

Anaesthesia for chronic spinal cord lesions

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Increasing numbers of patients with spinal cord injury present for surgery care. The most important perioperative risks are autonomic dysreflexia, bradycardia, hypotension, respiratory deficiency and muscle spasms. Patients with low, complete lesions, undergoing surgery below the level of injury, may safely do so without anaesthesia. An anaesthesiologist should be present to monitor the patient in this condition. General anaesthesia of sufficient depth is effective at controlling spasms and autonomic dysreflexia but hypotension and respiratory dysfunction are potential risks. There is a growing consensus that techniques of regional anaesthesia are safe, effective and technically simple to perform in these patients. *Hippokratia 2006; 10(1):28-31*

Keywords: anaesthesia, complications; trauma, spinal cord.

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Dramatic improvements in the care of spinal cord injured patients have been achieved over the last few decades. Overall mortality decreased from over 80% at the time of World War I to less than 2% by the early 1980s. The implications of increased survival are an increase in the prevalence of spinal cord injuries, an increase in the numbers of patients presenting for elective surgery and an ever increasing number of spinal cord injured patients who develop further medical conditions associated with normal ageing. Although the majority of spinal cord injured patients currently undergo elective surgery in specialised spinal units, the appearance of such patients on operating lists of other hospitals is likely to increase. The distribution of surgical speciality is given in Fig. 1. Urological procedures are by far the most common, followed by surgical treatment of pressure sores, orthopaedic surgery and neurosurgery. Operations of the 'other' category include a wide variety of procedures like hysterectomy, third molar extraction, laparotomy and electroconvulsive therapy¹.

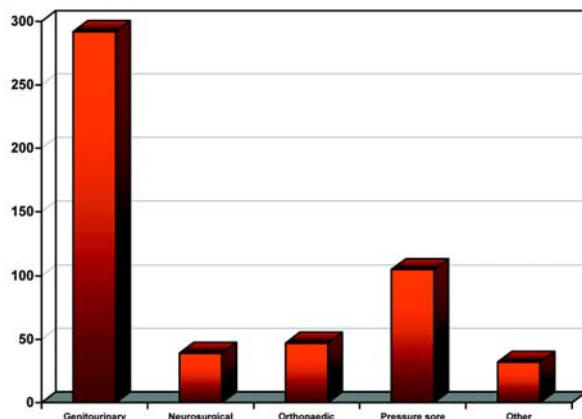


Figure 1 Surgical category for procedures in survey patients.

Anaesthetic Assessment, Precautions and Management

The assessment of patients before surgery should focus on the following points:

- Sensory level compared with surgical field.
 - Complete or incomplete lesion?
 - Time since injury: spinal shock or reflex phase?
- Risk of hyperkalaemic response to suxamethonium 3 days – 9 months.
- Previous anaesthetic history: especially use of “standby” anaesthesia. Previous anaesthetic records should be located.
 - Airway and neck movements: particularly after cervical spine surgery.
 - Respiratory assessment: particularly high lesions. History of respiratory tract infections, intensive care unit admissions, etc. Tracheostomy past or present. Vital capacity should be measured in all patients with lesions above C7. When in doubt, chest X-ray and arterial blood gases should be ordered.
 - Cardiovascular assessment: baseline blood pressure, heart rate. History of postural hypotension. History of autonomic dysreflexia – suggested by symptoms of headache and sweating when bladder full.
 - Musculoskeletal: spasms, contractures, pressure sores.
 - Medications: especially anticoagulants, baclofen and dantrolene.
 - Allergies.
 - Full blood count: anaemia is common, especially in the presence of pressure sores or chronic sepsis.
 - Urea and electrolytes: to exclude renal impairment.
 - Liver function tests: especially where there is chronic sepsis.

Sedative premedication is not commonly used. Those patients with higher lesions may be sensitive to standard

premedication doses, although delayed gastric emptying may reduce the effect of oral drugs. In some centres, pre-operative medication is given to prevent autonomic dysreflexia, e.g. oral nifedipine 10 mg, 1 h before surgery. Spinal cord injury is associated with renal impairment, which may result in reduced clearance of some drugs².

“Standby Anaesthesia”

The loss of sensation caused by spinal cord injury means that many patients could undergo surgery without anaesthesia and without feeling pain from the operative site. Approximately one-fifth of cases are conducted with this technique of ‘standby anaesthesia’. The choice of this technique depends on various factors:

- Site of surgery and level/completeness of lesion.
- Likelihood of autonomic dysreflexia: autonomic dysreflexia is more likely in patients with cervical lesions and in those who have a past history of the phenomenon, either during surgery or in daily activities.
- Likelihood of spasms: patients who are frequently troubled by spasms usually require anaesthesia for control during surgery.
- Patient’s willingness.
- Previous anaesthetic history: many spinal cord-injured patients have had multiple procedures and may regularly undergo surgery without anaesthesia.

