TRANSLUMBAR AORTOGRAPHY—ITS HAZARDS IN RELATION TO ANAESTHESIA

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Translumbar aortography was first described by the Portuguese urologist, Dos Santos, in a report to the Surgical Society of Paris in 1929 (Dos Santos, 1929). It is only in more recent years, however, that the technical development of this procedure has reached a stage where its safety and simplicity have been such as to elicit a more widespread interest in its diagnostic applications. Although outstanding results have been reported by workers both in this country and abroad, establishing the value of aortography as a clinical diagnostic procedure (Nelson, 1942; Leriche, 1952; Stirling, 1957), it is still true to say that the frequency and extent of its application are mainly limited by the risks involved. McAfee and Willson (1956) in a review of the complications of aortography testify to the hazards of anaesthesia and would appear to serve an indictment against the use of general anaesthesia for this procedure. As they are not alone in expressing such sentiments (Deterling, 1952), a reappraisal of the anaesthetic methods commonly employed would appear desirable, with particular reference to the complications of this procedure.

Contrast Medium

The continued interest shown in the use of new contrast media for this radiographic examination suggests that no entirely satisfactory substance has yet been evolved, although vascular visualization was first accomplished (Haschek and Lindenthal, 1896) within a short time of Röntgen’s epoch-making discovery in 1895. Although the modern organic iodides have now almost completely supplanted the original use of sodium iodide in this field, possible toxic effects from these opaque media still constitute a real danger. With regard to sensitivity, the inclusion of promethazine in the pre-operative preparation of the patient, together with the routine use of an intravenous test dose of the medium (1–2 ml) administered 5 to 10 minutes prior to induction of anaesthesia with subsequent check on blood pressure and pulse rate, will eliminate any serious hazard from this source (Stirling, 1957).

All the opaque media in current use, whether of the organic or inorganic variety, must be regarded as chemotoxic to nervous tissue and even one of the most recent to receive favourable comment—sodium acetrizoate—has been the subject of a communication regarding its chemotoxic properties (Tarazi et al., 1956). The
implications arising from this fact and their bearing on the choice of anaesthesia are discussed more fully below.

Irrespective of the medium used, and even with such recent compounds as sodium acetrizoate, some degree of sensory stimulation is elicited on rapid intra-aortic injection, although not of the intensity formerly obtaining with sodium iodide. The discomfort (heat) experienced by the conscious patient may lead to sudden movement at a critical phase of the procedure and constitutes the main objection to local anaesthetic techniques.

TECHNIQUE OF INJECTION

In addition to toxicity of the contrast medium as an undoubted cause of many of the reported complications following aortography, the mode of injection per se is now regarded by many as a significant factor (Leriche, 1952; Crawford et al., 1957). While some authorities condemn any form of pressure device as a possible cause of neurological disaster (Sutton, 1957), other workers, although not condoning the use of high pressure gas-air machines, have pointed out the relative advantages and safety of a simple hand operated pump (Stirling, 1955). In this connection a recent report (Gaylis and Laws, 1956) has served to illustrate the danger of intramural extravasation as a further hazard during injection, emphasizing its possible significance in relation to neurological sequelae.

In addition to thirteen cases of paraplegia following aortography, a review of the literature would indicate a formidable list of other reported complications. Although some of these lie outside the scope of this communication, it is pertinent to note the occurrence of such hazards as aortic dissection, extra-aortic extravasation, perithecral injection, haemorrhage, and pneumothorax.

ANAESTHESIA

The following brief review illustrates the widely conflicting opinions expressed in recent reports on anaesthetic methods for this procedure and serves to indicate the necessary criteria for adoption of a suitable anaesthetic technique.

Spinal Analgesia.

This is widely regarded as the method of choice in the United States (Adriani and Roman, 1948; Feldman et al., 1954) where amethocaine hydrochloride (Pontocaine) is commonly employed in either a hypobaric or hyperbaric solution. As complete sensory analgesia for this procedure demands a block to the level of the fifth thoracic segment, some degree of hypotension is inevitable, necessitating the judicious administration of a vasopressor agent. In an effort to overcome this objection, recent reports have advocated use of the drug lucaine hydrochloride (β-2-piperidyl-ethyl-ortho-amino-benzoate hydrochloride) in hypobaric solution for the production of sensory subarachnoid block without significant motor paralysis (Feldman, 1954; Greene et al., 1956).

The most serious objection to spinal analgesia, however, only becomes apparent when its possible risks are equated against the reported complications from aortography per se. Paraplegia or any of the diversified features of the cauda equina syndrome have been attributed to errors in the technique of spinal analgesia so that complete exoneration of the spinal technique would be virtually impossible to establish. In the light of these considerations translumbar aortography should be considered a contra-indication to the use of spinal analgesia.

Epidural Analgesia.

Although capable of producing satisfactory results (Feldman, 1954), the main disadvantages of this technique are associated with the delay in onset of analgesia, and the rather high failure rate in any but the most expert hands. Where analgesia is limited to a purely sensory block without significant motor paralysis, hypotension is unlikely to be a troublesome feature. A more serious objection to this technique, as with spinal analgesia, concerns the medico-legal considerations which would undoubtedly apply in the event of neurological sequelae, and in these circumstances epidural analgesia cannot be regarded as the method of choice.

