

PERIPHERAL NERVE BLOCKADE

REASONS FOR FAILURE

Dr.Selva Kumar. M.D ., D.A., DNB, Assistant Professor,

Dept.of Anaesthesiology, Madurai Medical College, Madurai.

It is heartening to see a crying patient with a fracture settling down after a nerve block which slowly takes off his pain and at the same time allowing the patient to remain conscious. But at the same time, if the block fails it adds misery to an already suffering individual. So it becomes necessary to known about the factors affecting the success rate of a nerve block and perfecting them so as to reduce the failure rate to an acceptable minimum.

The variables affecting the success rate of a nerve block can broadly classified into.

- A. anatomical factors
- B. surgical factors
- C. patient selection
- D. drug factors

Anatomical consideration:

The main prerequisite for successful regional anesthesia is a full understanding of the relevant topographical landmarks, the intervening structures between the skin and target nerves and the course and immediate relations of the target nerves. Each peripheral nerve usually has a cutaneous sensory component and a somatic component supplying motor fibers to muscles and sensory and proprioceptive fibres to joints and other deep structures.

General principles of peripheral nerve anatomy:

1. Cutaneous sensory distribution can be mapped either as an individual dermatome which represents a single nerve root derivation or as a peripheral nerve territory which represents derivation form multiple nerve roots.
2. If a local anesthetic block is performed at the level of the nerve roots such as an interscalene brachial plexus block, the onset of anesthesia is best monitored by checking the dermatomal pattern of anesthesia. Any failure or inadequacy will usually manifest itself in a dermatomal pattern but if the technique is performed at the level of a peripheral nerve then the failure will occur in the distribution of the nerve territory. A Knowledge of the limits of territory is therefore necessary.

3. It is important to understand the limitation of particular nerve plexus block and the commonest nerves being missed in a plexus block. For e.g: Interscalene block may miss the ulnar nerve; axillary block may miss the musculocutaneous nerve. If musculocutaneous nerve is missed, inspite of a successful motor block provided by axillary block, the patient will experience pain in the area of distribution of lateral cutaneous nerve of forearm which is a continuation of musculocutaneous nerve. The anterior and lateral aspect of the shoulder area may be reinforced by the supraclavicular nerve - that is the reason for the supraclavicular block missing the shoulder area.

4. Some of the sensory nerves are in subcutaneous plane and some may lie beneath the fascial plane. For e.g: the dorsal nerve of penis lie beneath the Buck's fascia and the Femoral nerve lies beneath the fascia lata. Subcutaneous infiltration to block these nerve with volumes of drug will not block them.

5. The deep structures supplied by the nerve do not necessarily underline the cutaneous distribution. The musculocutaneous nerve supplies the flexor muscles in the upper arm but its cutaneous distribution is in the forearm. This difference between the motor and sensory components of a nerve block can be utilized to allow the patient to make voluntary muscle movement during surgery. Thus surgery for Dupuytren's contracture can be undertaken after blocking the ulnar and median nerves at the wrist to produce sensory block in the surgical field but still allows the patient to flex the forearm muscles which remain unaffected.

6. Hilton's law states that the motor nerve to a muscle tends to give a branch to the joint which the muscle moves and another branch to the skin over the joint. Generally, this means that the nerve supply to a joint is derived from all the nerve which traverse the joint .This principle is important planning procedures for joint surgery .In the knee, for example, the obturator, femoral, sciatic and lateral cutaneous nerve of thigh all contribute fibers to the internal structures and need to be blocked in varying combinations, depending upon the type of surgery planned.

Surgical considerations:

- Successful regional anesthesia requires careful choice of which nerves to anesthetise and this depends on an understanding of the surgeon's intentions. This requires a preoperative discussion with the operating surgeon and a clear understanding of the procedures going to be performed. For e.g.: a surgical procedure in a forearm may require a split skin graft from the thigh. So without knowing it, going for a supraclavicular plexus block will be inadequate and it will require either supplementation with general anesthesia or an additional nerve block.
- In turn, the surgeon must also understand the different operating condition that regional anesthesia provides and be prepared to modify the surgical technique if necessary.
- The site of surgical incision should be carefully considered because it may cross the territory of several adjacent nerves.

