Management and monitoring of conduction anesthesia

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What (if any) considerations are unique to the management and monitoring of conduction anesthesia in comparison to general anesthesia? The author answers this question, stressing the importance of preoperative evaluation and medication, judicious preventive management, and maintenance of the respiratory and circulatory systems. This is the second in the series on conduction anesthesia papers that were presented at the 44th AANA Annual Meeting and Professional Sessions held during August, 1977 in Hollywood, Florida.

Much has been written about and is contained in current literature which stresses the need and importance of thorough and complete physiological and psychological preparation of the preoperative surgical patient. The same preoperative preparation, evaluation, and considerations must generally be provided for the patient, regardless of whether a general or conduction (regional) anesthetic is to be administered. The psychological requirement becomes considerably more obvious for the patient being prepared for surgery with an anesthetic by the regional route.

Preoperative visit and evaluation

The relative importance and value of a preoperative visit by a member of the anesthesia staff whether for a general or regional anesthetic cannot be stressed enough. It is essential that the anesthetist visit the patient in order to establish a degree of rapport and thereby possibly increase the patient's confidence in the anesthesia care team. This constructive reassurance may help the patient to understand more adequately the type of anesthetic being planned and considered, the reasons for the choice, and how it will best be administered.

This increased understanding can have a distinct advantage as to how the patient accepts his anesthesia. It also should help to decrease the patient's anxiety and fears, possibly allowing for a decreased dose of premedication and providing for a quiet, cooperative, more relaxed and receptive patient. Aside from decreasing the patient's fears, the preoperative visit can assist the anesthetist in making a complete physiologic evaluation of the patient's status.

A thorough preanesthetic note should be written on all preoperative cases. It should include a preanesthetic evaluation, a review of systems, the description provided to the patient of the specific anesthetic technique, as well as an explanation of the risks and complications of the technique. It is important to note at this time whether the patient appears to understand the risks and complications and whether he or she accepts the anesthetic techniques proposed.

Physiologic evaluation

When making a preoperative visit
to the patient, the anesthetist personally can evaluate the physical and emotional as well as the physiologic aspects and concerns. Only after studying the patient’s chart, including the history and physical, laboratory data and reports, and a review of systems can the anesthetist make an adequate evaluation on the patient. Utilization of this acquired knowledge, along with taking into account the type of surgery proposed, can assist the anesthetist in determining if the patient is a reasonable candidate for a regional anesthetic.

Specific areas of consideration include, but are not restricted to, the patient’s cardiovascular, respiratory, musculoskeletal, and central nervous systems along with his or her mental competency and peripheral neuromuscular status. A review of significant pathophysiologic conditions and changes in the heart and circulation, the brain, kidney, liver, and other organ systems is vital. Prescription medications that many patients are now taking may preclude the use of regional anesthesia, or in some manner, adversely affect the course of surgery or anesthesia. Some of the preparations may be related to anticoagulant, tranquilizer, steroid, or antihypertensive therapy.

**Purposes for conducting a preanesthetic evaluation**

A preanesthetic evaluation should elicit the advantages and disadvantages of spinal anesthesia for the proposed surgery.

The evaluation should serve as a vehicle for gaining more pertinent information about the patient that may not be common knowledge or be recorded on the record, or that may not even be considered specific to anesthesia interests, such as previous anesthetic experiences and problems, drug allergies and sensitivities, prolonged drug therapy (including the name of drug and duration of time taken), history of neurologic pathology, meningitis, or previous back injury.

Finally, the evaluation should serve to relate the patient's status and proposed surgery to the indications and contraindications for regional anesthesia.

**Preoperative medication**

Preoperative medication need not be any different for regional or general anesthesia, the considerations are the same; use what has worked best in the past and for whatever purpose you want to achieve. Some anesthetists may con-

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**Table 1**

Advantages of a subarachnoid block

1. Less toxic to major organ systems
2. Preserves spontaneous respirations
3. Inexpensive
4. Minimal equipment required
5. Decreased incidence of aspiration
6. Ideal for patient who objects to a general anesthetic
7. Provides a relaxed abdomen, constricted intestines
8. Eliminates—coughing, bucking, stormy emergence
9. Minimal physiological disturbance
10. Wound bleeding reduced
11. No risk of explosion

**Table 2**

Disadvantages of subarachnoid block

1. More strain on cardiovascular system with hypotension
2. Disliked by patients
3. Post-spinal headache
4. Does not reduce incidence of post-op chest complications

