts on the same side.

Since that time there have been few observations on the place the artery may hold in physiology or medicine.

**Case Records**

Here it is important to consider the clinical condition of those patients who have come to necropsy and in whom there has been clear evidence of this vessel's occlusion following operation for the removal of an acoustic neurofibroma. Each case will be described in terms of operation procedure, postoperative course, and post-mortem findings.
Case 1.—The first case of which we have any record relating to the infarction of thepons was in 1938. A woman (H. W.), aged 45 years, was admitted under the care of Dr. Denny-brown with a six weeks history of dizzy attacks and ataxia followed by vomiting attacks. On Nov. 8 she underwent the operation of partial removal of an acoustic neurofibroma; after this she was reported as being in poor condition from loss of blood. On the next day she was conscious but had an abnormally rapid pulse rate. Two days after operation progress was reported as good although she had retention of urine. On the fourth day, however, she was comatose with a temperature of 104°F., pulse rate of 150 per minute, and normal respirations. She died on the fifth postoperative day. The post-mortem report stated that there was no excessive hemorrhage but there was some laceration of the side of thepons in the region of the middle cerebellar peduncle on the side from which an acoustic neurofibroma had been partly removed (Plate IIb).

COMMENT.—The specimen shows what has been variously described as a laceration of thepons, presumably by the surgeon or as malacia pontis. It exactly resembles the appearance of infarction resulting from occlusion of the anterior inferior cerebellar artery, and lies in the area of supply of that artery.

Case 2.—The second case (D. C.) was in 1945 under the care of Mr. Northfield who has kindly permitted me to include this case. She had had a sub-occipital decompression in April, 1944, following a three-year history starting with weakness of the right hand. In July, 1945, a partial removal, and in October, 1945, a complete removal of the acoustic tumour was accomplished. At this operation a careful although tedious mobilization was achieved; at the lower pole of the tumour where scar tissue attached it to the lateral cerebellar lobe a relatively small vessel suddenly bled and was clipped. The final removal was straightforward and the surface of thepons was at the end of the operation completely free from bruising. That evening the ward sister reported that breathing was deep, the head inclined back to the left, the mouth twitching and drawn to the right, the eyes turned to the left, the jaw clenched, and that there were generalized shaking movements, with the arms spastic, loss of consciousness, deep stertorous breathing, excessive saliva, pulse bounding and strong, and cyanosis. The blood pressure was 150/95 mm. Hg, the pulse 140, and respirations 28 per minute. The temperature was 102-4°F. One hour later the pulse was 120 and respirations 28 per minute and of bubbly character, the temperature being 102-4°F. She was speaking, however, and two hours after that could answer questions although she was complaining of headache. The next day lumbar puncture pressure was 250 mm. of brownish c. s. f., there being no block. Two days after operation the temperature was 104°F., pulse 168, and respiration rate 40 per minute; she answered questions and both plantars were flexor. That evening the pulse rate rose rapidly to 176, her respiration became very bubbly, and she was cyanosed. Half an hour later the pulse rate was 200 and the respirations 32 per minute. Two hours later the pulse rate was uncountable, respirations 32 per minute, and temperature 103°F. She still continued to respond to questions. At 9 p.m. that evening, about fifty-two hours after operation, a right ventricular tap revealed a pressure of 300 mm. of crystal-clear cerebrospinal fluid. The following morning at 2.55 a.m., the pulse rate having been uncountable for the previous nine hours, the respirations became irregular and finally failed at 4.25 a.m., two and a half days after operation.

Necropsy Report (Dr. J. G. Greenfield).—A silver clip was present in the anterior inferior cerebellar artery about an inch from the basalir. The right lobe of the cerebellum was destroyed except for a thin layer of the inner part of the upper hemisphere and for a bit of the lower posterior part of the hemisphere including the uvula and tonsils. The fourth ventricle was opened and balloonsed towards the lateral angle. There was an extensive area of infarction involving the middle peduncle and the lateral half of thepons; it extended inwards to a point 3 mm. to the right of the median raphe and 10 mm. to the right of the median raphe ventrally in the mid-pons plane. At the lower end of thepons this area extended into the uppermost medulla as low as a plane 3 mm. above the olive. At the lower limit of thepons the infarction reached the middle line dorsally and extended forwards 3 mm. along the mid-line and extended forwards laterally at an angle 30° from the mid-line. It did not appear to extend more than 2 or 3 mm. into the medulla. At the juncture of thepons and mid-brain there was hemorrhage into the mid-lateral zone in the right side but not extending as high as the lower limit of the red nucleus in the territory of the right anterior inferior cerebellar artery. There was slight dilatation of the third ventricle and moderate dilatation of the lateral ventricle.

