Thorax (1972), **27**, 496.

A complication of percutaneous cannulation of the internal jugular vein

J. D. WISHEART, M. A. HASSAN, and J. W. JACKSON

Harefield Hospital, Harefield, Middlesex

Reviews of the use of the technique of percutaneous cannulation of the internal jugular vein for central venous pressure monitoring have indicated that it is free from serious complications. A patient is reported here in whom the ascending cervical artery was damaged during attempted cannulation of the internal jugular vein prior to aortic valve replacement. Haemorrhage from this site after the operation led initially to an extrapleural haematoma and soon afterwards to a haemothorax, which proved fatal despite immediate resuscitation and exploration.

Percutaneous cannulation of the internal jugular vein is widely practised for central venous pressure monitoring during cardiac surgery. It was first described by English, Frew, Piggott, and Zaki (1969), who reported 200 cases without complication. Jernigan, Gardner, Mahr, and Milburn (1970) used it in 1,000 cases with three complications, all successfully treated. This report concerns a fatality arising from this technique.

CASE REPORT

A 33-year-old housewife presented with dyspnoea on severe exertion due to congenital aortic stenosis. Investigations revealed a gradient of 80 mmHg across the valve, therefore valve replacement was advised. At operation on February 4, 1971, the aortic valve was found to be stenosed and calcified and was replaced by an aortic homograft.

After induction of anaesthesia an unsuccessful attempt had been made to cannulate the right internal jugular vein but was abandoned after a small haematoma had formed. The operation was itself completed without incident and the patient returned in good condition to the intensive therapy unit. A chest film taken immediately after her return from the theatre showed extrapleural shadowing of the right apex (Fig. 1). This was assumed to have been caused by an extravascular infusion of fluid, as there had been difficulty in positioning the tip of the central venous pressure cannula which was eventually inserted through the innominate vein. It was considered likely that this had perforated the superior vena cava with an infusion of fluid into the mediastinum which had tracked to the right apex stripping the pleura. The infusion was discontinued. Repeat chest radiography 30 minutes later showed that the extrapleural shadow had increased in size (Fig. 2). A short time later signs of hypovolaemia became apparent which initially responded to transfusion but recurred and persisted despite energetic blood volume replacement. A third film (Fig. 3) was taken which showed a complete right haemothorax. The patient was therefore immediately returned to the theatre for exploration.

While re-opening the median sternotomy wound, a systolic cardiac arrest occurred due to exsanguination. Adequate blood volume and good cardiac output were eventually restored after a period of internal cardiac massage. For a time during the early part of the period of massage the heart was initially empty and there was no significant cardiac output. Cerebral damage must have occurred at this stage as the pupils remained dilated after restoration of an adequate circulation.

Further exploration revealed the heart and mediastinum to be intact, but the right hemithorax was full of blood. When this was emptied a tear was observed in the mediastinal pleura above the azygos vein and the apical pleura had been stripped to the sixth rib. The pleura was widely opened and considerable bleeding was observed continuing to come from the root of the neck, but the source could not be identified from this approach. The incision was therefore extended to the neck, exposing the innominate artery, the right common carotid artery, the right subclavian artery, and their branches in the neck: the right internal jugular vein was defined and the right recurrent laryngeal nerve preserved. The site of bleeding was eventually identified as the ascending cervical artery, where it lies posterior to the internal jugular vein. Haemostasis was obtained.

Following operation her pupils remained fixed and dilated and her circulatory condition was unstable. She died the next day. Necropsy was carried out but provided no further information.