**Table 3**

Indications for subarachnoid block

1. Vascular emergencies of lower extremities
2. Lower abdominal or extremity procedures below T8 level
3. Full stomachs—generally emergencies
4. Obstetrical deliveries—abdominal, vaginal
5. Urologic procedures
6. Renal, hepatic, metabolic diseases
7. Varied positional surgical procedures—prone, lateral, knee-chest
8. Patient preference
9. Differential diagnostic procedures
10. Dislocated hip
consider a heavy premedication to render a patient quiet and cooperative. There are some patients who will only agree to regional anesthesia if they are assured of heavy premedication. Lighter premedication may be indicated to allow for a more cooperative patient; this is especially true if the patient’s level of consciousness is important to determine dermatomal levels or paresthesias upon needle insertion.

The selection and choice of a premedication again is up to the anesthetist and the benefits derived thereof. A combination of narcotic and tranquilizer generally works well and may be given with or without an anticholinergic drug. Use of atropine may decrease the incidence of nausea and vomiting by diminishing the parasympathetic effect of spinal anesthesia on the intestine. Premedication should be reduced or omitted in the geriatric, parturient, or poor risk patient. Remember, it is always possible to administer additional sedation, tranquilization, or analgesia intravenously in the operating room under controlled conditions.

Objectives of premedication

Premedication should achieve the following: (1) reduce the level of anxiety and apprehension, (2) reduce the undesirable parasympathetic response produced by the parasympathetic over-ride of the sympathetic block, (3) inhibit mucosal secretions and reduce the metabolic rate, (4) produce amnesia, tranquility, and sedation, (5) produce analgesia and increased tolerance to painful stimuli, (6) enhance and potentiate anesthetic agents, and (7) reduce the incidence of nausea and vomiting.

Preparation

Anesthesia equipment should be on hand and in functional order. This equipment should include an anesthesia machine or positive pressure apparatus; a source of oxygen, suction, and intravenous therapy; an EKG monitor; and drugs such as sedatives, vasopressors, and muscle relaxants. Preparation should also be made and equipment be available in the event that the block should fail or be inadequate, or that emergency measures are needed for resuscitation. Thiopental or diazepam should be available to treat any local anesthetic toxic reaction. Drugs and equipment for general endotracheal anesthesia or airway support should always be close at hand.

Monitoring the patient

The patient undergoing a surgical procedure with a regional anesthetic should be monitored in the same manner and with the same frequency and accuracy as the patient anesthetized with
a general anesthetic. The usual vital signs (pulse, respirations, and blood pressure) should be monitored and recorded on a standard anesthetic record by an anesthesia team member. The complications which can occur under spinal anesthesia may be prevented or reduced if adequate attention is directed toward preventing them or the prodromal signs of impending catastrophe are recognized. These signs may be manifested by minor changes in the patient's color, pulse rate or rhythm, fluctuations in blood pressure, or the onset of light headedness or nausea. All patients, where indicated by age, history or electrocardiogram, should be monitored by continuous EKG.

The following factors are of prime significance in the management of a patient under spinal anesthesia. Circulation is of prime importance in maintaining adequate blood pressure so as to sustain perfusion and normal physiologic function of major organs. The chief effect is hypotension due to a preganglionic blockade of sympathetic fibers running with the anterior roots across the subarachnoid space. The resulting vasodilation markedly reduces the peripheral resistance in accordance with the law of Poiseuille, whereby the velocity of flow in a tube is proportional to the cross-sectional area of the tube.

With a block below the T6 level, you can expect a 20% reduction in blood pressure. With a block above T6, you can expect as much as a 50% drop in blood pressure. Thus, the higher the level of sympathetic blockade, the greater the potential for hypotension. After the administration of the spinal in the pregnant patient, the anesthetist should move the uterus off the vena cava by left-uterine displacement. This is best accomplished by the use of a roll placed under the patient's right hip.

There are six different ways in which intradural spinal blocks can affect and influence the cardiovascular system. They are: (1) vasodilatation of resistance and capacitance vessels, (2) sympathetic blockade of cardiac efferent sympathetic fibers from T4 to T1, resulting in bradycardia and affecting cardiac output, (3) Bainbridge reflex bradycardia (which causes increased pressure in the vena cava and right auricle and a slowing of the pulse), (4) influence of Marey's law causing tachycardia (hypotension, low volume pulse and resultant tachycardia), (5) absorption of the regional anesthetic drug into the circulation resulting in depression of vascular smooth muscle and beta adrenergic blockade of the myocardium with a fall in cardiac output, and (6) adrenaline effect when the drug is used (following absorption, the result is beta stimulation and an associated rise in cardiac output and a reduction in peripheral resistance).

