INfiltration Anaesthesia of the Lower Arm and Hand

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In the treatment of surgical diseases of the upper extremity, partly local and partly general anaesthesia are used. The opinion of Kochert, that local anaesthesia is advisable only when contraindication of narcosis exists, is no longer accepted. We cannot lay down any general rule as to the best types of anaesthesia to be applied, for example, the age of the patient or his psychic disposition has often induced us to complete under narcosis an operation which is normally carried out by employing only local anaesthesia. On the other hand, it may happen that the patient's fear of narcosis is so great that in order to avoid it he is ready to bear even considerable pain. However, whatever the method the surgeon employs, his aim is always to carry out the operation with the minimum of pain. This can only be achieved through the choice of drugs of the appropriate kind and quantity and through the use of correct methods correctly applied.

The oldest, as well as the best known methods of analgesia, employed in surgical treatments of the upper extremity, are the two evolved by Oberst and Kullenkampff. The first of these, though simple, is not in all cases without danger, as we shall see later. The second, besides requiring specialized technical skill, also leads in a certain number of cases, not only to unpleasant symptoms such as paralysis of the cervical sympathetic system, blocking of the phrenic nerve and pain in the chest, but also to serious collapse, pneumothorax and even death. On account of these dangers, these methods can certainly not be employed for ambulant cases.

In the last century, Korning and Goldscheiner investigated the problem of infiltrative anaesthesia. In animal experiments,
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they succeeded by the injection of anaesthetic solutions into the prepared nerve (i.e. by endoneural injection) in making the area supplied by the nerve completely insensitive. Soon they were able to demonstrate that analgesia could also be obtained, though more slowly, by perineural injection, that is, by allowing the anaesthetic fluid to reach the immediate surroundings. By systematic investigations, they also showed that the nearer this injection is to the site of operation the smaller the actual amount of solution required.

Endoneural methods of peripheral infiltration anaesthesia can be used with complete success, only when the nerve passes over bone or lies within a bony canal; for example, the brachial plexus as it lies on the first rib, the ulnar nerve on the humerus or the infraorbital nerve in the infraorbital canal. According to Braun, among the nerves of the upper limb, only the ulnar nerve in its groove can be anaesthetized in this way (after Krogius). Wiedkopf advocated the analgesia of radial and median nerves also, at the elbow and above the elbow, respectively. The localization of these nerves, however, is made difficult through the lack of definite bony landmarks and so these methods could not become popular. Although above the wrist there is still no sure bony guide to these nerves, anaesthesia in this region is more often performed.

The inadequacy of peripheral infiltration anaesthesia in the upper limb led me to investigate further these two nerves. Dissection showed that suitable sites for nerve puncture of the radial and median nerves exist also. They are found as follows:

By the movements of pronation and supination of the lower arm the head of the radius is easily defined. One and a half centimetres below this, a line is drawn perpendicular to the long axis of the arm. In position of supination, from the junction of the thenar and hypothenar eminences, a line is drawn at right angles to the former. The radial nerve lies at a depth of about one and a half centimetres, directly on the bone, below the point
of intersection of these two lines and can be reached by a perpendicular thrust of the needle. In the case of a successful nerve puncture, the patient experiences an electric sensation; if this reaction does not occur the nerve will be found by deviating the needle a few millimetres from the perpendicular. The location of the median nerve is not quite as simple, but with a little practice it too can be anaesthetized. The method is as follows:

By pronation and supination, the lateral border of the Pronator Teres is defined. Half a centimetre medial to this (thus avoiding injury to the brachial artery), level with the lateral epicondyle, the ulna can be reached by a perpendicular puncture of the Pronator Teres and Brachialis muscles. The median nerve lies in the space between the two muscles. As long as the needle is piercing both muscles, it cannot be moved from side to side. By carefully withdrawing the needle, a certain depth will be reached at which, for the first time, its free movement will be possible. This level corresponds to the intermuscular plane. Here the needle is turned at an angle of almost 180 degrees and pushed carefully in a lateral direction, until a resistance is felt, which is caused by the median nerve. In both cases, 5 to 10 cubic centimetres of 2 per cent novocain are injected after a successful nerve puncture.

I have had the opportunity of testing the technique described above on twenty patients, two with fractures of the radius and eighteen cases of panaritium of the hands with definite lymphangitis. In all cases, in twenty to twenty-five minutes, the whole area innervated by the nerves was made completely insensitive and all motor impulses were blocked. The area was definitely hyperaemic as a result of paralysis of all the vasoconstrictor and vasodilator fibres. In one case, though the sensory function of the radial nerve was eliminated, the motor functions remained unimpaired. The effect lasted about one and a half hours. As the cutaneous nerves can easily be anaesthetized by simple subcutaneous circular infiltration, complete insensitivity of the
whole lower arm and hand can be achieved without the infiltration of the brachial plexus.

*Indication.* In all those cases of finger panaritia, where an accompanying lymphangitis reaches the first phalanx, Oberst’s infiltration method cannot be used. Should the patient have also myocardiac lesions, a contraindication of narcosis also exists. At our present stage of knowledge, the only possible alternatives would be freezing or Kullenkampff’s anaesthesia. Freezing is the simplest form of analgesia, though probably few patients who have suffered from this method would consider that...
it deserves the name anaesthesia. The latter is a complicated procedure and can be dangerous as explained before. It is also contraindicated in cases of pulmonary tuberculosis, emphysema, that is, in those diseases where narcosis is also out of the question. It is then evident that in these patients, the infiltration anaesthesia of the lower arm is the only possible method. In Oberst's method, the locally administered solution causes a mechanical compression of the vessels. In advanced cases of pyogenic processes of the finger, especially if arteriosclerosis or diabetes is also present, this mechanical compression may lead to irreparable damage, by gangrene setting in. In the infiltration anaesthesia of the lower arm, this danger does not arise, for the fluid is applied at some distance from the site of the operation and, furthermore, is accompanied by extreme vasodilation. In closed fractures the simple local anaesthesia is excellent, but in serious injuries and open fractures the infiltration anaesthesia of the lower arm can again well be employed. According to Cryle, intraneural injection of novocain also diminishes the shock.

**Summary.** With the infiltration anaesthesia technique of the lower arm, a new indication can be established and the complications of narcosis can be avoided. It is indicated in all those surgical diseases of the lower arm and hand, where the more dangerous and complicated Kullenkampff method or general anaesthesia are not desirable.