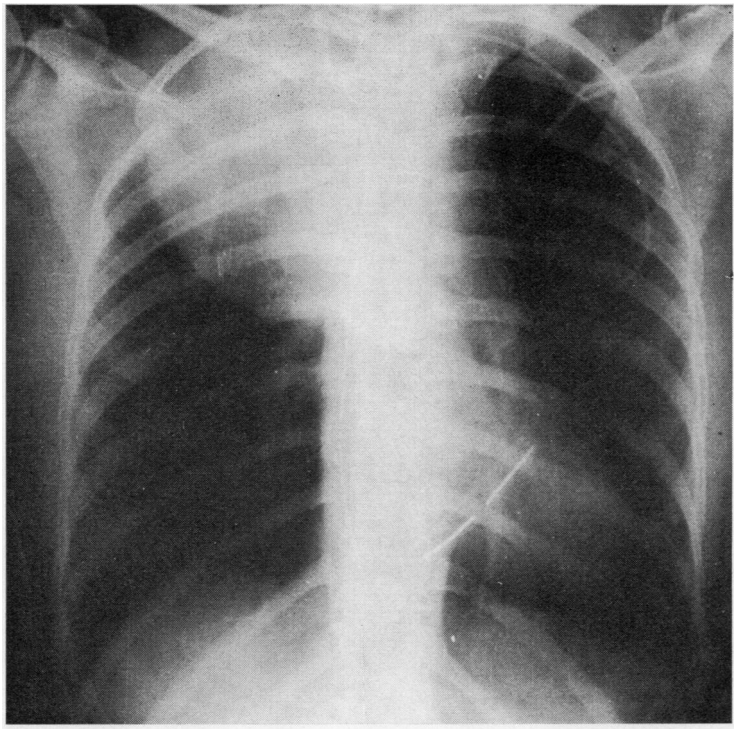

FIG. 1. *Postoperative chest film showing extrapleural shadowing at right apex.*

DISCUSSION

It seemed apparent that the ascending cervical artery had been damaged during the attempt to cannulate the internal jugular vein and that the initial blood loss had been contained while the pleura remained intact. It is of interest that at no time did the neck haematoma appear to be under tension. Eventually the pleura gave way and the patient exsanguinated herself into the right chest, with the clinical manifestations described.

Central venous cannulae have been known to perforate the right atrium leading to pericardial tamponade (Friedman and Jurgeleit, 1968; Thomas, Carter and Lowder, 1969; Latimer, 1971), but there has been no report of perforation of the superior vena cava as was originally proposed in this patient to explain the first two chest radiographs. Jernigan *et al.* (1970) report that in one case the cannula perforated the internal jugular vein and the perfusion was delivered into the neck tissue. This fluid tracked downwards leading to radiological widening of the mediastinum and rupture of the pleura resulting in a hydrothorax.

Arterial damage (Longerbeam, Vannix, Wagner, and Joergenson, 1965) and haemothorax (Schapira and Stern, 1967) have previously been described using the technique of percutaneous puncture of the subclavian vein. None of these cases was fatal, but in our patient the normal haemostatic mechanisms were modified after the injury as the patient was heparinized while on bypass.

If this case were regarded as a penetrating injury of the neck, then a considerable body of surgical experience is brought to bear on its management. In extensive reviews of this subject by Fogelman and Stewart (1956), Stone and Callahan (1963), and Shirkey, Beall, and De Bakey (1963), only one case of trauma to the ascending cervical artery is described. They advise that the management of this type of injury should be based on immediate resuscitation followed by assessment and an early decision to either explore or observe. Shirkey *et al.* (1963) report that the mortality is trebled if exploration is not carried out before six hours. These considerations underline the urgent need to demonstrate the nature of the increasing pleural shadow, which in our patient was later coupled