- Even if the incision is entirely within the normal territory of a single nerve, it is prudent to block adjacent nerve territories as they are very variable and may have considerable overlap. Surgically, the operation may also turn out to be more extensive than first planned.
- The site of limb surgery may affect the preoperative planning. Proximal surgery above the knee or elbow usually requires plexus anesthesia than discrete nerve blocks which are more appropriate for distal surgery.
- Even when the surgery is in the distal limbs , surgical need may dictate that a tourniquet is necessary and this may demand a plexus block in order to enable the patient to tolerate the tourniquet.
- Surgical stimulation may cause the patient distress despite a fully functioning block. This commonly occurs during hernia or scrotal surgery when the traction on the spermatic cord causes deep visceral pain in the abdomen despite a satisfactory somatic block.
- Surgeon has to be gentle in handling the tissues as pulling the structures like omentum or spermatic cord may stimulate the unblocked areas giving rise to discomfort.
- If the preoperative diagnosis is in doubt and if the surgeon feels that it may be required to modify the surgical plan on the table, then it is not wise to go for a limited nerve block- either a more proximal nerve block or general anesthesia must be chosen.

Patient selection:

- Obviously if an obese patient is selected for a peripheral nerve blockade, then the chance for failure will be high. If it is mandatory to go for a block in these patients, it is wise to select a block which requires an easily palpable land mark rather than with a deep seated difficult land mark .For e.g: Axillary block may be preferred over supraclavicular brachial block as it needs only axillary artery to be palpated not the deep seated first rib.
- Regional anesthesia in the conscious patient requires active cooperation. In patient where this is not forthcoming, as may occur with intoxication, head injuries or severe anxiety, general anesthesia supplemented by a regional technique is the most sensible course.
- No patient should be coerced in to a regional technique against their will .For most patient a brief outline of the benefits of regional anesthesia like pain relief of several hours duration ,less nausea ,less drowsiness and early returning to oral feeding usually results in a willing patient and overcomes reluctance of “ needling ”.
- Clear instruction about the incidence of paraesthesia should be given to the patient otherwise local pain may be mistaken for paraesthesia and the patient may misguide the anesthetist. If paraesthesia is sought during the procedure, it must be in the prescribed area not a vague one. In supraclavicular brachial plexus block, paraesthesia in the

scapular region because of stimulation of suprascapular nerves may make the operator to misplace the solution .

- The variety of sensations that the patient might experience during surgery despite a fully functioning block should be fully explained to prevent them from being interpreted as a sign of failed anesthesia. A variety of non-specific sensations which are painless but nonetheless disconcerting may be felt. Reassurance that this is normal and not a sign of a failed technique is necessary to maintain patient's confidence.
- If the patient is comfortable and correctly positioned for the block and the operator is comfortable and well prepared, then the chances of the technique being performed quickly and successfully are increased.

Drug selection:

- Obviously a short acting drug like lignocaine may not cover the entire duration of the surgery, if surgery is unexpectedly prolonged.
- Likewise if a long acting drug is selected as bupivacaine, sufficient time must be allowed for the block to set in. If frequent testing is done to know the onset of the block, the patient may become anxious and he may start complaining of pain even when the block has set in successfully.
- Date of expiry should be checked before the drug is being injected. Likewise if the drug vial is repeatedly autoclaved, it might have lost its potency.

Thick nerves like femoral and sciatic nerve need concentrated local anesthetic solution. Dilute solution in spite of correct placement may produce partial block.

Others:

- If the part of the drug is being injected intravascularly, then the sufficient amount may not reach the nerves.
- If the surrounding area is inflamed, the resultant acidic pH lowers the concentration of active form of the local anesthetic drug thereby increasing the chance of failure.
- Individual and anatomical variations in patients: It has been shown that the effect of local anesthetics in man varies greatly. In a series of experiments, it was found that the quotient of the longest and the shortest durations of analgesic effect was 16, i.e the longest duration was 16 times longer than the shortest.
- Nerve paths can vary from one patient to another. In most cases, these usually small variations have no significance in the effect of local anesthetic.

- Wrong Dispensing: Instead of local anesthetics, water being dispensed as local anesthetics. But world literature says after analyzing so many suspect solutions that deviations in the stipulated contents of local anesthetics just do not occur.
- Obstruction to diffusion: Too much of connective tissue barriers may hinder the diffusion of the e.g.: hernia block for a recurrent inguinal hernia.
- A needle with a extension tube (Immobile needle-described by Winne) avoids movement of the syringe during aspiration, injection and syringe exchange, thus minimizing the risks of nerve trauma and needle misplacement.
- Bevel of the needle: short beveled or pencil pointed needle are favored because the amount of feedback from them is so superior to long beveled needles that the likelihood of success is enhanced.
- Using P.N.S: The P.N.S can be used to electrolocate any peripheral nerve of mixed motor and sensory function. Whilst a purely sensory nerve can be stimulated at high power to produce paraesthesia, this is an unreliable method that may be painful for the patient and is not recommended.
- P.N.S is not a substitute for inadequate anatomical knowledge and should not be employed to hunt blindly for nerve.
- P.N.S is most useful in the location of deeply placed nerve and plexuses which have a characteristic distribution of muscle movement when stimulated and which are traditionally associated with a low incidence of success when the technique is attempted "blind".
- Always use a standard approach to the nerve, paying particular regard to the tactile information being generated by the needle. Advance the needle until within the expected vicinity of the nerve. Attach the nerve lead to the needle hub and then stimulator should be turned on.
- When using the current of the order of 3mA or less, the nerve will not be stimulated if the needle tip is more than 1cm distant.
- In order to place the needle tip adjacent to the nerve, carefully adjust the needle tip position whilst reducing the stimulus strength until the muscle movement is just discernible with the minimum stimulus possible.(usually 0.1-0.5mA delivered current)
- The minimum stimulating current and voltage will vary according to which nerve is being blocked, the age of the patient and the presence of neuropathy. Small and superficial nerves such as the median or radial nerves require 0.1-0.3mA and less than 1v while large and deep nerves such as sciatic or obturator require up to 2mA and 3v.