Local infiltration anaesthesia is useful to allow surgery to take place in areas of incomplete sensory deficit, particularly for body surface surgery. Local anaesthetic solutions containing adrenaline should be avoided because of the greater sensitivity of the spinal cord-injured patient to catecholamines. For all operations on spinal cord-injured patients, regardless of anaesthetic technique, it is recommended that the usual precautions are taken, such as the necessary presence of an anaesthesiologist, venous access is secured and monitoring is in use throughout the procedure³.

General Anaesthesia

There are no special considerations that favour the use of any particular induction agent (Fig. 2). Ketamine

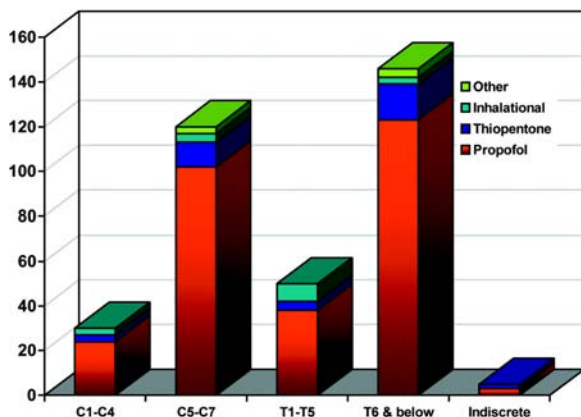


Figure 2 Induction agent used in survey patients receiving general anaesthesia, grouped by level of lesion.

carries the theoretical risk of worsening muscle spasm. No depolarising neuromuscular blocking agents are commonly used to facilitate tracheal intubation but their use beyond an initial intubating dose is rarely required. Anecdotal evidence and personal experience suggest that the doses required are lower in spinal cord-injured patients^{2,3}. Most authors agree that suxamethonium may be used safely in the first 72 h after injury and few would deny that elective use of suxamethonium is safe after 9 months^{4,5,6}.

A wide-bore intravenous cannula is recommended. It is common practice to give 500-1000 ml of crystalloid before induction to reduce the likelihood and severity of hypotension after induction. All fluid losses should be diligently replaced. It is important that basic monitoring devices are applied before induction and remain in place until after recovery. Invasive monitoring is not considered necessary on a routine basis. Central venous pressure measurements are difficult to interpret but pulmonary artery wedge pressure measurement may be a useful guide to fluid administration during major surgery in compromised patients².

Rapid sequence induction is not routinely employed for elective surgery. Although gastric emptying is slower in spinal cord-injured subjects, no significant increase in the incidence of regurgitation of gastric contents has been demonstrated. The technique of airway management is largely the same as it is for non-spinal cord-injured patients. The laryngeal mask airway is the most commonly used technique in all categories. Theoretical reservations that this should lead to an unacceptable incidence of aspiration have not been borne out. Tracheal intubation may be difficult in those with fused cervical vertebrae and bradycardia may occur on intubation, especially during the phase of spinal shock. This can be prevented by the prior administration of atropine^{7,8}.

Several authors have pointed out the advantages of intermittent positive pressure ventilation; however, positive pressure ventilation causes a greater drop in blood pressure in tetraplegic patients, particularly when combined with myocardial depressant drugs like halothane. Spontaneous ventilation is usually appropriate for short operations. Many patients with cervical lesions have borderline lung function and hypoxia and hypercapnia are likely if some patients are allowed to breathe spontaneously^{2,5,9}.

The threat of pressure sores makes generous padding at all pressure points essential. Silicone pads and pillows are preferred. Limbs should be well secured to prevent injury from spasmodic movements. Spinal cord-injured patients have a greatly reduced ability to generate heat after surgery. For this reason, prevention of hypothermia during surgery is of great importance. Humidification, fluid warming, superficial hot air blankets and operating in a warm ward are all recommended².

Where autonomic dysreflexia occurs during surgery, management should begin with removal of the precipi-

tating stimulus, if possible. Most episodes appear to be brief and self-limited and in most cases no specific treatment is required. Dysreflexia occurring under general anaesthesia is best treated with increasing anaesthetic depth in the first instance. Where drug therapy is required, nifedipine and labetalol are used most commonly, though propranolol, midazolam, spinal anaesthesia and transdermal glyceryl trinitrate patches were all used on survey patients. Spasms can occur during general anaesthesia if the patient is too lightly anaesthetised and can usually be managed by increasing the anaesthetic depth. Muscle relaxants are rarely required for this purpose⁹. Priapism may complicate urethral instrumentation in males. This response may be abolished by deepening the anaesthesia or by careful administration of metaraminol¹⁰.