Dr. J. G. Greenfield reported that post mortem the infarcted area on the side of thepons showed on section as a partly hemorrhagic and a partly necrotic area. In the mid-brain it involved the outer part of the crus chiefly in a hemorrhagic manner with a zone of early necrosis between the hemorrhage and the fillet tract. There was also a small oval area of necrosis midway between the fillet and the posterior longitudinal bundle with a small hemorrhage near its dorsal surface, and small hemorrhages were seen round the iter of Sylvius on the right side. At the junction of thepons and mid-brain the dorsal and external part of the crus was involved in hemorrhagic necrosis. The fillet here was free from degeneration except for some vacuolar degeneration at its outer part but there was a zone of early necrosis dorsal to its outer end, under the wall of which small hemorrhages were present. In the mid-pons just above the exit of the fifth cranial nerve there was much more degeneration than hemorrhage. The degeneration involved most of the bundles of the crus except those situated most antero-medially and those lying under the emerging fifth nerve. Between this and the fillet there was a fairly large area of degeneration near the surface with hemorrhages in a fairly wide area under the floor of the upper end of the fourth ventricle on the right side. Just below the exit
of the fifth nerve there was a zone of degeneration extending about a third of the distance in from the surface of the median raphe with hemorrhages into the middle cerebellar peduncle and under the floor of the fourth ventricle. No hemorrhage or degeneration was seen in the medulla on this side (Plate III).

COMMENT.—In this case the surgeon stated definitely that following the final removal of the tumor the side of the pons was perfectly clean with no bruising or damage whatever. At necropsy, the infarct, which must have developed subsequent to operation, was in the territory supplied by the anterior inferior cerebellar artery, and the occluded artery appeared to be that which caused bleeding in the final stages of operation.

Case 3.—The third case (G. B., aged 47 years) was admitted under the care of Dr. E. A. Carmichael in February, 1946, because of deafness in her right ear for the previous three years. A piecemeal removal of a right acoustic neurofibroma was accomplished. Considerable arterial hemorrhage was encountered in the later stages and was eventually controlled with silver clips and fibrin foam. The whole operation took three hours. One hour and ten minutes after the start the blood pressure rose from the normal 120/90 to 160/110 mm. Hg, with a fall of pulse rate from 120 to 110 per minute (Fig. 2). This slowly returned to normal over the next half hour, to remain so for a further twenty minutes. In the remaining hour it fell gradually to 110/85 mm. Hg with a pulse rate of 140. That evening the patient was very shocked, but regained a state in which she was able to respond by blinking to spoken words. Her state of consciousness did not alter from then to near the end. Blood pressure fell to 80/60 and then was unrecordable. That night a blood transfusion restored the circulatory state temporarily. She died the following morning seventeen hours after operation. At necropsy, there was a small blood clot over the bed of the tumour on the right side of the pons. “A silver clip was found on a vessel 1½” from the midline which was thrombosed back to the basilar artery and passed from the lateral surface of the pons to the infero-lateral surface of the cerebellum on the right side (anterior inferior cerebellar artery).” The right side of the pons was considerably bruised, and the middle cerebellar peduncle was very flattened by the tumour. On histological examination it was found that considerable haemorrhagic infarction of the pons on the right side merged with an area of pallor of myelin staining which reached nearly to the mid-line at the mid-level of the pons, but nowhere involved the most ventral half of this part (Plate IV).

