WHAT'S NEW IN REGIONAL ANAESTHESIA?

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Predicting what is coming in a speciality is always interesting. Many predictions fail to come true and the real advances are not foreseen.

Reviewing the literature on what is new in regional anaesthesia often reveals the work of the particular author who is involved in the development of cutting edge technology and so conflict of interest may make it difficult to separate fact from hype.

I will present three aspects of possible future directions for regional anaesthesia, and some personal predictions that may advance the practice of regional anaesthesia. These are broadly grouped as advances in ultrasound technology, advances in pharmacology and advances in anaesthesia delivery.

Advances in Ultrasound

Of all the future developments, this holds the greatest interest. Current ultrasound technology has advanced significantly in the last decade. Ten years ago ultrasound machines were bulky, expensive and uncommon in hospitals – let alone operating rooms. Their anaesthesia applications were limited to transoesophageal and transthoracic assessment of cardiac function, and predominantly for the cardiac anaesthetist. Since that time, they have become compact, affordable and much easier to use with rapid powerful image processing and image display.

Recently 3-dimensional and 4-dimensional ultrasound devices have been investigated for use in regional anaesthesia. Currently these devices suffer from several limitations, which relate to image acquisition and display. With improved processing power, better probe design and new 3-D displays all being developed, the use of 4-dimensional displays will in time make the use of USG RA easier and safer.

On the issue of safety, there is still no clear benefit of using ultrasound over the old 'blind' approach. The reasons for this aren't clear, as ultrasound allows us to identify the anatomy and more accurately place the needle. Common sense would suggest it should be safer, so why is this not being shown in clinical practice? One major problem is that there are no accurate historical data to compare rates of complications. Prior to the introduction of US, there were no large multicentre prospective audits of regional anaesthesia. Many complications were not reported for fear of litigation, many anaesthetists would not do RA for fear of complications, and many stopped if they had a serious complication. Current prospective evidence is that the risk of serious and persistent neurological complication is small – certainly less that the risk of driving your car to work each day, yet some practitioners still have a phobia for RA.

Technology continues to advance with the development of ultrasound visible needles. There has been much work in research and development trying to make needles that are image-able at greater than 45 degrees. Some new products have recently hit the market that may be worth considering.

Advances in Pharmacology

The speciality is still looking for the ideal agent – long acting and without motor block and the search continues! One possible solution is to prepare local anaesthetic agents in liposomes to produce a sustained release delivery. Possible candidates for adjuvants to local anaesthetic agents include: neostigmine, midazolam, clonidine, adenosine, adrenaline, dextrans, NMDA antagonists, opioids, magnesium, steroids, NSAIDS, and tramadol. Each of these agents will be considered individually.

Adenosine

A1 adenosine receptors are found in the substantia gelatinosa, and intravenous adenosine has been shown to be as effective as remifentanil for analgesia. Its use in neuraxial and peripheral nerve block has failed to show any advantage.

Adrenaline

Addition of adrenaline increases the quality of thoracic epidural analgesia. Studies have shown that concerns about the risk of spinal cord ischaemia with the use of epidural and intrathecal adrenaline, are unfounded. Addition of adrenaline to LAs for peripheral nerve blocks provides no analgesic benefit in terms of prolongation of sensory blockade and has no effect upon the systemic absorption of ropivacaine but does decrease systemic levels of prilocaine, bupivacaine and lignocaine.

Clonidine

Addition of clonidine to subarachnoid block (15-150 micrograms) with local anaesthetic results in a block that lasts around 60-100 mins longer, but produces significantly more hypotension. Its use in peripheral blocks remains equivocal at best, possibly prolonging axillary block with mepivicaine but making no difference if bupivacaine is used, and may still be associated with hypotension.

Dextrans

These agents have been investigated for some time. They were thought to act by 'trapping' the LA at the site of injection via several postulated mechanisms. They have not been shown in studies to prolong neural blockade.

Magnesium

At resting membrane potential, NMDA receptor channels are blocked by extracellular magnesium ions in a noncompetitive manner. Intrathecal magnesium (50mg) has been shown to prolong the analgesic effect of fentanyl for labour analgesia and lower limb surgery, although with a slower onset block. When used as an adjunct to bupivacaine and sufentanil in patients undergoing lower limb arthroplasty, 94.5mg of intrathecal magnesium decreased postoperative analgesia requirements by almost 50%. It has not been associated with any increase in side effects or adverse events. When given by the epidural route, magnesium decreases pain scores and analgesic requirements for up to 72 hours.

