TOTAL VERTEBROBASILAR ARTERIOGRAPHY USING A
SINGLE VERTEBRAL PUNCTURE TECHNIQUE

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(Received for publication February 16, 1960)

The cervical portion of the vertebral artery has suffered neglect at postmortem studies for various reasons. The inaccessibility of the vessel lying deep in the bony canal, the time-consuming procedure of examining it and the technical difficulties associated with this have all contributed to its neglect. Added to this, in this country we have the very strong views of the morticians forbidding dissection of the major vessels in the neck which they claim interferes with embalming. This has almost invariably resulted in the examination of only the intracranial portion of the vertebral artery at necropsies. It is not surprising, therefore, that there has been poor clinical-pathological correlation.

In most published studies on occlusion of the carotid artery, no mention is made of the condition of the cervical portion of the vertebral artery.

Hutchinson and Yates \(^6\) have shown an intimate relationship of the vertebral artery on its medial aspect to the neurocentral joint within the vertebral canal. Osteoarthritic changes with spur formation could easily impinge on the vessel and result in changes in the wall of the vessel (Fig. 1). These authors \(^6\) studied 100 autopsies on patients who were selected because they had shown clinical evidence of cerebral ischemia.

In these studies \(^7,18\) they showed: 1) Of 83 patients examined, 40 had stenosis or occlusion of one or more vessels in the neck. 2) In 7 cases the vertebral arteries alone were affected. 3) Of 100 cases examined, in 55 the vertebral vessels were affected and in 77 the carotid vessels were affected by stenosis. 4) The most common site of involvement of the vertebral artery is at its origin from the subclavian artery. 5) It is not uncommon to have involvement of the cervical portion of the vertebral artery without involvement of the intracranial vessels. 6) The most common etiological factor was atherosclerosis.

The anatomical studies of Stopford \(^15\) have given us information concerning the anatomy of the vertebral arteries from their origin. He

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Fig. 1. Vertebral angiogram showing kinking of the vessel, probably caused by osteophytes in the foramen transversarium.
demonstrated a larger vertebral artery on the left side in 51 per cent of cases, and a larger vessel on the right side in 41 per cent of cases. The vessels were of equal calibre in 8 per cent of cases.

Hutchinson and Yates stated that no valid conclusions can be reached concerning the effects of vascular disease of the carotid and vertebral arteries on the brain without a full knowledge of the four vessels in their entire course. They further advocated the use of the term caroticovertebral stenosis since the wide clinical spectrum often presented cannot be explained solely on occlusion of one carotid artery, or even both carotid arteries.

These studies are not of mere theoretical interest since reconstructive surgery of the great vessels in the neck has now assumed a major role. For these reasons it is necessary and logical to examine all the major vessels in the neck, including their sites of origin.

The purpose of this paper is to describe a technique whereby both the origin of the vertebral artery at the subclavian artery and the rest of its course, including the basilar tree and all its branches to their terminations, can be outlined radiologically using a single puncture of the vertebral artery.

In the past various techniques have been used. The vertebral artery has been catheterized via the radial artery, via the brachial artery, and via the femoral artery. Percutaneous puncture of the subclavian artery is also used, and intravenous techniques are used whereby all the major vessels in the neck are visualized simultaneously. All these techniques are rewarding to those well practised in the use of them.

If detail and definition of both the basilar tree and the cervical segment of the vertebral artery are required, I feel that the following technique is of great value since it is so simple and results in a high degree of definition—anterior cervical approach (Lindgren) using the Sheldon needle and modifications (Swann). In this technique, without re-puncturing the artery and with the needle in the same position, excellent detail may be obtained of both the intracranial segment of the vertebral artery and its branches, and the cervical portion of the vertebral artery down to its origin from the subclavian artery.

**TECHNIQUE**

The trachea is displaced towards the contralateral side and the carotid artery towards the ipsilateral side. The procedure is performed using either local anesthesia or general anesthesia. The anterior tubercles of the transverse processes of C3 and C4 are palpated and the Sheldon needle is introduced in the foramen transversarium. The needle has a side opening, and the notch on the side of the needle hub shows whether the small opening at the tip is directed upwards or downwards (Fig. 2).

