when contrast medium was introduced into the pharynx and again when the endotracheal tube was placed. This initially gave the impression that the laryngeal closure reflex was intact, and seemed to confirm the findings of Claey's,4 who used smaller amounts of Innovar. However, radiologic examination showed that four of the 12 patients had aspirated the contrast medium and that the integrity of the laryngeal closure reflex could not be relied upon.

In Group II, patients who received topical anesthesia, laryngeal exposure was achieved in 12 of 18 patients. In these 12 patients contrast medium introduced into the pharynx was not aspirated. This would therefore seem to be a safer procedure for intubating the trachea of a patient with a full stomach. But, because it is technically difficult for the anesthesiologist and unpleasant for the patient, intravenous sedation may be desirable. If Innovar is used to facilitate “awake” intubation, it should be given in minimal amounts and with the knowledge that the risk of aspiration may be higher than when topical anesthesia only is used.

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A Complication of Radial-artery Cannulation

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Serious complications resulting from radial artery cannulation are rare. Two cases of ischemic cutaneous damage from such cannulation are reported.

REPORTS OF TWO CASES

Patient 1. A 44-year-old man underwent aortic-valve replacement with a Starr-Edwards prosthesis during cardiopulmonary bypass. A PTFE (Teflon) cannula was passed into the left radial artery, using the needle-and-wire technique described by Seldinger,1 soon after induction of anesthesia. The site of puncture of the skin was approximately 1 cm proximal to the radial head, and the tip of the cannula was about 6 cm proximal to the puncture. The cannula was used for manometry and blood sampling. It was continuously flushed by means of a continuous infusion pump at a rate of 8 ml/hr with sodium chloride, 0.9 per cent, containing heparin, 1,000 units/l. Free flow was found at all times.

Approximately nine hours after cannulation, a dusky purple area was noticed over the middle third of the anterior surface of the forearm. The cannula was withdrawn approximately 2 cm. Little change was noticed over the next six hours, and the cannula was removed. Systemic perfusion throughout this period was good. After four days the appearance of the affected skin was normal.

Patient 2. A 17-year-old boy involved in a traffic accident had received multiple injuries to the lower limbs, abdomen and thorax. Left-radial-artery cannulation was carried out percutaneously using a PTFE Venflon cannula of external diameter 1.4 mm prior to repair of a ruptured thoracic aorta during cardiopulmonary bypass. Flushing technique was identical to that described above. During operation the arterial supply to the cannulated limb was interrupted for a period of 10 minutes, during which time flushing of the cannula was continued.

During the first 24 hours after operation the systemic circulation was frequently poor. Cardiac arrest occurred once; the patient was resuscitated.
by open-chest massage. At the end of this period the skin over the middle third of the anterior aspect of the forearm, excluding the hand, was noticed to be dusky and to have poor capillary filling compared with adjacent areas. The cannula was removed. Over the next five days part of the area of skin became necrotic despite improved systemic perfusion and oxygenation. Recovery of the lesion was allowed to occur by granulation and took place over the next six weeks (figs. 1 and 2).

**DISCUSSION**

Radial-artery cannulation is now a routine procedure in the management of many major surgical and intensive-care patients. It is especially desirable in cardiopulmonary bypass procedures and with anesthetics involving induced hypotension. Considering the large number of cannulations performed, few complications have been reported. Bedford and Wollman reported a high incidence of radial-artery occlusion in the postcannulation period, with recanalization in 75 days or less.\(^5\)

A satisfactory ulnar-artery anastomotic supply to the tissues normally supplied by the radial artery should be demonstrated to avoid ischemic injury to the hand. Either the compression test described by Allen\(^2\) or the test involving exsanguination of the arm with an Esmarch bandage followed by reperfusion while the radial artery is compressed at the wrist, as described by Barber, Wright and Ellis,\(^4\) may be quickly and easily performed. The latter has the advantage of not requiring patient effort or cooperation.

Two cases of damage to the skin proximal to the site of arterial puncture are reported. In one, the damage was severe. It seems that the position of the tip of the cannula may be critical, and the following observation may easily be confirmed: After placement of the cannula, a bolus injection of 3 or 4 ml of heparinized saline solution is made through it. One of two responses is usually seen. Either a localized area of a few square centimeters of intense blanching occurs, or there is a less localized, transient area of slight pallor. If the former is obtained, slight adjustment of the position of the cannula tip usually converts the response to additional injections to a larger area of slight pallor, which the author considers preferable. It suggests less interference with the local cutaneous circulation by the flushing fluid, the function of which is solely to prevent platelet aggregation along the length of the cannula and at its tip.

Radiographic examination of the area of distribution of a bolus of radiopaque contrast medium injected through the cannula proved impractical, as well as subjecting the patient to unnecessary radiation. Slow injection of fluorescein and subsequent examination of the arm under ultraviolet light has been performed in six other patients. The area of fluorescence was altered markedly by small changes in the position of the tip of the cannula. Unfortunately no such investigation was carried out in the two cases reported.

Other possible causes of the localized lesions, apart from malpositioned cannulas, include continuous flushing in the presence of impaired circulation and absent circulation for a time, as in the second case. Local response to heparin or degradation products seemed unlikely causes, although

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**FIG. 1 (left).** Patient 2, 36 hours after cannulation. **FIG. 2 (right).** Patient 2, 96 hours after cannulation.
hypersensitivity and anaphylactoid reactions do occur. Heparin is remarkably stable in solution, and tests at dilutions of 1 unit/ml in 5% dextrose have shown no deterioration for as long as 60 hours. Freshly prepared flushing solution was used in both cases reported, and in neither case was it more than 24 hours old when removed. Collapsible plastic containers with air exclusion were used for the fluid.

In conclusion, two cases of ischemic changes of the skin of the forearm following radial-artery cannulation are reported. It is suggested that care be taken to observe the response to a bolus injection of flushing fluid after positioning the tip of the cannula. Careful observation of the arm for signs of cutaneous ischemia, and prompt relocation of the cannula should they occur, may prevent permanent damage.

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REFERENCES


Anesthetic Management of Cholecystectomy in a Patient with Buccal Pemphigus

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Pemphigus, a chronic disease of worldwide distribution, is characterized by bullous eruptions of the skin and mucous membranes of the mouth, conjunctiva, and genitalia. The disease is thought to result from a loss of intercellular bridges, resulting in the separation of the epidermal cells, edema, and bulla formation. Eruptions may occur spontaneously or may be precipitated by trauma, stress, allergies, drug sensitivities, or infections. Mortality is greater than 90 per cent, with an average duration of life of 14 months after onset, if untreated. Steroid therapy has significantly reduced mortality and extended life expectancy. Death usually results from fluid, electrolyte, and protein loss, or secondary infection. Difficulty in swallowing can lead to cachexia. The fragility of the mucous membranes of such patients poses obvious problems in anesthetic management.

REPORT OF A CASE

The patient was a 77-year-old Caucasian woman. Ten weeks prior to admission she had had an attack of right-upper-quadrant abdominal colic and fever. Her symptoms had abated in four days. A second attack had occurred ten days later, and on roentgenographic examination, a solitary radiolucent gallstone was seen. The patient was scheduled for elective cholecystectomy.

On admission, the patient gave a history of recurrent severe buccal ulcerations which had first