Special attention to body temperature and respiratory function is required after general anaesthesia. Tetraplegic patients are best-nursed supine. Autonomic dysreflexia may occur in recovery and may require drug treatment^{2, 9}.

Regional Anaesthesia

Spinal anaesthesia has been recommended^{3, 8, 11}, especially for urological surgery. Its advantages are the reliable prevention of autonomic dysreflexia and avoidance of some of the hazards of general anaesthesia. However, it may be impossible to determine the level of the block and it is not known whether the usual dose/response characteristics are seen in spinal cord injury patients. Technical difficulties may occur, as a result of kyphoscoliosis, previous spinal surgery, inability to flex the spine due to spasms and bony deformities. The recommended dose for routine use in urological surgery is 1.5-2.0 ml of hyperbaric 0.5% bupivacaine^{3, 9}.

The use of epidural anaesthesia is widely reported as being less satisfactory. Failure to block sacral segments and missed segments resulting from distortion of the epidural space are the most likely explanations, together with an inability to assess the block accurately. Another problem is the difficulty of meaningfully assessing the effect of a test dose, which could lead to a total spinal. The only common use of epidural anaesthesia in spinal cord-injured patients remains the prevention of autonomic dysreflexia during labour^{9, 12, 13}.

Brachial plexus block is a useful means of avoiding general anaesthesia for upper limb surgery. The axillary approach is probably preferable to the supraclavicular approach, given that a pneumothorax is more than usually hazardous in spinal cord-injured patients with borderline lung function. In patients with cervical lesions, a nerve stimulator may give neither the sensation of paraesthesia nor the familiar pattern of twitching in the hand, especially if roots of the brachial plexus have been damaged in the original accident².

Spinal Patients and Obstetrics

McCluer¹⁴ found that of 227 women with spinal cord

injury, 76% of paraplegics and 56% of quadriplegics were sexually active. The incidence of pregnancy in spinal cord-injured women is increasing⁷⁵ and maternal age at delivery is falling^{15, 16}.

The physiological changes that occur as a result of spinal cord injury are exaggerated by pregnancy. With high lesions, orthostatic hypotension may be prominent and further reductions in respiratory reserve may occur. Increased minute volume and oxygen demand, along with a reduction in functional residual capacity and poor cough may precipitate pneumonia or respiratory failure. Menstruation often ceases for 6-18 months after injury but usually resumes and fertility in spinal cord-injured women approaches normal⁸.

Urinary tract infection is extremely common in the spinal cord-injured parturient and is strongly associated with the use of catheters. Premature labour is commoner in spinal cord-injured, parturient particularly with high thoracic and cervical lesions and in many cases may be precipitated by urinary tract infection. The anaemia commonly seen in spinal cord injury often worsens during pregnancy and is associated with the development of pressure sores. Such sores can arise after less than 2 h of sustained pressure. Aggressive prevention and treatment of anaemia is recommended, with transfusion or iron supplements. The risk of thrombo-embolic complications is further increased during pregnancy¹⁷.

Ideally all spinal cord-injured patients should be seen antenatally by an anaesthetist to discuss intrapartum analgesia and make a respiratory assessment. Parturients with spinal lesions below T10 are likely to experience pain during labour and those with lesions between T5 and T10 may at least be aware of contractions. Uterine contractions are a potent trigger for autonomic dysreflexia and the incidence is greater with higher lesions. Autonomic dysreflexia is reported up to 85-90% of parturients with lesions above the T6 level. In many cases, the development of autonomic dysreflexia is the only clue to the onset of labour. Intrapartum morbidity appears to be related to the degree of hypertension. A variety of techniques have been employed to control autonomic dysreflexia in labour, including a range of antihypertensive agents and general anaesthesia, but the measure employed most commonly is epidural analgesia. Introducing an epidural catheter may be difficult because of spasms and distorted anatomy due to spinal cord injury or difficulties with patient positioning. Monitoring the level of the block is often difficult but the adequacy of the block can be judged by the quality of blood pressure control. Epidural block is not commonly associated with hypotension, provided there is appropriate fluid loading and the block is established slowly. Autonomic dysreflexia may occur up to 48 h after delivery and it is often appropriate to leave the epidural catheter in situ for this time. The headache and hypertension of pre-eclampsia may occasionally be mistaken for that of autonomic dysreflexia. If epidural anaesthesia fails to control blood pressure, nifedipine, hydralazine

or verapamil may be given. These drugs have no adverse effects on the uterus. As a last resort, general anaesthesia and caesarean section are occasionally required¹⁸.

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