- An initial injection of 1-2ml may produce an increased muscle movement following electrical stimulation as the local anesthetic improves the electrical conductivity, usually followed quickly by a fade in the movements which can be attributed to the nerve being displaced by the injection and thus increasing the needle –nerve distance.

Type of failed blocks:

- I. Total failure: The bolus of local anesthetic completely misses its target and the surgery couldn't be proceeded.
- II. Incomplete block: Patient has numbness in the area of nerve distribution but not adequate for the knife to applied. This situation arises when weak concentration of local anesthetic is employed or when only a part of the bolus injection reaches the nerve fibers.
- III. Patchy block: Some areas in the distribution of the plexus have escaped. Patient complaints of pain when noxious stimulation is applied to these areas but he is quiet when other areas are stimulated.
- IV. Wear off block: When surgery outlasts the duration of the block, this situation arises.
- V. Misdirected block: The part or the whole of the drug is injected in to the neighboring structure – for e.g.; in to a vessel or in to the pleural cavity.

Prevention of block failure:

- If you are planning for a nerve block, see the patient first. Examine him whether the landmarks are felt easily and he is co-operative.
- Discuss with the surgeon about his plan.
- Enquire about the position of the patient during surgery. It may be needed to place the patient in prone position for a posterior approach of a humerus.
- Use premedication judiciously.

- If the patient is very obese and it is difficult to feel the landmark, you can better avoid regional nerve block. Straightway general anesthesia may be planned or PNS can be utilized.
- Explain the procedure to the patient. Sometimes this may be counterproductive. The patient may be over enthusiastically guide or misguide you.
- Place the patient in the recommend position for the block. This will greatly help in identifying the nerve. For e.g.; hyper abducting the arm will make the axillary artery impalpable which is the only landmark for the axillary block.
- Use the recommend sized needles. Too long needles not only miss the target but may produce complication.
- For some blocks, holding the needle with the attached syringe is advantageous (e.g. supraclavicular brachial block but for some (e.g. axillary block) holding the needle alone will be easy.
- If vessel is punctured, either the technique can be converted into a transarterical technique carefully or needle may be withdrawn completely and pressure be applied for sufficient time to avoid haematoma formation. If haematoma is allowed to form, it will dilute the local anesthetic solution injected and also it will confuse the anesthetist when he is testing for bloody aspiration.
- Always aim for a more reliable endpoint viz paraesthesia or definite conducted vascular impulse. If paraesthesia is obtained, confirm the area of distribution.
- Use sufficient volume and concentration of local anesthetic solution.
- If early onset of block is required, select lignocaine.
- Check for expiry date of the drug.
 - A needle with a short extension tube helps in fixing the needle in position by the operator and injection by a different person.
- Avoid giving block in a inflamed, edematous area.
- Give sufficient time for the drug to begin its action.
- Don't allow the surgeons, staff nurses and other theatre personnel to breathe into your nose while you are giving a nerve block. It will subconsciously increase the anxiety level in you.
- Avoid selecting nerve blocks in a busy list.

- Be prepared for a failure and ready with an alternative technique.

Management of failed blocks:

However careful we are, failures are bound to occur. In those situations, decision has to be taken whether to changeover to general anesthesia or manage with TIVA. The stage of the surgery influences the selection of the anesthetic technique. If it has to begin, it is better to start G.A- keeping in mind that starting a general anesthesia in a hurried manner may predispose to commit errors.

If the surgery is going to be over within a short time, then he can be managed either by holding a mask or by TIVA.

Conclusion:

It is possible to reduce the incidence of block failure to minimum by meticulously following the technique and the above recommendations. If failure occurs, instead of feeling depressed, it is wise to analyze the cause of the failure and rectify it by repeated practice.

