J Clin Pathol 1985;38:1400–1402

Technical method

Technique for removal of the vertebral arteries

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Examination of vertebral arteries is often neglected in most hospital and coroner's necropsies. This is undoubtedly a reflection of the relative inaccessibility of these vessels, but this neglect belies their pathological importance. Although there have been several pathological studies of the vertebral arteries, none of these studies described a method for removing the arteries that would be suitable for routine practice. Hutchinson and Yates investigated atheroma of the cervical portion of the vertebral arteries and recommended complete removal of the spine from the atlas to the seventh cervical vertebra and subsequent decalcification.[1] Vanezis, who investigated vertebral artery trauma, suggested removal of the neck, together with a portion of the base of the skull, including the foramen magnum and decalcification for six to eight weeks.[2] Although these methods are suitable for research purposes, they require a relatively lengthy period of decalcification before examination and are clearly too time consuming for everyday use. Gresham and Turner recommended opening the vertebroarterial canal with sharp pointed snippers, but gave no details of the technique to be used, nor did they specify the size of the snippers.[3] We have used sharp pointed clippers in various mortuaries and have found that they were invariably too large and unwieldy for the task in hand.

To discover an efficient method for removing intact vertebral arteries twenty five pairs of vertebral arteries were removed from the bodies of unselected hospital and coroner's necropsies by various methods.

Materials and methods

Our method required the use of three relatively inexpensive but essential instruments not routinely used in necropsy work: a Swann Morton number 5 scalpel

Accepted for publication 13 August 1985

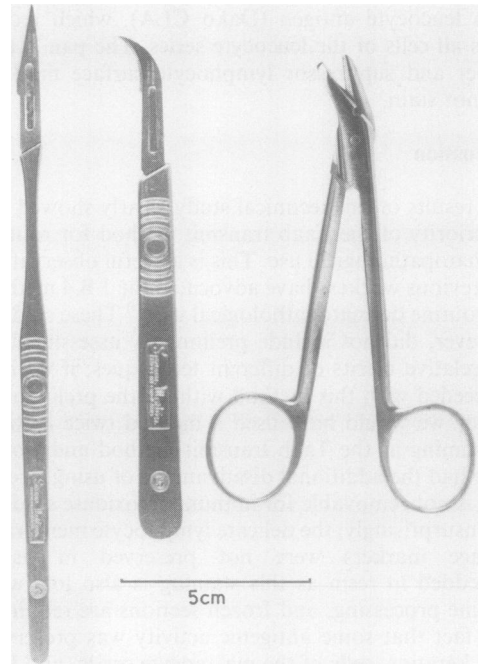

Fig. 1 *Three instruments used for dissection: a Swann Morton number 5 scalpel handle with number 11 blade; Swann Morton number 3 scalpel handle with number 12 (curved) blade; pair of curved heavy pattern Universal wire cutting scissors.*

Fig. 2 *Path of right vertebral artery is shown in upper part of neck. Overlying muscles have been dissected off the front of cervical spine. Arrows show transverse processes of axis and atlas vertebrae.*

handle with a number 11 blade; a Swann Morton number 3 scalpel with a number 12 blade; and a pair of curved pattern universal wire cutters (Fig. 1).

With the neck well extended, the body was opened in the usual manner, with a Y shaped incision beginning behind each mastoid process and meeting at the sternal notch from where it was extended to the symphysis pubis. The V shaped flap of skin created was reflected as far as the lower edge of the mandible and the tongue with the floor of the mouth, and the neck organs were dissected free of the cervical spine. The chest and abdomen were opened in the usual way, but before removing the thoracic organs both subclavian arteries were severed at a point proximal to the origin of the vertebral arteries, leaving both vertebral arteries intact. The calvarium was also removed in the usual way. The basilar artery was then severed and, together with the vertebral arteries, was dissected free from the front of the brain stem after which the brain was removed. To complete the preparatory dissection the longus coli and longus capitis muscle were dissected off the front of the cervical spine (Fig. 2). The medial half of each clavicle was removed to give access to the origin of the vertebral arteries. These last two steps are simple but very important procedures. Dissection and removal of the muscles was an absolute prerequisite for exposure of the vertebral artery, and removal of the medial half of each clavicle greatly facilitated access to the origin and proximal segment of the vertebral artery.