These beneficial effects of magnesium are only evident if administration is commenced before the start of the surgical procedure, demonstrating pre-emptive analgesia mediated via NMDA pathways. The optimal dose remains to be established. Animal experiments suggest that there is no role for the use of magnesium as an adjunct to peripheral nerve blocks.

Midazolam

There is a high concentration of benzodiazepine receptors in the substantia gelatinosa so midazolam is another candidate. Studies have shown that 1-2mg in adults and 0.23-0.5 mcg/kg prolongs analgesia with bupivacaine by 2-6 hours and with fentanyl by 50 mins without prolonging motor block. One study of patients having supraclavicular nerve blocks, showed that midazolam (50 mcg/kg) was associated with improved postoperative pain scores and decreased analgesic requirements for up to 24 hours. Intra-articular midazolam (50–75 mcg/kg) provided 4 hours of additional analgesia after arthroscopy. It has been shown in humans not to be neurotoxic.

Neostigmine

Cholinesterase inhibitors exert a dose-dependent antinociceptive effect by the activation of intrinsic ascending and descending cerebral cholinergic pathways via muscarinic, but not nicotinic, receptors. Intrathecal neostigmine

(50–200 mcg) is as effective as intrathecal morphine for postoperative analgesia after gynaecological surgery and prolongs postoperative analgesia after lower limb orthopaedic surgery. Its usefulness is limited by numerous side effects including sweating, evacuation of bowels and severe nausea and vomiting, which have proved to be resistant to pharmacologic treatment. The high incidence of side effects outweighs its benefit for central blockade. Its use in peripheral blocks has been studied and the results are equivocal, with side effects occurring in 30%.

NMDA Antagonists

Ketamine has been used as a subarachnoid agent in cancer patients but causes frequent psychomimetic side effects. Its use in the epidural space has had mixed results and peripherally it has no advantage over placebo for neural blockade.

NSAIDS

Some evidence supports the use of NSAIDs for IVRA. Research is ongoing for intrathecal use. It has also been suggested they may be useful for infiltrational anaesthesia, but evidence is lacking.

Opioids

There is good evidence to support their use in central neuraxial blockade. However there is little evidence to support their use in peripheral blocks.

Steroids

Dexamethasone 8mg added to peripheral blocks prolongs duration. The mechanism of action is unclear.

Tramadol

As an analogue of codeine, tramadol should have some effect as an adjunct. Studies to date have been variable in support of its use – being either no different or of some benefit. There is however some concern over neurotoxicity in animals.

Intralipid

The introduction of the Lipid Rescue (www.lipidrescue.org) protocols is another new advance. This has saved lives and has been endorsed by ANZCA.

Advances in Agent Delivery

There has been further development of small and effective infusion pumps, which now means that the concept of patient controlled regional anaesthesia (PCRA) at home is a real possibility.

PCRA catheters (incisional, intraarticular, and perineural) have been maintained for 1-7 days postoperatively in patients at home. Several prospective trials have examined perineural PCRA in outpatient settings. PCRA has been found in several prospective randomised trials to deliver equivalent or superior analgesia compared to continuous infusions or placebo, while simultaneously reducing total local anaesthetic doses. In a multicenter, randomised, prospective trial, perineural continuous infusion or PCRA ropivacaine were compared with IV PCA morphine in patients with moderate pain after ambulatory upper or lower extremity orthopaedic procedures. Pain scores and the need for rescue analgesia were lower in both local anaesthetic groups compared to morphine. The morphine group also experienced more side effects (PONV, sleep disturbance, dizziness) and more mechanical malfunctions (catheter kinking, dislodgement, or dizziness).

Although PCRA appears to offer superior analgesic efficacy compared to continuous infusion or PCA morphine it is not fool-proof and analgesic gaps due to equipment failure and catheter kinking or dislodgment may still occur. This requires the team providing such a service to have well planned rescue interventions in place and clear instructions for the patients receiving this therapy.

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