CHAPTER 1: INTRODUCTION

General considerations

Regional anesthesia refers to a group of techniques performed either at the neuraxial or peripheral nerve levels that render part of the body insensate to pain. They accomplish this by selectively interrupting nerve transmission without the need to alter the patient's level of consciousness.

In this manual I discuss regional anesthesia related issues as well as nerve block techniques commonly used in the United States with special emphasis on the techniques we perform at Cook County Hospital in Chicago.

Regional anesthesia has been traditionally considered an "art". As such, it is usually practiced by "artists", who use their particular talents to produce results difficult to reproduce by artistically challenged anesthesiologists like most of us. I have a great respect and admiration for all the pioneers who introduced and/or helped popularized the various regional anesthesia techniques available to us now. The anesthesiology community owes them a debt of gratitude for they built the foundations of our current practice. However, I also believe that regional anesthesia in the 21st century should be practiced more as a science than an art, taking advantage of all the various technologies available to us now. Using technology to help our work does not demean our practice; on the contrary, it makes it more rational, reproducible, and potentially easier and safer. The introduction of ultrasound in regional anesthesia is an example of that.

The nerve blocks that we perform, and which I describe in these pages, are based on anatomical, physiological, and pharmacological facts. The endpoints chosen are objective, while the local anesthetics are used in volumes and concentrations considered adequate and safe by clinical experience. Regional anesthesia practiced in this manner, should likely lead to predictable and reproducible results.

Regional anesthesia carries the risks and complications associated with the use of local anesthetics (i.e., local anesthetic toxicity), the risks and complications of using needles and drugs in the proximity of nerves (e.g., neuropraxia, irreversible nerve damage) and those risks associated with a particular technique (e.g., pneumothorax, total spinal). As with any other anesthetic technique, choosing regional anesthesia requires a thorough assessment that involves the patient, the surgeon, the nature of the procedure and its estimated duration, as well as the anesthesiologist's level of experience with regional anesthesia and its management.

Patient selection and premedication

The type of anesthesia for any procedure must be tailored to every individual patient. There are patients who usually are considered not good candidates for regional anesthesia as the sole anesthetic (e.g., drug abusers, pediatric patients). On the other hand, we have a large successful experience with peripheral nerve blocks on drug abusers and some pediatric patients, confirming that each case must be individually evaluated.

Judicious use of sedation increases patient's cooperation and acceptance. Sedation should be used to calm anxiety, but not to turn the patient unconscious or otherwise unresponsive. This is especially true in blocks performed close to the neuraxis, like interscalene blocks and lumbar plexus blocks. Keeping the patient lightly sedated, but awake and cooperative, makes the procedure easier for both the patient and the anesthesiologist. Traditionally it has been considered that an awaken patient would contribute to the safety of the technique by being able to communicate pain at injection, which could be an indication of intraneural injection or by developing symptoms that could be early indicators of impending systemic toxicity. This is now controversial since there is some evidence that nerves can be penetrated and injection can be performed intraneurally, although extrafascicular, without pain. Improvements in ultrasound technology with better imaging resolution could potentially improve safety.

Monitoring

Every nerve block, whether it is performed in a dedicated room, holding area, OR, PACU or office, must be treated as potentially dangerous. Monitoring blood pressure, heart rate and pulse oximetry, as well as the establishment of an IV access must always be considered. Supplemental oxygen should be given especially when sedation is being used. Resuscitation equipment, including oxygen, Ambu bag, airways of different sizes, intubation equipment and tubes, along with appropriate resuscitation drugs and suction capabilities, must always be readily available.

A clear strategy to deal with and treat complications must be in place. It is always advisable, before starting a technique, to leave room at the head of the bed for the anesthesiologist to manage the patient's airway, should that become necessary. Familiarity with the surroundings helps when dealing with emergencies.

Outcome and regional anesthesia
Is regional anesthesia safer than general anesthesia?