**Treatment or prevention of vasodilatory hypotension**

To treat or prevent vasodilatory hypotension, an intravenous infusion of 5% dextrose in water or balanced salt solution should be started using a large-bore needle for rapid infusion of intravenous fluids should it be necessary. Just prior to the onset of the block, the rapid administration of 500-700 ml of this solution can easily be tolerated by the average, healthy patient. Furthermore, it is highly advocated and proves most beneficial in compensating for the vasodilatory effects of a spinal block. Elastic stockings or ace bandages applied above the knees will (1) decrease venous stasis and peripheral pooling due to the sympathetic blockade and loss of muscle tone in the lower extremities, and (2) improve peripheral circulation and venous return to the heart.

Vasopressor therapy may be initiated prophylactically prior to the administration of a subarachnoid block. Ephedrine 12.5 mg IM is generally considered the drug of choice, since its direct and indirect effect will work centrally and peripherally to help support the blood pressure. Additional increments can be given IV if a more rapid
onset of action is required. Ephedrine is advocated as the best choice in obstetric cases, since it reduces uterine blood flow the least of all vasopressors.

Supplemental oxygenation (a 3-5 liter flow) via nasal prongs, disposable oxygen masks, or through the anesthesia circuit can be used as prophylactic support both in anticipation of hypotension and, most certainly, once it occurs.

Adequate respiratory movement must be maintained by means of spontaneous, assisted or controlled respiratory ventilation so as to assure satisfactory oxygenation of vital tissue and prevention of hypercarbia. The phrenic nerve supplying the diaphragm arises from the anterior roots of C3, 4, 5 and will not be influenced by a routine block. During normal inspiration, the diaphragm and the 5th-9th intercostals are active. Inspiratory reserve is not affected by subarachnoid block. Expiratory reserve is decreased by 50% with a level of T4 or higher, and pulmonary blood flow is decreased due to a drop in right atrial filling. Prophylactic administration of supplemental oxygenation, along with the use of vasopressors, is advocated strongly for regional block patients. Oxygen administration helps to combat both tidal and stagnant hypoxia by increasing the oxygen tension of the partially unsaturated venous and arterial blood.7

When hypotension without marked paralysis of the muscles of respiration is present, oxygen want is caused by stagnant hypoxia. Early signs and symptoms of oxygen want are yawning, nausea, vomiting, apprehension, fear, restlessness, dizziness, and headache. These signs are referable to tissue hypoxia of the central nervous system due to diminished blood pressure. Oxygen want caused by diminished respiratory excursion with progressive muscular paralysis is termed tidal hypoxia.7

During the first 15 minutes after a block is administered, it is necessary to closely observe the patient for breathing difficulties and to monitor the dermatonic levels for onset of an unnecessarily high spinal. Occasionally, patients may become apprehensive and begin to gasp in what appears to be an apparent oxygen want, even though they have adequate respiratory excursion. This syndrome should be evaluated carefully but may be due to the patient's unnecessary apprehension.

Table 5

| Essentials for treatment or prevention of vasodilatory hypotension |
|------------------------|-----------------------------------------------|
| **Intravenous therapy** | 
1. Large bore IV 16-gauge
2. Pre-load, 500-700 ml physiologic salt solution
3. Rapid infusion additional fluid if necessary |
| **Venous stasis** | 
1. Ace wraps or stockings to legs
2. Elevate legs if B/P ↓ |
| **Vasopressor therapy** | 
1. Ephedrine 12.5 mg prophylactic IM
2. Ephedrine 12.5 mg IV push
3. Neo-Synephrine ® drip 10 mg/250 ml fluid, 2-5mg IM
4. Vasoxyl ® 5-10 mg IM
5. Aramine ® 1-2 mg IM |
| **Prophylactic oxygenation for all subarachnoid blocks** | 
1. Nasal prongs 4-8L/M 25-35%
2. O2 rebreathing mask c bag 8-15L/M 40-70%
3. O2 mask 8-15L/M 30-60%
4. NRB c bag & one-way valve 8-15L/M 40-95%
5. Aerosol mask—large bore tubing 10-15L/M 40/70/95% |

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The patient in eminent danger with a high or total spinal may show signs of oxygen want, cyanosis, cervical or supraclavicular retraction, and may complain of tingling or numbness in the fingers. With a total spinal, the patient goes to sleep from sensory deprivation and possibly from hypoxia to brain cells. This patient should be reassured, rapidly be put to sleep, and be given airway support via mask or intubation. Maintenance may be controlled with thiopental, nitrous oxide, and oxygen, with assisted or controlled respiration.

