Anaesthetic Requirement in Spinal Cord Injured Patients undergoing Operation below the Level of Cord Injury.

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ABSTRACT

BACKGROUND:

Anaesthesia in spinal cord injured (SCI) can be hazardous. In complete injuries above T6, the abnormal state of the respiratory and the cardiovascular systems pose special problems. The objective of this study therefore was to evaluate the anaesthetic requirements in patients with complete SCI undergoing operation below the level of the cord lesion.

PATIENTS AND METHOD:

The medical records and the operation notes of all patients with complete SCI who underwent surgical operations between January 2001 and December 2005 were reviewed. Information about their demographics, level of injury, indications for operation, type of operation done and the type anaesthesia used were collated. The choice anaesthesia was guarded by the proximity of operation site to the level of cord transaction and by patient's preference. The pre-operative and intra-operative blood pressure, pulse rate and respiratory rate were used to monitor cardiovascular and respiratory responses.

RESULTS:

They were twenty-eight, all male except one. The age range was 13-67 years with an average of 32 years. The level of cord lesion varied. The thoracic spine was most involved followed by the cervical spine.

The most common indication for operation was pressure sore.

The anesthetic requirement varied, and ranged from general anesthesia (GA) to no anaesthesia at all. Three broad groups were observed: no anaesthesia; sedation with diazepam; and general anaesthesia. There was no remarkable change in the blood pressure readings in the three groups. However, three patients who had GA and whose operation sites were in the twilight zone had remarkable changes in the pulse and respiratory rates.

CONCLUSION:

Even though spinal patients are insensate below the level of their injury, significant proportions that need operation below the level of cord lesion require anaesthesia.

KEYWORDS: spinal cord injury, surgery, anaesthesia.

INTRODUCTION

Anaesthesia in spinal cord injured (SCI) can be hazardous. In complete injuries above T6, the abnormal state of the respiratory and the cardiovascular systems pose special problems-sympathectomy, unopposed vagal discharge, hypotension, bradycardia etc.

A number of drugs routinely used in anaesthesia may be inappropriate in SCI especially in acute phase. The use of suxamethonium in cervical spine injury is inapt; the fasciculation of the neck muscles, which are in spasm following injury, can cause displacement of the fracture. Secondly, suxamthonium in SCI is known to be associated with hyperkelemia. This condition has been shown to be potentially lethal in SCI .The pathophysiology appears to be a hypersensitive reaction of skeletal muscles involved. This hypersensitive reaction develops gradually over 8-10 days and lasts for 8-9 months. The use any anaesthetic drug that causes myocardial depression may be hazardous in a patient with sympathectomy of spinal shock and who may have myocardial damage following the acute sympathetic discharge at the time of the injury. Also in complete cervical spine injury, there is total sympathectomy characterized by hypotension, bradycardia, and loss of temperature regulation.. With unopposed vagus innveration, the response to hypoxia is bradycardia, reversible by giving oxygen and also atropine. This bradycardia can lead to asystole [1] . The application of this knowledge allows better understanding of several important reflexes that pose great problem in anaesthesia for SCI. Therefore anaesthetic care in SCI requires anaesthetist who is familiar with these problems. Such personnel may be far between locally.

In our setting, many SCIs arrive hospital late with pressure sores. Some now live long enough for other surgical problems requiring anaesthesia to occur. The indications for anaesthesia may therefore include treatment of the primary injury; associated injuries, or complications thereof.

To the best our knowledge, no study has evaluated the anaesthetic requirement in SCI in our environment. The objective of this study therefore was to evaluate the anaesthetic requirements in patients with complete SCI undergoing operation below the level of the cord lesion.

PATIENTS AND METHOD

The medical records and the operation notes of all patients with complete SCI who underwent surgical operations between January 2001 and December 2005 were reviewed. Information about their demographics, level of injury,

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indications for operation, type of operation done and the type anaesthesia used were collated. The choice anaesthesia was guarded by the proximity of operation site to the level of cord transaction and by patient's preference. The pre-operative and intra-operative blood pressure, pulse rate and respiratory rate were used to monitor cardiovascular and respiratory responses. All the patients were starved overnight before their operation.