Case 4.—The fourth case (A. E., aged 57 years) was admitted under the care of Dr. F. M. R. Walshe in October, 1946, with pain behind his left ear and slight deafness on the left side which began four years previously. A small acoustic neurofibroma of the size of a pigeon’s egg was removed. The operation note reports that an artery running over the surface of the tumour was clipped and divided. The operation took two hours, and fifty minutes after the start of operation the blood pressure rose to 150/80 mm. Hg and the pulse rate fell to 72 per minute with normal respirations for ten minutes (Fig. 3). That evening the patient failed to recover full consciousness though he reacted to stimuli. No improvement occurred with ventricular and lumbar punctures, which revealed slightly blood-stained fluid. The blood pressure remained normal but the pulse was reported as full and bounding; respirations were normal. Early the following morning, however, the
condition deteriorated, the temperature rose to 102°F. the pulse was feeble—150 per minute; and the respirations stertorous, 30 per minute. He died twenty-three hours after operation.

NECROPSY REPORT.—The cavity from which the tumour had been removed was filled with half an ounce of blood clot. The anterior inferior cerebellar artery was double on this side though single on the other. The upper left artery had a free end in the region of the internal auditory meatus. Section of the pons showed almost complete destruction of the tegmentum, passing inwards as far as the mid-line against the ependymal lining and extending backwards along a line running from the central fovea of the ventricle to the outermost part of the ventral surface (Plate Va, b).

Case 5.—The fifth case (A.B., aged 58 years) was admitted under the care of Sir Charles Symonds because she had had paresthesia over the left side of her face for four years.

In October, 1947, an attempt was made to remove a left acoustic neurofibroma the size of a walnut. A large artery crossing its posterior surface was double-clipped and divided, after which the capsule was coagulated and the contents evacuated with spoon and suction. The lateral portion was removed by morcellment until the uppermost nodule of growth passing through the tentorium was exposed. This was grasped with rongeurs and was delivered downwards into the wound when a sudden spurt of air followed by cerebrospinal fluid—at first clear and later blood-stained—was noticed through the indwelling lateral ventricular cannula. This spurt of fluid ceased two or three seconds after becoming blood-stained, the whole of this process lasting no more than ten seconds after the first change in the patient's condition was noticed. "Almost immediately after this first change in condition was noticed the tension of the contents of the posterior fossa became raised and the cerebellum started to herniate. The retractor had to be removed, and immediately further cerebellar herniation took place and in the space of a minute it was quite obvious that a severe hemorrhage had taken place in the supratentorial chamber . . ." The patient's general condition had immediately deteriorated, and by the time the rapid closure of the wound had been completed the respirations were very slow and shallow, the pulse very thin and rapid, and the blood pressure unrecordable. Soon, however, her irregular respirations rose to 22 per minute with occasional deep sighs. The pulse was 120 per minute and the blood pressure rose to 100/60 mm. Hg. She remained deeply unconscious and did not respond to stimuli. The left pupil had a fair reaction to light but the right had none. The right was slightly larger than the left. She remained in this condition for a further nine hours, during which time the blood pressure slowly fell. The right lateral ventricle was tapped and clear cerebrospinal fluid under increased pressure was found. Following this, the blood pressure was said to have improved. However, her temperature rose and respirations became stertorous. She remained deeply un-conscious with increasing pulmonary signs, and died twenty hours after operation.

At post-mortem examination there was no excessive bleeding anywhere and the anterior inferior cerebellar artery was found clipped and divided but not thornbosed. A small nodule of tumour one inch long and ⅓ inch wide lay in the cerebello-pontine angle adherent to the brain and internal auditory meatus. There was hemorrhagic softening of the lower pons and upper medulla on the left side. No blood clot was found in the lateral ventricles, only blood-stained fluid.

Microscopically, sections of the lower two-thirds of the pons showed swelling and punctate hemorrhages in the lateral area including the tegmentum; this area showed as a region of pallor of myelin staining and a relative increase of interstitial spaces (Plate Vc, d, e).

Case 6.—The sixth case (B.M., aged 56 years) was admitted under the care of Dr. D. Brinton in March, 1948, because she had had attacks of vertigo for the past year. At operation an acoustic neurofibroma was completely removed from the left cerebello-pontine angle; during this procedure two arteries were exposed, clipped, and divided. At this stage, forty minutes after the first incision, the blood pressure rose sharply to 120/78 mm. Hg, having been falling slowly from 110/72 to 94/60-i, the pulse rate falling to 78. Twenty minutes later the blood pressure was 98/70 mm. Hg and at the end of the operation thirty minutes later it was 95/65. Four hours later she was conscious and rational but restless and picking at the bedclothes: five hours after operation the blood pressure rose to 150/100 mm. Hg and remained at about this level for five hours. Her temperature was 102°F. Later that day she became confused and drowsy. Three days later she was still...
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stuporose; operation wound was re-opened but no haemorrhage was found. She died on the following day (Fig. 4).

