

ANAESTHESIA FOR OPERATIONS IN THE VERTEBRAL CANAL *

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THOUGH it is now almost eighty years since Horsley removed the first spinal tumour I have been unable to trace a single reference in the literature to anaesthesia for this operation. The reason for this apparent neglect is to be found in the fact that on the whole laminectomy for spinal tumour is an uncommon procedure. For example, in the Manchester Neurosurgical Unit where some 200 major operations are performed each year, only 25 are laminectomies. The recent popularity of the disk operation has led to a series of articles on anaesthesia for this purpose (5, 6), but laminectomy still remains neglected. The present paper is therefore concerned primarily with this subject, although the difficulties of the disk operation will be mentioned for the sake of comparison.

Most of the patients who come to operation with a spinal tumour are bad risks (table 1). Their average age is high (table 2) and the incidence of obesity, chronic bronchitis and hypertension as complicating factors is heavy. In addition, many of them have gross muscle wasting in the lower limbs and not infrequently disturbance of bladder function with consequent urinary infection, all of which increase the risk of operation and add to the difficulty of maintaining safe anaesthesia.

The position adopted for the operation of laminectomy is far from satisfactory. The patient usually lies on his face and in consequence must lift the entire weight of his trunk every time he breathes. If his shoulders are raised on rests or a sandbag is placed under his manubrium sterni he may breathe more easily. On the other hand, if the table is sharply angled or a bar raised under his abdomen in order to undo the normal lumbar curve, the amount of disturbance of respiration produced is markedly exaggerated. This measure is necessary only during the disk operation. During laminectomy it is a surgical luxury. The lateral decubitus causes much less interference with respiration than the face down position and is of great value in dealing with poor risk patients. Those who have a longstanding fibrous and irreversible contraction of the hamstring muscles must of necessity also be accommodated in this position. When the contracture is

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due to muscle spasm it is readily abolished by a small dose of a spinal anaesthetic after which it is possible to operate on these patients in the face down position if the surgeon so desires. Another solution of the difficulty of obtaining a satisfactory position for anaesthesia for operations on the spine is to be found in the practice of operating with the patients sitting up. This is of special value in dealing with those who have cervical spinal tumours with respiratory difficulties. The surgical approach to the deeply placed cervical vertebrae is greatly facilitated. Anaesthesia does not upset the vasomotor stability as a rule. If it does, a small dose of ephedrine injected intravenously will restore the blood pressure. Tolerance to blood loss is undoubtedly somewhat reduced but the great reduction in the venous bleeding at the operative site fully compensates for this.

TABLE 1
CLASSIFICATION OF PATIENTS AS TO RISK

Operative Risk	Good	Fair	Poor	Bad
Spinal Tumour	14	18	40	26
Prolapsed Disk	64	34	3	0

These, then, are the problems peculiar to operations for the removal of spinal tumours. In view of the fact that the patients are such poor risks and that not even the slightest degree of respiratory obstruction can be tolerated, it is obvious that the services of a specialist anaesthetist are necessary. It will be apparent, too, that without an endotracheal airway satisfactory results are not likely to be obtained.

TABLE 2
CLASSIFICATION OF PATIENTS AS TO AGE

Age Group	10-19	20-29	30-39	40-49	50-59	60+
Spinal Tumours	3	12	18	20	30	15
Prolapsed Disks	0	25	27	30	13	0

Patients in the sitting and lateral positions do not require any special care during anaesthesia and almost any method properly used will serve in such cases. As the diathermy is employed as a rule, I prefer the non-inflammable combination of nitrous oxide, oxygen and a supplement, usually trichlorethylene, after a barbiturate induction. Very ill patients may be anaesthetised with the aid of local infiltration and paravertebral block with pentothal in hypnotic doses. This method is particularly applicable to those undergoing the operation of cordotomy who must be aroused immediately after the spinothalamic tracts have been divided in order to determine the extent of the analgesia produced. It is commonly said that patients with intractable

pain so welcome any measures for its relief that they can be operated upon under local anaesthesia alone. In actual fact, most of them have become such hopeless psychoneurotics, perhaps because of the narcotics they have received, that the very thought of an operation during which they will be awake, fills them with terror. If the process of recovery at the time of testing is unduly slow, it may be hastened by the intravenous injection of small doses of coramine. Further, if a bilateral cordotomy has been performed in the upper dorsal region, the vasomotor centre will be cut off from the blood vessels of most of the body; consequently, the blood pressure will fall and the elimination of anaesthetic drugs will be slowed unless a vasopressor drug is also given (fig. 1).

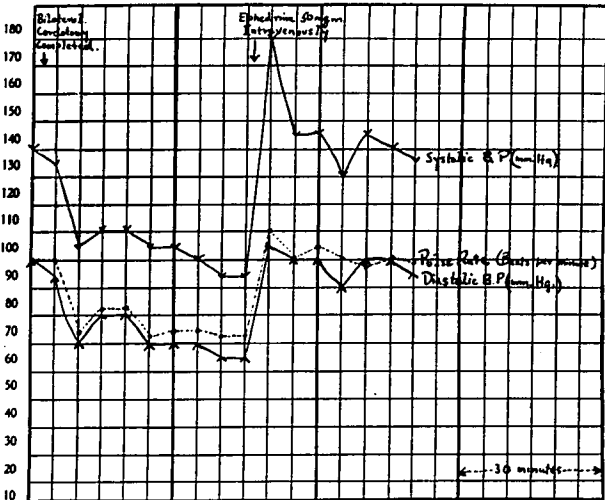


FIG. 1. The blood pressure after bilateral cordotomy.