Maximum protection against surgical reflex activity must be assured by supplementing spinal analgesia with narcotic analgesia. This reflex activity may also be blocked by the administration of parasympatholytic agents, such as atropine or glycopyrrolate (Robinul®).

The patient should be maintained in maximum comfort and be kept at ease; this includes positioning in such a manner so as to avoid interference with vital functions or to prevent excessive pressure on the peripheral nerves or other structures. The use of medication to produce somnolence, sedation, or amnesia is most beneficial to patient comfort.

Incidental complications of regional block

One complication of sympathetic blockade is vasodilatation. Decreased vascular tone and increased vascular space favor heat loss; and in a cool operating room, the patient’s temperature could drop significantly. A patient under regional block should have his temperature monitored as judiciously as the patient under general anesthesia. Absence of sweating may increase the likelihood of temperature rise. Since sweating is controlled by the sympathetic nervous system, this physiologic mechanism is interrupted by the subarachnoid block.

The use of anticholinergic agents further adds to the retention of excess body heat. By virtue of the lack of heat and temperature sensation in the regional blocked patient, it is imperative that any use of external heat be monitored very carefully so as not to inadvertently burn the patient in the anesthetized area.

Although not truly monitored, nausea and vomiting are a common occurrence with which to contend. Nausea is generally induced by various afferent stimuli involving the upper gastrointestinal tract. In contrast, vomiting is usually due to stimulation of the vomiting center. Preganglionic sympathetic fibers from T5 to L1 tend to slow intestinal peristalsis; parasympathetic innervation becomes dominant, sphincters relax, and the small bowel may dilate.

Hypotension and hypoxia should be controlled and avoided; if they occur, they should be treated with fluids, vasopressors, and oxygen. Any psychic or emotional stimulus for nausea and vomiting may be decreased through adequate premedication and the use of tranquilizers with antiemetic properties, such as promethazine (Phenergan®), hydroxyzine (Vistaril®), and droperidol (Inapsine®). The use of anticholinergic drugs to block vagal and parasympathetic responses also may be helpful.

Immediate postoperative care of the regional block patient

The patient should be moved into bed by a sufficient number of individuals so as to maintain proper support and body alignment. Careful movement of the patient will ensure minimal physical damage or discomfort, but most important, will prevent postoperative hypotension from sudden changes in position due to hydrostatic instability.

If the patient has had continuous oxygen support during the surgical procedure, it should be discontinued 10-20 minutes before the patient leaves the operating room. This is done to evaluate the patient’s requirement for continued therapy.

The higher the level of sympathetic blockade, the greater is the potential for hypotension. Vasopressors may be employed prophylactically in the initial
stages of the block; however, these should be discontinued as soon as possible. If the pressure continues to fall, after discontinuing vasopressor therapy, an underlying cause should be determined and proper treatment instituted. In any event, vasopressor therapy should be discontinued 30 minutes prior to removal of the patient from the operating room so as to evaluate cardiovascular stability.

Intravenous therapy should be maintained into the postoperative period until it is determined that cardiovascular stability is intact and that the patient has dissipated the block. Continued management should be extended into the recovery period, depending on the patient's status and condition.

Summary

The importance of the preoperative management of the patient prior to the administration of subarachnoid block (regional) anesthesia cannot be overemphasized. The following points are detailed:

1. The necessity of making a preoperative visit and evaluation, at which time a rapport is established with the patient and the anesthetic course is planned and discussed.

2. The essentials of the preoperative physiologic evaluation and its considerations with respect to the proposed regional anesthetic.

3. The considerations for the appropriate preoperative medication and its selection for the patient under the given circumstances.

The significant aspects of the monitoring and operative management of the regional block surgical patient also are highlighted:

1. The techniques and methods of monitoring and managing the patient in order to detect prodromal signs of impending catastrophe.

2. The maintenance of adequate circulation and blood pressure so as to retain at least basic physiologic functions by the administration of appropriate fluids and vasopressor agents when necessary.

REFERENCES


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