At post-mortem examination the left side of the pons in the region of the middle cerebellar peduncle was found to be swollen with a rather local protrusion, which was soft on section. A silver clip lay on the left anterior inferior cerebellar artery and a clot was attached to the vessel just short of the clip. On section of the lower two-thirds of the pons a haemorrhagic infarct in the distribution of the anterior inferior cerebellar artery was seen (Plate VI).

Case 7.—The seventh case (J.W., aged 62 years) was admitted under the care of Sir Charles Symonds in February, 1948, because she had had attacks of vertigo and ataxia for seven months previously. A left acoustic neurofibroma was completely removed. Blood pressure remained normal throughout operation and for seven hours later. It then rose to 160/100 mm. Hg and remained at this level for at least twelve hours. On the following day her condition was fairly good although she was incontinent of urine and feces (Fig. 5). On the second postoperative day the left cornea was observed to be ulcerated. On the third day she was drowsy and slightly confused, having increased tone in all four limbs. She also had a hoarse, irritating cough. On the sixth day she was drowsy but rousable. By evening, however, she was reported to be unconscious. The next day, seven days after operation, she died.

NECROPSY REPORT.—The right side of the pons was bruised and the right anterior inferior cerebellar artery was thrombosed where it ran outward to the internal auditory meatus. There was slight hydrocephalus. There was an area of pallor of myelin staining in the region of the junction between the lateral part of the pons and the middle cerebellar peduncle, and the lateral tegmental area was affected. Throughout this area there were microscopically punctate or ring hemorrhages and an apparent increase of interstitial spaces (Plate VIIa, b, c).

COMMENT.—This is the only case without operative occlusion of the vessel; thrombosis obviously took place later. This time the operation chart did not reveal any autonomic change although in the subsequent twenty-four hours the pulse pressure did alter in a manner similar to that seen in the other cases.

Discussion of Cases

The above series of seven cases consists of one from Chase Farm Hospital and six from the records of the National Hospital, London. These six occurred between 1938 and 1948 and all died following the complete or nearly complete removal of acoustic nerve tumours. During the same period there were eight other deaths from acoustic nerve tumours at the National Hospital. In one case no operation was performed, two underwent suboccipital decompression only, and five had both partial removals and suboccipital decompression. None of these cases had pontine infarction as described above.

The operation and postoperative records are given in the cases described because it appears that clipping or injuring the artery may be associated with autonomic disturbances. The blood pressure rose at or near the time when the artery was occluded, but soon subsided and in most cases the immediate postoperative state seemed fairly satisfactory. However, the pressures in the lumbar theca and lateral ventricles, when taken, remained high; consciousness was disturbed and there were many signs of generalized increase of intracranial pressure. The final deterioration resembled very closely that seen in patients dying of supratentorial tumours.

Correlation of Data

It will be seen that the area of infarction of the pons in these seven cases coincides almost exactly with that area which accepts the dye when it is injected into the anterior inferior cerebellar artery. The area we consider to be of primary importance, as far as the patient's life is concerned, is the tegmental area. This point will be elaborated later.

The lateral branch of the artery which winds around the flocculus sends back branches to this area which would therefore be involved if the clip were placed on the artery as it crossed the eighth nerve. Further, the possibility of retrograde thrombosis provides an explanation for an ischaemia of the tegmental area, even if the latter were supplied
by the main stem of the anterior cerebellar artery. There appears to be little or no intrapontine anastomoses between arteries penetrating the pons or the middle cerebellar peduncle. The anastomotic supply via the posterior inferior cerebellar artery may be lost if this artery is relatively small on one side. The previously stated findings that anastomoses do not permit ready overflow from one arterial distribution to another and that spasm tends to occur in the branches of the injured artery, are also factors which may impair the recovery of circulation after occlusion of the vessel.

The study of autonomic disturbances from brain-stem injury has interested many physiologists and clinicians, and it is the effects of such injury which still prevents success in the treatment of conditions raising intracranial pressure.

