Damage to peripheral nerves at or around the time of a surgical operation has been a well-recognized hazard for many years. Regional anaesthetic techniques may be implicated in the aetiology of such damage and there have been isolated reports published [1–3], but for several reasons it is difficult to obtain an accurate assessment of the incidence of the problem or if this has changed over time.

Peripheral nerve damage is not as dramatic or potentially catastrophic as the more central neural damage which may be associated with spinal or extradural techniques. Minor degrees of damage are often unreported and may not even be noticed by the patient. Signs of damage may not become apparent for some time, as interference with the microvasculature of any neural structure may result in the subsequent development of a neuropathy, and in normal clinical practice relatively few patients who have received a peripheral nerve block are seen after operation by the anaesthetist at a time when nerve damage is detectable. Several reports [4–8] of large numbers of upper limb blocks suggest that the incidence of serious damage is very small, but most studies concentrate on immediate rather than late complications. Neurological damage may not become apparent for up to 1 week after the procedure [9].

Damage may be caused by physical, chemical or ischaemic mechanisms acting alone or in combination and these may be related to a regional anaesthetic technique. There is no good clinical evidence that any particular disease or drug therapy predisposes a particular patient to develop nerve damage after regional anaesthesia, but it is well known that in some diseases, such as diabetes mellitus, there are alterations to the microvasculature of peripheral nerves and this may alter the effects of trauma to the nerve. Particular care should therefore be exercised when dealing with such patients, although it will be recognized that these are the very individuals who may benefit most from regional anaesthesia.

Needle trauma remains an important factor. Trauma may damage neural blood vessels or neural barriers, cause extra- or intraneural haematoma or oedema, and lead to degenerative changes or discontinuity of fibres. Many techniques require the elicitation of paraesthesiae in order to obtain a reasonable success rate, and even if paraesthesiae are not deliberately sought, they may occur [10]. The presence of paraesthesiae may be associated with a greater incidence of damage, and if they are to be elicited, this should be carried out gently and certainly not repeatedly. It is important that the patient understands clearly what is being sought and that good rapport exists between anaesthetist and patient, as otherwise repeated nerve trauma may occur. For major nerve and plexus blocks, an immobile needle technique is recommended and, should the needle inadvertently move after the commencement of the injection of local anaesthetic, there should not be any attempt to elicit further paraesthesiae.

It has become fashionable to sedate the patient or even administer general anaesthesia before performing a regional block, and to use a peripheral nerve stimulator to identify the correct position of the needle tip. This may be less variable between patients and give rise to less nerve trauma; however, intraneural injection will not be apparent. Intraneural injection is normally painful and should be readily distinguishable from pain caused by distension of a sheath—so-called pressure paraesthesiae. It may cause intraneural compression and ischaemia for 10–15 min [11], with resultant neuropathy. Recently, a patient undergoing surgery to the hand received a general anaesthetic after which median and ulnar nerve blocks at the wrist were performed [Medical and Dental Defence Union of Scotland, personal communication]. After operation, he developed weakness and persisting paraesthesiae in the distribution of the median nerve which was not helped by a carpal tunnel decompression. In the absence of other evidence, it would be hard to refute the suggestion that damage was caused by the intraneural injection and that any signs of this would have been masked by the general anaesthetic.

The needle itself [12], in particular the length of the bevel and its direction are also relevant, as described in a paper in this issue of the Journal [13]. Long bevel needles are certainly less unpleasant for the patient, particularly if injection is being made above the clavicle or at the elbow or wrist, but the use of a short bevel needle may help identify tissue planes, especially for the axillary approach to the brachial plexus. Short bevel needles produce more damage than long bevel needles when they impale nerves, but they are less likely to impale a nerve.

Local anaesthetic agents in clinically used concentrations are not neurotoxic when applied extra-neurally. Concern was expressed some years ago about 2-chloroprocaine, when permanent neural damage followed accidental intrathecal injection [14]. This has been ascribed to the combination of the acidity of the solution and the presence of the antioxidant sodium metabisulphite [15]. There may be important differences in the neurotoxicity of substances if these are injected intraneurally and this...
has been demonstrated with adrenaline [16]. Theoretically, any preservative in the solution might be neurotoxic and it would therefore be wise to use preservative-free solutions for nerve or plexus blocks, as extraneural injection cannot be guaranteed. Accidental injection of the wrong solution is a potential problem which does not appear to have been reported with peripheral nerve block, but has occurred in obstetric practice when potassium chloride was administered extradurally, with devastating consequences. The introduction of chemical agents used in skin preparation is a theoretical rather than a practical problem and the introduction of infection after the injection of local anaesthetic solutions is very rare and has not been implicated in peripheral nerve damage.

Factors unrelated to the anaesthetic may also be responsible [17]. Tourniquets can cause damage to nerves, especially if applied incorrectly or for very prolonged periods of time. Incorrect positioning of the patient is also well recognized as a cause and this can occur with regional and with general anaesthetic techniques. Cases have been reported, after general anaesthesia, in which it has not been possible to identify the causative factor despite extensive investigation; these may represent a lack of observation, rather than indicate the presence of other mechanisms [18].

There are immense practical difficulties involved in conducting a major clinical study of the effect of needle type and other factors which may be involved in the aetiology of nerve damage caused during regional anaesthesia. In the meantime, it would appear wise to concentrate on the use of a meticulous technique. A thorough knowledge of local anatomy is essential before any block is attempted. It may be reasonable to carry out blocks on the lower limb with the patient anaesthetized, as the consequences of minor degrees of neural damage are less severe and it is common to require a combined local and general technique for surgery. This method can certainly not be recommended for trainees working unsupervised who wish to gain more experience of a technique with which they are unfamiliar; this should not be embarked upon lightly for upper limb blocks. More than 40 years ago, Wooley and Vandam [4] stated that it may be prudent to avoid the use of brachial plexus nerve block in persons whose fingers and hands are exceedingly important for the performance of fine work—for example musicians and certain technicians. This advice is still as pertinent today and should be followed unless there are good reasons to the contrary.

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REFERENCES

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