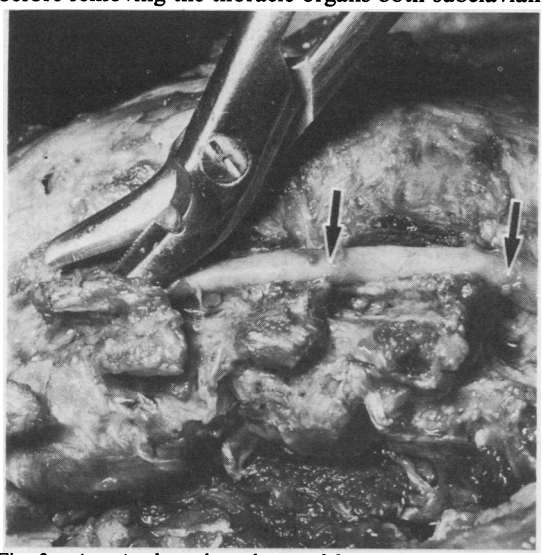

Fig. 3 *Anterior bony boundaries of formamina transversarium of sixth and fifth cervical vertebrae have been removed (arrows). Anterior bony boundary of fourth cervical vertebra in the process of being removed by wire cutters. Note that wire cutters are pointing in cephalic direction.*

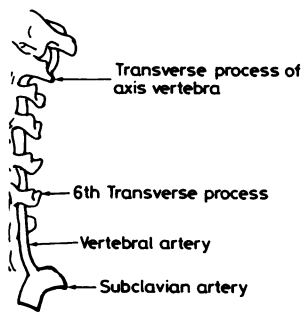

Fig. 4 *Course of vertebral artery as it ascends through foramina transversaria of lateral processes of cervical vertebrae. Artery executes sharp lateral turn when it reaches inferior surface of medial part of transverse process of axis vertebra.*

Each vertebral artery was then dissected free of its loose connective tissue attachments as far as the foramen transversarium of the sixth cervical vertebra. The anterior bony boundary of the foramen of each of the sixth, fifth, fourth, and third cervical vertebrae was then removed, using the heavy pattern wire cutters (Fig. 3). This was done by severing the small bar of bone that forms the anterior boundary of each foramen as close to the vertebral body as possible and snipping off the anterior tubercle of each transverse process. Using a number 11 blade on a number 5 scalpel handle, each artery was then mobilised as far as the axis vertebra.

After the vertebral artery had emerged from the foramen transversarium of the third cervical vertebra,

Fig. 5 *Artery has been exposed as far as transverse process of axis vertebra. Anterior bony boundary of foramen transversarium of axis is about to be removed. Note that wire cutters are pointing laterally.*

Fig. 6 *Anterior bony boundary of foramina transversaria of atlas and axis vertebra have been removed (arrows). Artery can now be mobilised as far as posterior atlanto-occipital membrane.*

further travel in a vertical direction was impeded by the inferior surface of the superior articular process of the axis vertebra (Fig. 4). As the artery reached this process, it executed a sharp lateral turn, tucking itself snugly into the angle between the body of the axis vertebra and the inferior surface of the superior articular process of the axis vertebra. The artery continued to travel laterally and inclined slightly in a cephalic direction as it passed through the foramen transversarium of the axis vertebra. Once this anatomical fact was appreciated, there was no difficulty in exposing the artery, again using the wire cutters, as it passed through the foramen (Fig. 5). During this stage of the dissection, the tip of the transverse process of the axis vertebra, which is easily palpated, was a useful landmark.

As soon as it had emerged from the foramen transversarium of the axis vertebra, the vertebral artery turned in a cephalic and slightly posterior direction to enter the foramen transversarium of the atlas vertebra; with the neck well extended this direction tended towards the floor. To mobilise the artery any further it was necessary to sever the anterior and posterior bony boundary of the foramen transversarium of the atlas vertebra, using the wire cutters. This gave sufficient exposure to enable essential mobilisation of the artery as far as the posterior atlanto-occipital membrane (Fig. 6).

When the vertebral artery had been mobilised as far as possible from the anterior cervical approach the intracranial part was then mobilised. The dura mater was incised by sweeping the number 12 blade on the number 3 scalpel handle around the upper border of the foramen magnum. The freed dura mater was then cut away to leave a narrow rim of dura mater around each artery. It was impossible to follow visually the course of the vertebral artery as it passed under the edge of the occipital bone to cross over the posterior arch of the atlas vertebra and beneath the lower edge of the atlanto-occipital membrane. The artery could be mobilised, however, from its loose connective tissue attachments, meningeal branch, and attachments to the posterior ramus of the first cervical nerve and the lower border of the atlanto-occipital membrane, by using the number 12 blade on the number 3 scalpel handle and a blind dissection technique. The tip of the curved blade was inserted under the edge of the occipital bone and swept carefully around the circumference of the artery, taking care to ensure that it was as far from the arterial wall as the limited space would allow. Several careful sweeps around the artery were required, and providing the artery had been fully mobilised from the anterior approach, both arteries could then be drawn gently through the foramen magnum and into the cranial cavity.

Discussion

Although requiring a little practice the method described was found to be the most reliable and practicable way of removing vertebral arteries intact. Both arteries could be fully exposed within about twenty minutes; complete removal of both arteries intact usually took about thirty minutes. Unlike other methods, the verebral arteries could be examined immediately without the impracticable time consuming process entailed in decalcifying the entire cervical spine, a procedure that also creates problems when attempts are made to restore the body after necropsy. Furthermore, the three instruments required are inexpensive, easily obtained, and greatly facilitate a task that is usually, but unjustly, considered to be difficult because in most mortuaries the instruments available are unsuitable for the task.

References

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