Eight cc. of contrast medium (we use Renografin 60 per cent or Hypaque 50 per cent) are injected, and excellent contrast is obtained outlining the vertebral artery from the site of puncture or even a few cm. proximal to this and the basilar artery, including the complete basilar tree (Fig. 3).

To visualize the cervical segment of the vertebral artery, the needle is left in position but simply rotated through 180 degrees. An injection is now made applying slightly more pressure to the plunger of the syringe. The contrast medium will pass down the vertebral artery and will outline the cervical segment, the origin of the vertebral artery and the subclavian artery and its branches (Fig. 4). By using this technique, excellent contrast will be obtained both in the basilar tree and in the cervical portion of the vertebral artery. If this high degree of definition is not necessary, then one of the other techniques may be used.
retrogradely and filling of the subclavian and brachial arteries resulted. In the second case there was no filling of the vertebral artery beyond the site of puncture, the contrast medium again passing down the vertebral towards the subclavian artery. Subsequent puncture of the vertebral artery a few days later on the same side was successful. Non-filling on the first occasion was probably a result of spasm in the vessel at the site of puncture. This has been described and illustrated by Morris.¹⁰

An attempt was made to puncture the left vertebral artery in the third case without success, and no injection was made. The brachial catheter technique described by Pygott and Hutton¹¹ was then used. Excel-

DISCUSSION

More than 200 vertebral angiograms have been performed by the author, using this technique. Over 60 of these were at the National Hospital for Nervous Diseases, Queen Square, London, and 140 at St. Vincent’s Hospital, New York City.

Diagnostic films in both the lateral and anteroposterior projections were obtained in 90 per cent of cases examined at the National Hospital and in 90 per cent of cases examined at St. Vincent’s Hospital. No information concerning complications is obtainable in the cases of angiography performed at the National Hospital.

In 3 of the unsuccessful cases at St. Vincent’s Hospital, one patient had periarterial contrast material around the site of puncture of both vertebral arteries without any filling of the vertebral artery distal to the site of puncture. Contrast medium, however, passed

Fig. 3. Lateral vertebral angiogram. Note site of needle puncture at bottom of photograph.

Fig. 4. Vertebral angiogram with opening of needle directed downwards. Note filling of lower end of vertebral artery, the subclavian artery and the internal mammary artery.
lent filling of the subclavian artery with contrast medium was obtained and a fine, thread-like, left vertebral artery was outlined. The vessel was so small that percutaneous puncture was impossible. The right vertebral artery was of a large calibre and was easily punctured.

In 3 further cases, minor periarterial contrast medium was seen at the site of puncture which apparently had no effect on the patient or the examination.

The reverse-flow technique, i.e., the rotation of the needle through 180° with retrograde flow of contrast material, has been attempted in 28 cases. Good visualization of the proximal course of the vertebral artery and its origin was obtained in all 28 cases, i.e., 100 per cent (Fig. 4).

Placement of a needle in the vertebral artery is no problem to an experienced operator but most investigators agree that dislodgment of the needle after the first injection is a most frustrating and troublesome occurrence. This often results in perivascular extravasation of contrast medium and a "failed arteriogram." This will necessitate repuncture of the artery which at this stage may not be possible because of formation of hematoma and spasm. Movement of the head and neck and recoil of the artery may be responsible for dislodgment of the needle. With the needle described,* this complication has been reduced to a minimum since the needle transfixes the artery and the contrast medium leaves the needle in the same direction as the long axis of the vertebral artery (Fig. 2).

The incidence of local complications is considerably lower using this needle than using a needle with an opening at the tip.16

SUMMARY

A new application of an established technique has been described whereby, using a single puncture of the vertebral artery, both the basilar tree and the cervical segments of the vertebral artery, including its origin from the subclavian artery, can be demonstrated radiologically with a maximum degree of definition.

I am grateful to Doctor C. G. de Gutiérrez-Mahoney (Director Neurological Division, St. Vincent's Hospital) for his help and advice. I also wish to thank Miss G. Bishop and Mr. R. Henning for the diagrams and the reproduction of roentgenograms.

REFERENCES

14. Steinberg, I., Finby, M., and Evans, J. A. A

* This needle and modifications are now obtainable from Becton, Dickinson & Company, Rutherford, New Jersey.