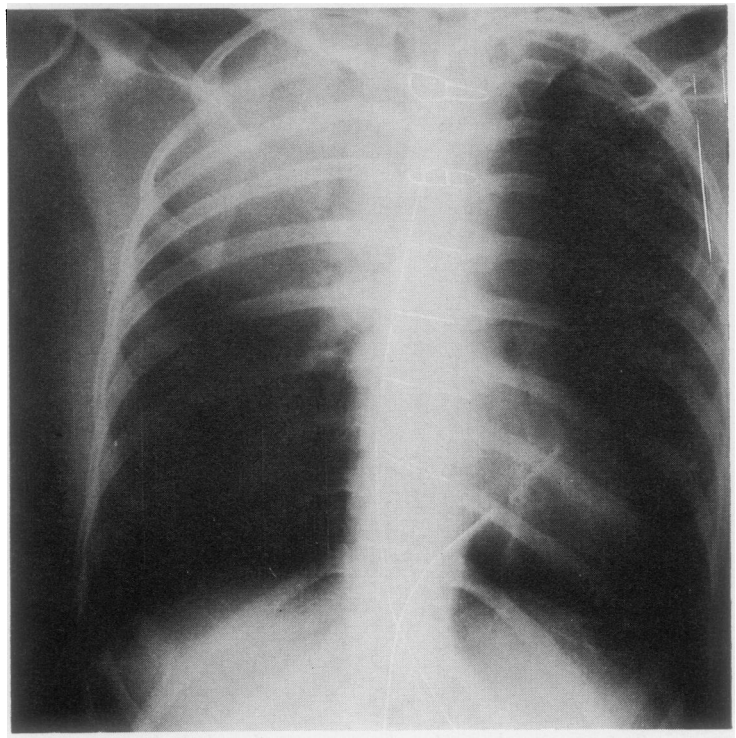

FIG. 2. *Chest film 30 minutes later showing increased extrapleural shadowing.*

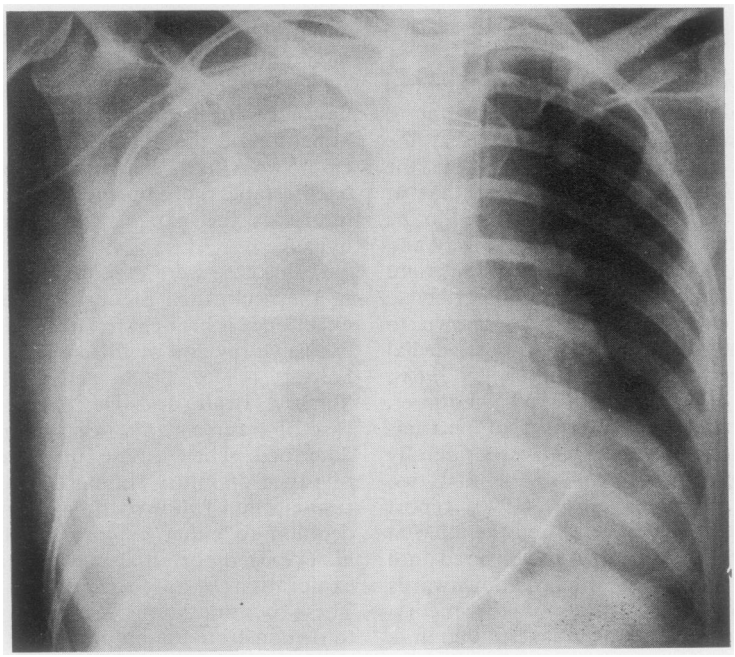

FIG. 3. *Right haemothorax.*

with the signs of hypovolaemia. This might be done by needle aspiration, taking care not to damage the pleura or other blood vessels during the procedure.

In conclusion, the technique of percutaneous cannulation of the internal jugular vein, hitherto regarded as safe, is not without potentially serious complications in patients who are heparinized, when undetected arterial damage may lead to continued bleeding.

REFERENCES

English, I. C. W., Frew, R. M., Pigott, J. F. G., and Zaki, M. (1969). Percutaneous cannulation of the internal jugular vein. *Thorax*, **24**, 496.

Fogelman, M. J., and Stewart, R. D. (1956). Penetrating wounds of the neck. *Amer. J. Surg.*, **91**, 581.

Friedman, B. A., and Jurgeleit, H. C. (1968). Perforation of atrium by polyethylene central venous catheter. *J. Amer. med. Ass.*, **203**, 1141.

Jernigan, W. R., Gardner, W. C., Mahr, M. M., and Milburn, J. L. (1970). Use of the internal jugular vein for placement of central venous catheter. *Surg. Gynec. Obstet.*, **130**, 520.

Latimer, R. D. (1971). Central venous pressure catheterisation. *Brit. J. Hosp. Med.*, **5**, 369.

Longerbeam, J. K., Vannix, R., Wagner, W., and Joergenson, E. (1965). Central venous pressure monitoring. *Amer. J Surg.*, **110**, 220.

Schapira, M., and Stern, W. Z. (1967). Hazards of subclavian vein cannulation for central venous pressure monitoring *J. Amer. med. Ass.*, **201**, 327.

Shirkey, A. L., Beall, A. C., and de Bakey, M. E. (1963). Surgical management of penetrating wounds of the neck. *Arch. Surg.*, **86**, 955.

Stone, H. H., and Callahan, G. S. (1963). Soft tissue injuries of the neck. *Surg. Gynec. Obstet.*, **117**, 745.

Thomas, C. S. Jr., Carter, J. W., and Lowder, S. C. (1969). Pericardial tamponade from central venous catheters. *Arch. Surg.*, **98**, 217.