There seems little doubt that violent changes of intra-abdominal pressure caused by vomiting have some connexion with the production of this condition. Vomiting so often occurs in association with chronic malnutrition that a nutritional factor may also be operative.

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Medical Memorandum

Use of Papaverine in Traumatic Arterial Spasm after Supracondylar Fracture of Humerus

Threatened ischaemia consequent upon fractures in the upper limb has always presented its difficulties, not only of recognition but also of treatment. The following case report illustrates some of the prevailing views held on the treatment of arterial spasm.

CASE REPORT

On March 20, 1954, a 6-year-old boy was brought to the casualty department with a history of having injured his left elbow.

On examination he was pale and in some pain but not obviously shocked. The left elbow was swollen, heavily contused, and deformed, suggesting a supracondylar fracture of the humerus. The proximal end of the humerus was palpable in the antecubital fossa and appeared to be immediately subcutaneous. The radial pulse was impalpable despite prolonged examination and its absence indicated some form of arterial damage. X-ray examination confirmed the diagnosis of a severe supracondylar fracture with marked posterior displacement and a less severe lateral displacement of the distal fragment.

One attempt at manipulation of the fracture was made in the casualty department in the hope that adequate reduction would restore the blood supply to the distal part of the limb (Griffiths, 1948). Not only was there a failure to restore the radial pulse, but reduction of the fracture was impossible, and it was clear that the proximal fragment of the humerus had buttonholed the soft tissues. As his fingers were developing a cyanotic tinge and fast becoming cool and swollen, the patient was prepared for transfer to the theatre, where both the fracture and the brachial artery could be explored.

At operation a medial longitudinal incision was made because of the severe soft-tissue swelling. The subcutaneous tissues were found to be severely contused and lacerated. The proximal end of the humerus was found to have buttonholed the brachialis muscle and lay just under the skin in the antecubital fossa, in direct medial relationship to the median nerve, which, however, showed no signs of damage.

Initially the brachial artery was difficult to identify by virtue of the extreme spasm for approximately 12 cm. of its

length, which made it resemble one of its own venae comites. When ultimately identified by the recognition of proximal normal pulsation, the vessel was lifted from its bed so far as was technically possible in a vessel so contracted. This procedure produced no obvious change in the condition of the artery, and without further delay a 5% solution of papaverine sulphate was applied superficially to the vessel wall. The response was dramatic. The brachial artery assumed its normal size within two to three minutes, with ample evidence of full and sustained arterial pulsation. The vessel wall appeared undamaged. Reduction of the fracture was not completely successful, for it was virtually transcondylar and very unstable.

The loosely sutured wound was drained and the arm immobilized in a plaster-of-Paris posterior slab and a lateral stirrup. At the conclusion of the operation stellate ganglion and brachial plexus blocks were performed. The radial pulse was now easily palpable at the wrist.

Post-operative treatment included elevation and cooling of the limb. The following morning the radial pulse remained easily palpable; the fingers were warm and the colour was normal. By the same evening the whole limb had begun to swell and the pulse was correspondingly weaker, although the fingers retained their warmth. All dressings were freed, and to ensure maximum vasodilatation of collateral vessels a further brachial plexus block was performed. The pulse none the less continued to be weak and intermittently palpable for the next three days, but at all times the hand remained warm. The view was held that the pulse was difficult to feel owing to the increasing tension created by the injury. Confirmation of this view was provided by inspection of the arm and elbow; for here, in association with the intense swelling, the skin showed the haemorrhagic vesication of impaired viability. Subsequently the wound broke down for this very reason and required skin grafting.

Although his convalescence was slow, he ultimately made satisfactory progress, and when seen six months after the injury there was no evidence of ischaemic changes to be found in the limb.

COMMENT

Griffiths (1948) has shown that, when conservative measures have failed, exploration must be carried out to expose the artery, and, provided there is no arterial damage, the vessel is liberated, mobilized, and, if necessary, a solution of procaine applied. At the conclusion of the operation he advocates sympathetic paravertebral block in the neck, presumably to eliminate spasm in the smaller arteries and in the arterioles.

It has since been shown experimentally by Kinmonth (1949) that smooth-muscle contraction gave rise to local segmental spasm in the large arteries of the body, in the maintenance of which nervous factors did not play a demonstrable part. Following these important findings, Kinmonth (1952) made known the results of directing his attention to paralysing smooth muscle itself by smooth-muscle-relaxing drugs. He found that the local application of papaverine sulphate to the walls of large arteries was the most effective in the volume of its response, in its speed, and in its sustained action.

This case demonstrates the immediate and dramatic effect of papaverine sulphate in relaxing arterial spasm when used locally. In injuries of this nature, where, following exposure of the brachial artery, simple spasm is found, the initial local application of papaverine would appear to be the treatment of choice.

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