BLOCK OF THE BRACHIAL PLEXUS BY THE AXILLARY ROUTE¹

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A TECHNIQUE for blocking the brachial plexus by the axillary route was described by Labat in 1922 (1) and in Pitkin's *Conduction Anesthesia* in 1946 (2), but the method advocated by Arcado and Adriani in 1949 was simpler and more effective (3). However, it took nine years before we heard of the application of this technique with some success. In the Current Comment of *Anesthesiology* of March-April and of September-October, 1958, Preston J. Burnham and Kenneth F. Eather report and discuss the successful use of this method of regional anaesthesia (4, 5). In January and February, 1959, articles by Clayton, Turner, and Burnham treating upon this procedure were published in the *Journal of the American Medical Association* (6, 7).

Having had 17 years' experience with the brachial plexus block by the supra-clavicular route, we became interested in this type of block by the axillary route.

TECHNIQUE

The patient lies with his arm abducted at 90 degrees in a neutral position or in external rotation. To keep the arm in a neutral position, an assistant holds the limb at the wrist, if the arm is placed in external rotation, the hand and forearm rest on a pillow near the head. The operator stands inside the arm. He must feel the axillary artery, but, in order to locate it, he must be familiar with the anatomical relations of the block in the axilla. The landmarks must be carefully

FIGURE 1

¹Nesacaine hydrochloride used in this study was supplied by Maltbie Laboratories Division, Wallace & Tiernan Ltd., 925 Warden Ave., Scarborough, Ont.

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located. At the level of the insertions of the pectoralis major muscle anteriorly and of the conjoint tendons of the latissimus dorsi of the teres major muscles posteriorly, the neurovascular bundle can be felt.

In Figure 1, one can see that, between the insertions of the pectoralis major muscle and of the latissimus dorsi muscle, there is, along the axillary artery, the tendon of the long head of the biceps muscle and of the coracobiceps muscle.

FIGURE 2

In Figure 2, one can see the same muscles from another plane and the importance of the coracobrachialis muscle as a landmark is apparent. An imaginary line can be drawn perpendicular to the insertions of the pectoralis major muscle anteriorly and of the joint tendons of the latissimus dorsi and of the teres major muscles posteriorly, because the injection must be made through this line anterior and posterior to the axillary artery.

A very important landmark is the conjoint tendon of the coracobrachialis muscle and of the short head of the biceps muscle beneath the inner side of the pectoralis major muscle near its insertion at the humerus. The fingertip palpates the coracobrachialis muscle below the pectoralis major muscle and, posteriorly, it feels the neurovascular bundle where the terminal portion of the axillary artery lies. Posterior to this bundle, the finger feels the anterior part of the tendon of the latissimus dorsi muscle.

By pressure, the finger feels the pulsations of the axillary artery in the groove beneath the coracobrachialis muscle where the space of the neurovascular bundle is located. The space, 3 cm. in diameter, is surrounded by a fascia which is the prolongation of the axillary fascia.

In Figure 3, a sagittal section shows the median nerve which is medial and more superficial than the axillary artery; the musculocutaneous nerve which is anterior and beyond the axillary artery, the ulnar nerve which is inferior and below, the radial nerve which is posterior, below and behind the axillary artery; the medial brachial cutaneous and the medial ante-brachial cutaneous nerves which are inferior and superficial to the axillary artery.

FIGURE 3

Anterior to the neurovascular bundle is the coracobiceps muscle, and posteriorly there is less than $\frac{1}{2}$ in. from the cutaneous surface to the medial side of the humerus. It is important to locate exactly the terminal portion of the axillary artery to avoid injection outside the fascia surrounding the space or into the muscles

FIGURE 4

In Figure 4, one can see the projection of the muscles on the skin, the projection of the axillary artery, and the site of the intradermal wheal.

In Figure 5, the finger feels the pulsation of the axillary artery in the space of the neurovascular bundle. The finger also feels the coracobrachialis muscle anteriorly and the tendon of the latissimus dorsi muscle posteriorly. In this way, we are certain of the exact location of the axillary artery and we can place a finger right in front of it: the method is indeed a simple peri-arterial infiltration in the axilla with a No. 24 needle, 2.5 cm. long.