Every discussion on regional anesthesia must address the issue of its relative safety compared to general anesthesia. Despite several studies suggesting it and an intuitive feeling that regional anesthesia seems "safer' than general anesthesia, no definite and general answer can be given. The inability to give a clear answer is the result of, on the one hand, increased safety under any type of anesthesia and paucity of evidence in the literature on the other. Most of the outcome studies available to us have compared the relative benefits of neuraxial anesthesia (spinal or epidural) versus general anesthesia in intra abdominal surgery. Most of the studies lack the power (number of cases) to be able to see a true difference, if it existed, and most of them are retrospective. Lack of randomization raises the possibility of technique bias selection (i.e., regional anesthesia may have been preferred in sicker patients obscuring its potential benefits).

Other problems have to do with the parameter chosen for comparison. Traditionally we have concentrated on clinically oriented outcomes, like mortality and cardiovascular, respiratory and other major morbidities. This has proven challenging for major events requiring an extremely large sample in order to find a statistically significant difference, since mortality for example under any type of anesthesia is extremely low. Other parameters like DVT, myocardial infarction, pneumonia seem more adequate for comparison, but their rates vary according to the procedure and not just type of anesthesia.

The physiological response to the stress of surgery or "surgical stress response" involves release of local and central mediators leading to increased levels of, among others, cathecolamines, cortisol, aldosterone and renin. It is also frequently associated with hypercoagulability, immune response depression and protein wasting. The release of local tissue inflammatory factors like cytokines and interleukins can be partially blocked by non-steroidal anti-inflammatory drugs and peripheral nerve blocks using local anesthetics. The central response, responsible for the release of cathecolamines and cortisol, can only be blocked by neuraxial blocks using local anesthetics. Determination of hormonal markers for stress can be demonstrated after general anesthesia and after certain regional anesthesia techniques. However, its impact on morbidity has not been clearly established. If physiological parameters are measured (e.g., PO2, O2 sat) the values obtained are frequently better (at least in the short term) after regional than general anesthesia. However, the real impact that better postoperative physiological parameters have on morbidity is not clear.

Nonetheless, there seems to be some agreement that regional anesthesia improves the outcome of selective surgical procedures in a number of different ways, including decreased rates of DVT, PE and blood loss.

Surgeries most associated with improved outcome after regional anesthesia include:

1. Hip surgery (hip fracture surgery and total hip arthroplasty): rates of DVT, PE and blood loss are reduced after neuraxial anesthesia. The mechanism is unknown, but may involve better peripheral circulation and less stasis.
2. Total knee arthroplasty: rates of DVT and PE are lower with neuraxial anesthesia.
3. Prostatectomy: similar reduction rates in DVT and PE and may also involve better peripheral circulation and decreased venous stasis.
4. Peripheral vascular surgery: epidural anesthesia and postoperative epidural analgesia have shown to improve graft patency after peripheral vascular surgery, but does not seem to improve outcome after intra-abdominal vascular surgery. Mechanism is not clear. Improve runoff due to vasodilatation or preservation of normal coagulation has been mentioned.
5. Colon surgery: postoperative thoracic epidural analgesia with local anesthetics has shown to enhance colonic activity after colon resection. If narcotics are used in conjunction with local anesthetics this beneficial effect is lost.

Procedures where regional anesthesia has not shown benefits as compared to general anesthesia include:

1. Upper abdominal and thoracic surgery, this is de spite the fact that better pain scores and times to extubation after regional anesthesia can be demonstrated.
2. Upper and lower extremity surgery, even though the patients receiving regional anesthesia may have a higher degree of satisfaction, better pain control and fewer side effects like nausea and vomiting, especially immediately after surgery. This difference rapidly disappears at 24 h.

In December 2000 Rodgers et al from New Zealand published a meta-analysis comparing outcome after regional and general anesthesia. The authors reviewed the literature prior to 1997

looking for randomized trials with or without use of neuraxial anesthesia (spinal or epidural). A total of 141 trials comprising 9,559 patients were included in this meta-analysis. The main findings were:

1. Overall mortality was about one third less in the neuraxial group (103 deaths/4871 patients versus 144/4688 patients, P=0.006). This decrease was observed regardless as to whether neuraxial was used alone or in combination with general anesthesia.
2. DVT decreased by 44%
3. PE decreased by 55%
4. Transfusion requirement decreased by 50%
5. Pneumonia decreased by 39%
6. There were also reductions in myocardial infarction and renal failure.