DETAILS OF GENERAL ANAESTHESIA

For those that required GA, intravenous dextrose containing infusion was set up for each patient and was followed with a premedication of intravenous (IV) atropine 0.01mg/kg body weight. They were induced with either IV diazepam 0.25mg/kg or midazolam 0.07mg/kg. In all the GA cases, endotracheal intubations were carried out and patient allowed the privilege of positive pressure ventilation to ensure adequate ventilation. Anaesthesia was maintained with boluses or infusion of propofol in 5% dextrose water, enough to guarantee amnesia. All patients recovered consciousness shortly after the surgery.

Patients who underwent multiple operations were counted as separated cases. Patients with incomplete injury were excluded as well as patients with incomplete records.

RESULTS

Within the five year period, there were forty nine SCI patients with surgically treatable conditions but only twenty eight consented to operations. They were all male except one.

The age range was 13-67 years with an average of 32 years. The level of cord lesion varied. The thoracic spine was most involved followed by the cervical spine. (Table ii).

The most common indication for operation was pressure sore. Flap cover was the most common operation performed. (Table iii).

The anesthetic requirement varied, and ranged from general anesthesia (GA) to no anaesthesia at all. Three broad groups were observed: no anaesthesia; sedation with diazepam; and general anaesthesia. Most patients whose operation sites were 2-3 spinal segments below the level cord received either sedation with diazepam and pentazocine or no anaesthesia. Six patients had GA. Three of these six patients had operation in the twilight zone; the other 3 had GA due to emotional over lay. (Table iv).

Four patients had operation in acute period (within 2 weeks of injury).

There was no remarkable change in the blood pressure readings in the three groups. However, three patients who had GA and whose operation site were in the twilight zone had remarkable changes in the pulse and respiratory rates (cases 8,10,13.) (Table i)

All GA were total intravenous anaesthesia (TIVA) based on anxiolytics and sedetohypnotics.

Table ii: Levels of injury

Cervical spine	7
Thoracic spine	11
Thoracolumbar	8
Lumbar	2
Total	28

Table iii: Indications for operation

Pressure sores Sacral Trochanteric Knee	Frequency(n) 14 8 1	Operation done Gluteal rotation flap Tensor facia lata flap Split Skin Graft(SSG)
Fracture fixation	2	Open reduction and internal fixation
Spinal decompression	3	Spinal decompression
Total	28	

Table iv: Anaesthetic requirement

Type of anaesthesia	Frequency (n)
Sedation with diazepam+ pentazocine	4
General anaesthesia	6
None	18
Total	28

DISCUSSION

Following complete transaction of the spinal cord, the patient goes through two stages- an acute spinal shock which lasts for a variable period of time ranging from few days to six weeks and chronic reflex stage. During these stages anaesthesia may be required to treat associated live threatening conditions; the spinal injury itself or complications that may arise in the course of its treatment and rehabilitation.

In cervical spine injury, there is paralysis of intercostals, which on its own reduces alveolar ventilation by 60% of tidal volume[2]. The average vital capacity of an average C5 quadriplegia with only diaphragmatic activity is 2200-2500ml [3]. The diaphragmatic activity is often subjected to mechanical splintage by gastric distension.

Also in complete cervical spine injury, there is total sympathectomy characterized by hypotension, bradycardia, and loss of temperature regulation.. Despite sympathectomy of the high lesions, the parasympathetic vagus nerve is intact being cranial in origin. The application of this knowledge allows better understanding of several important reflexes that pose great problem in anaesthesia for SCI.

In our study, most of our patients were young adults who were involved in road traffic accidents with subsequent SCI. This finding is similar to many reported findings that