It is interesting here to note that Le Beau and Bonvallet (1938) obtained a state of cerebral swelling in the supratentorial cerebral tissues, associated with a rise in blood pressure, following sections of the brain stem from the medulla oblongata up to the thalamus. They submit that the rate at which "cerebral edema" took place was related to the rise in blood pressure. A recent publication by Le Beau (1948) deals with this subject further. Kabat and others (1935) have shown that lesions in the region of the central tegmental tract, whether in upper pons or mid-brain, give rise to alterations in blood pressure in animals. A lateral tegmental lesion in the middle third of the pons in the cat also produces a similar rise of blood pressure (personal observation); this area coincides with that of the blood supply from the anterior inferior cerebellar artery. A further contribution on this subject is being prepared.

There are many implications arising from this work, and it is suggested that the rise in blood pressure which takes place during the course of the operation on an acoustic tumour at about the time when the anterior inferior cerebellar artery is occluded is caused by an ischaemia of the lateral tegmental area in the region of the pons supplied by that artery. What precisely happens to the cerebral and pulmonary circulations when the lateral tegmental areas are injured is at present a matter for further detailed investigation. The autonomic pathways in mid-brain and pons convey impulses for vasomotor and respiratory regulation, disturbance of which somehow sets up an irreversible process whereby the brain swells and the lungs become edematous.

Some findings which surgeons have reported are relevant here. First, as the surgeon approaches the pons, usually during the latter part of the removal of the tumour, the blood pressure is often noted as rising temporarily to 160/100 mm. Hg with a fall in pulse rate. This is sometimes ascribed to the removal of that last part of the tumour in the tentorial hiatus. I submit that it may be due to a spasm of the anterior inferior or superior cerebellar arteries impairing the blood supply to the lateral tegmental areas. This vasomotor change does not usually persist, and Beattie and others (1938) showed experimentally that after permanent unilateral lesions in the pons, mid-brain, or lateral hypothalamic area, the blood pressure tends to come down again to normal after an interval.

Secondly, the cerebellum is seen to bulge suddenly down into the wound and the intraventricular pressure to rise acutely as shown by the indwelling cannula in the lateral ventricle. Such an event is often attributed to the anasthetic; but another explanation may well be that the blood pressure, and the supra-tentorial pressure, rises as the lateral tegmental area is deprived of blood supply by the occlusion of the anterior cerebellar artery. Thus acute cerebral compression results, and the vicious circle of supra-tentorial compression occurs.

Thirdly, in two other cases following this type of operation complete anaesthesia of the ipsilateral side of the face and dissociated sensory loss of the opposite side of the body have been observed. This is probably due to infarction affecting the lateral pontine area in the region of the entering fifth nerve and its principal sensory nuclei and the spino-thalamic tract.

In conclusion, the chief implication of this work is that there is a grave danger to the patient if the anterior inferior cerebellar artery is occluded during the operation on an acoustic tumour. This danger is in damage to the autonomic pathways from infarction of the tegmentum of the pons. It must be conceded that there are many cases of recovery in which the anterior inferior cerebellar artery has been intentionally occluded at operation. However, if at operation the posterior inferior cerebellar artery were found to be unusually small it would be reasonable to infer that the anterior inferior cerebellar artery is large and that there is likely to be only a poor collateral circulation via the posterior vessel: in which case its operative occlusion might be dangerous.

Summary

1. The course, distribution, and anastomotic relations of the anterior inferior cerebellar artery are described.

2. Seven cases of acoustic neuroma are described in which an infarction of the lateral tegmental region of the pons, in the area corresponding to
the distribution of this artery, was found at necropsy, soon after operation. In all these cases there was occlusion of the vessel in the neighbourhood of the internal auditory meatus, either due to a clip placed on the vessel at operation or to post-operative thrombosis of the artery.

3. These cases suggest that occlusion of the anterior inferior cerebellar artery is an important cause of death after operation, especially when this artery is larger than usual. The recognition of an unusually small posterior inferior cerebellar artery may warn the surgeon that the anterior inferior artery is dangerously large.

4. An attempt is made to correlate certain clinical observations made on these cases, especially the rise of blood pressure following interference with the anterior inferior cerebellar artery, with the results of experimental lesions in the lateral tegmental region of the pons.

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REFERENCES
———— (1938). Ibid., 129, 833.
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