The authors concluded that neuraxial blocks "reduce postoperative mortality and other serious complications", adding that it was not clear whether these effects were due "solely to benefits of neuraxial blockade or partly to avoidance of general anaesthesia".

Meta-analysis has the advantage of pooling large number of patients making it possible to study rare or infrequent clinical events. However, it also means putting together trials from different institutions and in many cases may involve different countries and cultures. It remains to be seen whether these promising results can be duplicated, and whether they could apply more broadly to regional anesthesia beyond neuraxial blocks (i.e., peripheral nerve blocks).

Other authors, like Christopher Wu from Johns Hopkins, have shown the benefits of regional over general anesthesia, when non-traditional outcomes are measured. These outcome parameters include patient satisfaction (including analgesia, prevention of nausea and vomiting and discharge readiness), ability to undergo physical rehabilitation, and cost. These so-called "soft" parameters are very important in today's cost-conscious practice.

If the only benefit that regional anesthesia could offer were pain control, I believe it would be in itself a powerful reason to justify its use because of its great impact on patient satisfaction and its potential benefit on rehabilitation.

Airway and regional anesthesia

For some anesthesiologists managing a patient with a difficult airway almost always means securing it. This approach negates the benefits that regional anesthesia can provide when judiciously used. Evidence is lacking to support the superiority of neither approach.

We believe, that regional anesthesia, with its capacity to produce safe and dense surgical anesthesia with minimal physiological derangements, should be carefully contemplated, on a case by case basis, in all kind of patients, including those with potential difficult airway. This does not mean that the anesthesiologist should not be prepared at all times to manage the airway, and have at his/her immediate disposal all necessary equipment and personnel to do it. It is important to emphasize also, that attempting to secure the airway in all patients is not completely devoid of risks and could in itself lead to severe morbidity in some cases.

In our practice we routinely provide regional anesthesia to patients with challenging airways. These patients include, among many others, the obese, as well as trauma patients wearing halos and cervical collars. These patients are assessed individually. The discussion needs to involve the patient and the surgeon and must take into account the anesthesiologist's

expertise and familiarity with regional anesthesia. If a regional anesthesia option is selected, a backup plan, that can be readily implemented, must be available at all times.

References

1. Liu SS, Carpenter RL, Neal JM. Epidural anesthesia and analgesia. Their role in postoperative outcome. Anesthesiology 1995; 82:1474-1506
2. Sharrock NE: Risk-Benefit Comparisons for Regional and General Anesthesia, In: Finucane BT (ed), Complications of Regional Anesthesia. New York, Churchill Livingstone, 1999, pp 31-38
3. Neal JM, McDonald SB. Regional Anesthesia and Analgesia: Outcome and Cost Effectiveness. In: Neal JM, Mulroy MF, Liu SS (eds), Problems in Anesthesia, Philadelphia, Lippincott, Williams & Wilkins, 2000, pp 188-198
4. Neal JM: Regional anesthesia and Outcome. In: Rathmell JP, Neal J M, Viscomi CM (eds), Regional Anesthesia, The Requisites in Anesthesiology, Philadelphia, Elsevier Mosby, 2004, pp 164-170
5. Rodgers A, Walker N, Schung S et al. Reduction of postoperative mortality and morbidity with epidural or spinal anaesthesia: results from overview of randomized trials. Br Med J, 2000; 321: 1493-504
6. Wu CL, Fleisher LA. Outcomes research in regional anesthesia and analgesia, Anesth Analg 2000; 91: 1232-1242
7. Urban MK: Is Regional Anesthesia Superior to General Anesthesia for Hip Surgery?, In: Fleisher LA (ed), Evidence-Based Practice of Anesthesiology. Philadelphia, Saunders, 2004, pp267-269
8. Iohom G, Shorten G: Outcome Studies Comparing Regional and General Anesthesia. In: Finucane BT (ed), Complications of Regional Anesthesia, 2nd edition. New York, Springer, 2007, pp 39-52