FIGURE 5

An intradermal wheal must be raised below the coracobiceps muscle, 2 cm. higher than the insertion of the pectoralis major muscle and just in front of the axillary artery. The injection is made just underneath the fascia because the median nerve is more superficial than the axillary artery; the injection is also made on each side of the axillary artery by reinserting the needle through the same cutaneous wheal.

Each time, the skin is retracted slightly on each side, and the needle is directed at an angle of 30 degrees to the skin, before penetrating the fascia. When the needle is in the right place, strong oscillations of its hub are noticed. It is important to observe the movements of the needle oscillating with the pulsations of the axillary artery. If the oscillations of the needle are weak or absent, it is probable that the needle has penetrated anteriorly or posteriorly into an aponeurosis or into a muscle. Pulling the needle out slightly is often sufficient to see it pulsating again. The withdrawal of the needle out of an aponeurosis gives a particular sensation of escape.

To demonstrate a more precise location of the axillary artery, a two-needle technique is suggested. At the level of the inferior border of the pectoralis major muscle near the humerus, the axillary artery is sought with the finger just beneath the coracobiceps muscle. When the finger of the free hand feels the axillary artery, a first needle is introduced at a 30 degree angle, slightly anterior to the axillary artery, through the skin, the fat, and the fascia. After the fascia has been pierced, the pulsations of the needle are noted. Another needle is introduced on the opposite side at a 30 degree angle with the skin, close to the axillary artery and at the same level. In this manner, mistakes such as the puncture of a muscular aponeurosis, or the insertion of the two needles on the same side of the axillary artery, are avoided.

In Figure 6, one can see the exact location of the two needles. An injection of 10 cc. of Xylocaine hydrochloride 2 per cent or of Nesacaine hydrochloride 2 per cent with epinephrine 1/150,000 dilution is made through each needle, on both sides of the axillary artery and in front of the axillary artery at the withdrawal

FIGURE 6

of the needle. Aspiration tests and control of the oscillations are done before and after each injection.

The advantages of this technique are:

- Landmarks located easily
- Less apprehension, less objection from the patient
- No pain inflicted during the injection
- No necessity to elicit paraesthesia
- Drug toxicity decreased by half
- No problem with haematoma
- Anaesthesia more suitable about the elbow
- Bilateral brachial block permissible
- Shoulder girdle not involved by anaesthesia
- Elongation of the brachial plexus and neuritis less probable

The disadvantage is that the axillary route cannot be used for a dislocation of the shoulder joint or for a closed reduction of a fracture of the clavicle.

DISCUSSION

The block of the brachial plexus by the axillary route was performed at our hospital for the past year. It was learned and managed by 13 anaesthetists not familiar with this technique. It was administered for interventions about the elbow, the forearm, and the hand. A brachial plexus block by the axillary route may be used also for treating painful vasospastic conditions in which the upper limb is involved.

Since April, 1958, 165 axillary blocks have been performed for surgical procedures of the upper limb. Therapeutic axillary brachial blocks are not included in this series.

Analgesia was complete in 142 of these 165 blocks; in 23 blocks, analgesia did not develop as expected and had to be completed by local infiltration or by general anaesthesia.

Failures, amounting to 14 per cent, appeared mostly at the beginning of this series and were due to imperfect technical knowledge. Failures with the axillary brachial block seem to be nothing but a lack of mastery of the technique: too low, too deep, too high infiltration; too weak solution; injection into the neighbouring muscles.

In the last four months, 105 axillary blocks were done, with incomplete analgesia in only seven, giving 94 per cent of successful results

During the same period of time, 81 brachial blocks have been performed by the supraclavicular route: complete analgesia developed in 77, giving 95 per cent good results in comparison to 86 per cent for the total number of 165 axillary blocks.

A 16 mm. colour film on the axillary block, produced by Drs. A. Gagné and H. Drolet, residents in the Department of Anesthesia of Hôtel Dieu de Québec, was shown along with the paper at the meeting.

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