Table i: case summary

s/no	Age	Sex	level of injury	Indication for surgery	Operation	Anaesth-esia	Vital signs					
							Pre-op			Intra-op		
							BP	Pulse	RR	BP	Pulse	RR
1	50	M	T10	Trochanteric sore	Flap cover	None	120/70	80	22	120/70	88	22
2	30	M	T11	Femoral #	ORIF	Sedation	100/60	80	24	100/70	85	20
3	30	M	T11	Sacral sore	Flap cover	None	100/70	80	20	90/60	82	24
4	24	F	L3	,,	,,	GA	120/80	82	22	110/70	90	20
5	24	M	T6	Sacral sore	Flap cover	None	110/80	80	20	110/80	82	20
6	24	M	T6	Troch. sore	Flap cover	None	110/70	80	22	120/70	80	20
7	18	M	C6	Sacral sore	Flap cover	Sedation	110/70	64	20	120/80	68	22
8	**51**	**M**	**T12**	**Fracture dislocation**	**Decompression+ stabilization**	**GA**	**130/90**	**90**	**24**	**140/90**	**128**	**34**
9	67	M	L4	Troch. sore	Flap cover	GA	100/60	90	24	100/70	80	24
10	**26**	**M**	**T5**	**Gunshot+ paraplegia**	**Decompression**	**GA**	**120/80**	**80**	**24**	**130/80**	**116**	**34**
11	32	M	T11	Sacral sore	Flap cover	None	100/70	80	20	100/60	84	24
12	32	M	T11	Troch. sore	Flap cover	None	100/70	78	20	120/90	92	22
13	**23**	**M**	**T12**	**Femoral #+para**	**ORIF**	**GA**	**120/80**	**86**	**20**	**130/90**	**110**	**24**
14	33	M	T7	Burst fracture	decompression	GA	110/80	80	20	120/70	90	24
15	35	M	T7	Sacral sore	Flap cover	None	130/70	94	22	120/70	80	20
16	32	M	L1	Troch.& sacral sores	Flap covers	None	100/70	80	20	100/70	84	24
17	44	M	T5	Sacral sore	Flap cover	None	110/80	86	20	-	80	20
18	40	M	T9	Sacral sore	Flap cover	Sedation	140/80	80	20	120/80	80	24
19	22	M	C7	Troch. sore	Flap cover	None	90/60	82	22	-	100	26
20	22	M	C7	Trochanteric sore	Flap cover	None	110/80	92	26	100/70	100	20
21	22	M	C7		Flap cover	None	120/60	88	20	100/60	90	22

*troch. = trochanteric
*# = fracture
*para = paraplegia

trauma is the most common cause of death and disability in people below the age of forty years.[4]
Pressure sores were the most common indication for operative intervention. This is different from results from other centres where reduction and stabilization are the commonest operation[5]. This finding may be a reflection of the fact that our SCIs are treated conservatively with prolonged immobilization. Operative intervention for the purposes of either decompression or stabilization was not commonly done in our centre.

The anaesthetic requirements vary between individual patients. Of interest is the fact that eighteen patients whose operation sites were well below the level of the cord transaction did not require any form of anaesthesia and the procedures were well tolerated. However, three other patients who earlier opted for no anaesthesia were converted to GA due to emotional breakdown in the course of the operation. Whereas some strong willed patients prefer to keep awake during the procedures, others would rather they know nothing during the procedure. Problems are encountered when patients who preferred to be awake suddenly started showing signs of distress-restlessness, uncooperativeness and emotional outburst such as tearing or frank crying. This group of patients is extremely sensitive even to some normal comments and statement. Even perineal toileting during procedure tend to cause emotional distress in some of them. General anaesthesia then becomes mandatory in these situations. This finding emphases the importance of careful patient assessment and selection. It also underscores the fact that even when patient chooses no anaesthesia and is apparently fit, adequate arrangement must be made for GA should the need arises.
General anaesthesia like in any other procedures allows the surgeon enough time to complete procedure without restriction such as dedicated by patient's factors. It also allows normal consultations, discussions and decisions as may be necessary to be carried out on the table without considerations to patient's psychology and emotions.

Total intravenous anaesthesia (TIVA) based on anxiolytics sedetohypnotics were the essential ingrendients of anaesthesia for the spinal cord injured. These agents produce anaesthesia over 90 seconds when given intravenously in a smooth gradual fashion. Maintenance of anesthesia with propofol ensures prompt recovery without hangover effect. Oxygen supplement is necessary in anaesthesized spinal cord injured since anaesthesia blunts the normal physiological response seen during natural sleep, resulting in shunts. Endotracheal intubations were facilitated with medium acting muscle relaxants like vercuronium or atracurium which may not need to be revised at the end of the operation.

The reason for the changes in the cardiopulmonary responses in three patients who had their surgery under GA is not clear. However, we observed that three of them had surgery in the twilight zone; it may therefore be that total intravenous anaesthesia did not provide adequate analgesia in this group of patients.

CONCLUSION

Even though spinal patients are insensate below the level of their injury, significant proportions that need operation below the level of cord lesion require anaesthesia.

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