Local Infiltration and Paravertebral Block.

The advocates of local infiltration, either alone or in combination with paravertebral block, claim that this method constitutes the safest approach to anaesthesia for translumbar aortography (Deterling, 1952; Thornton, 1957). It is unlikely, however, that even the premedicated patient will regard paravertebral block as other than an un-
pleasant and trying experience. Despite the claims of safety to the patient based on the strictly limited disturbance to normal physiology, the method fails to achieve its primary function of adequate sensory loss, particularly during pressure injection when the degree of sensory stimulation is undoubtedly greater than with the slower manual method. This failure to ensure complete immobility of the patient during the critical phase of the procedure constitutes the main disadvantage of the method.

**Thiopentone Sodium.**

When the pharmacological limitations of this drug are ignored, it is not surprising that the results achieved by its use as the sole anaesthetic agent for aortography should be described in rather dubious terms (Smith, 1951; Deterling, 1952; McAfee and Willson, 1956). The absence of adequate respiratory control in the prone position associated with such risks as coughing and laryngospasm are sufficient reasons in themselves to prejudice this technique without the additional factor of lack of analgesic potency. It is perhaps no mere coincidence that extra-aortic extravasation has been the complication most frequently encountered with this technique of anaesthesia, which would appear to contribute more to the hazards of aortography than to its safety.

**General Anaesthesia.**

The adoption of the prone position for injection can be regarded as the only standardized part of this procedure which in other respects of its performance may vary between wide limits. Some workers recommend a control radiograph after positioning the patient and before insertion of the needle (Smith, 1952; Deterling, 1952); others stress the importance of a test injection and preliminary radiograph to ascertain the exact position of the needle in the aorta (Deterling, 1952; Crawford, 1957; Hare, 1957). A pressure device may be used for injection (Stirling, 1955; Gaylis and Laws, 1956), or the latter may be performed simultaneously through two needles, while radiography may involve a single or multiple film exposure technique. For the anaesthetist faced with the possible permutations and combinations of these variables, an unobstructed airway, control of respiration, and adequate analgesia are the basic criteria for success.

Endotracheal intubation with a cuffed tube avoids the dangers of respiratory obstruction in the prone position and is facilitated after induction with thiopentone by use of a small dose of suxamethonium hydrochloride (25–50 mg), the larynx and trachea being sprayed with lignocaine before insertion of the tube.

After positioning the patient and before insertion of the aortic needle, apnoea and controlled respiration are established by a further injection of suxamethonium, some estimate of the dose required being derived from the duration of apnoea following intubation. During introduction of the aortic needle, vigorous artificial ventilation is undesirable, particularly in cases of high aortic puncture where it may contribute to the risk of pneumothorax, a complication not unknown as a sequel to aortography. As nitrous oxide alone is unlikely to provide adequate analgesia especially where pressure injection of the contrast medium is employed, it is wiser to supplement the mixture rather than attempt to reinforce the lack of analgesic potency by vigorous ventilation and inactivation of the Hering-Breuer mechanism. Trichloroethylene may be added to the mixture of gases or pethidine may be used in preference and administered intravenously a few minutes prior to induction, thus ensuring maximum analgesic effect at the time of aortic puncture and injection.

Inadequate analgesia can scarcely be regarded as justification for recommending the use of a malleable needle “which would bend, in case the patient moved suddenly, while the needle was in the aorta” (Deterling, 1952), but rather as an indication of the need for reinforcing the anaesthetic mixture.

Experience at this medical centre now extends to over 1,000 cases of translumbar aortography mainly performed as an aid to urological diagnosis and to a lesser extent for investigation of peripheral vascular disease. The technical results achieved have recently been described in a monograph by Stirling (1957).

Pressure injection of the contrast medium by a simple lever device (Stirling, 1955) has been employed in almost all cases.

Local anaesthesia was favoured initially but soon abandoned when it proved unsatisfactory for the reasons already mentioned. In the remainder
satisfactory conditions have been consistently produced with a general anaesthetic technique based on the criteria described. There has been no significant postanaesthetic morbidity, nor has the technique contributed in any way to the incidence of postoperative sequelae.

CONCLUSIONS

It is perhaps significant that first reports on aortography did not appear in this country for more than twenty years after the original work of Dos Santos and his colleagues, and according to Leriche (1952) considerable controversy still exists as to the value versus the dangers of this procedure.

With the tremendous advances in cardiac and vascular surgery of the last decade, however, a renewed interest has developed in the diagnostic value of translumbar aortography and allied vascular visualization procedures, and it is highly probable that further study will bring forth even broader applications of these procedures. In these circumstances it is regrettable that the problems presented in anaesthetic management “have not been solved, despite the currently popular use of intravenous or local anaesthesia” (Feldman, 1954). It would appear that the end result in many instances has been a substantial contribution to the hazards of aortography rather than to its safety.

SUMMARY

As a result of experience gained, both in this country and the United States, of various anaesthetic techniques for translumbar aortography a critical review of current anaesthetic methods has been presented, in relation to the known hazards of the procedure, and the rationale of certain popular techniques has been questioned.

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REFERENCES