In the face down position, the difficulties of maintaining full oxygenation are considerable and mixtures of nitrous oxide and oxygen are not likely to prove satisfactory except in the healthiest of adults. Ether or cyclopropane, given in a closed circuit with as much oxygen as the desired depth of anaesthesia will permit, is preferable. Provided that leakage does not occur, the explosion risk is negligible even when the diathermy is in use. Children, on the other hand, tolerate nitrous oxide and oxygen anaesthesia well and babies who require the removal of meningocoeles can readily be anaesthetised with its aid.

After bromethol (avertin) or rectal hexobarbitone (evipal) premedication very little supplement is necessary. If vinyl portex tubes are used (2, 5), endotracheal methods should present little difficulty even in the youngest children.

It is during the disk operation that the problems of the face down position become most acute. When the table is sharply angled in order to undo the lumbar lordosis, interference with respiration becomes maximal. In addition, there is considerable pressure on the abdomen, often sufficient to obliterate the inferior vena cava. The result is that the venous return from the legs is impeded and a quantity

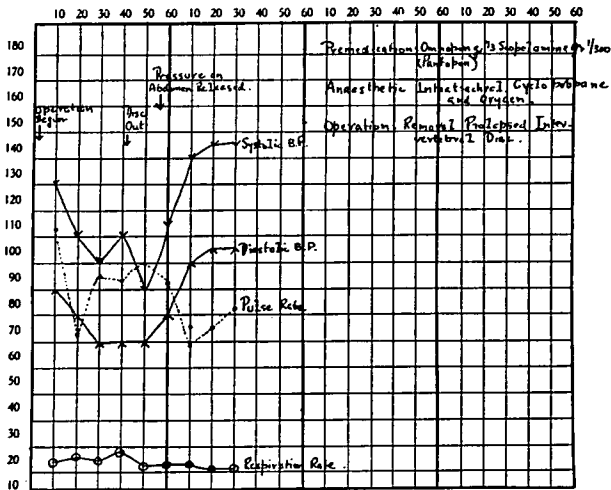


FIG. 2. The circulatory disturbance caused by the position for the disk operation.

of blood large enough to cause a serious deficit of circulating volume may be trapped there. In consequence, the blood pressure falls and the pulse rate rises (fig. 2). In addition, the anastomotic channels for the return of blood from the lower limbs, particularly those in the vertebral canal, are engorged. This extra bleeding seriously impedes the surgeon and can add materially to the amount of exsanguination resulting from the operation. This exceedingly unpleasant circulatory disturbance was a feature of several of the first patients I anaesthetised for the disk operation. Alteration in the agent employed made no difference to these changes (table 4), although partial withdrawal of the anaesthetic was associated with immediate recovery. It was,

however, impossible to strike a satisfactory mean between the depth of anaesthesia at which circulatory stability was maintained and that at which the posterior roots of the spinal nerves could be freely handled by the surgeon. When spinal was substituted for general anaesthesia, this upset did not appear. This method had several advantages. The level required, about the tenth dorsal segment, was not high; consequently, fall in blood pressure was unlikely. The upper abdominal muscles retained some of their tone and the vena cava was protected from pressure. The circulatory disturbance which was the bugbear of operation under general anaesthesia therefore did not appear. Also, the accessory muscles of respiration were not disturbed and could make good, in part at least, the respiratory activity prevented by the pressure on the abdomen.

TABLE 3
THE TYPES OF ANAESTHETIC USED DURING LAMINECTOMY

Anaesthetic	Cases
Nitrous Oxide, Oxygen and Supplement	36
Cyclopropane with Carbon Dioxide Absorption	27
Ether with Carbon Dioxide Absorption	15
Barbiturate and Local	20
All Operations for Spinal Tumour	98

In view of the known dangers of using heavy solutions for spinal anaesthesia in the "face down" and "bridge" positions, I used light (1 to 1500) nupercaine in my earliest cases done by this method. The quality of the anaesthesia was, however, variable and although all the expected advantages were obtained, too many patients required a supplement (table 4). A slightly stronger heavy solution of nupercaine (about 1 to 1000) was then used in a modification of the author's technique of spinal anaesthesia (2, 3) and more consistently good anaesthesia was produced. The actual details are given below.

TABLE 4
THE TYPES OF ANAESTHETIC USED DURING THE OPERATION FOR PROLAPSE OF THE INTERVERTEBRAL DISK

Anaesthetic	Cases	Comment
Nitrous Oxide, Oxygen and Supplement	5	3 patients had troublesome venous congestion
Ether with Carbon Dioxide Absorption	3	2 patients had the same upset as above
Cyclopropane with Carbon Dioxide Absorption	8	3 patients showed a like disturbance of the circulation
Light (1 in 1500) Nupercaine	26	Supplement required in 12 cases
Heavy Nupercaine (Author's Technic)	58	Supplementary anaesthesia in 8 cases
Heavy Nupercaine (Author's Technic) plus extra dose of 1:1500 Nupercaine	7	All cases satisfactory
Total Cases	107	

Premedication is heavy. Fit patients receive $\frac{3}{4}$ grain of omnopon (pontopon) and $\frac{1}{150}$ grain of scopolamine one hour before operation; the less robust receive $\frac{1}{2}$ grain of omnopon and $\frac{1}{200}$ grain of scopolamine. Those who are apprehensive are given 2 or 3 grains of phenobarbitone the night before operation and the same quantity immediately upon being wakened next morning. Lumbar puncture is performed with the patient in the lateral position. The dose of the 1 to 200 solution of nupercaine with glucose, varying according to the patient's estimated resistance to anaesthesia from 2.0 to 2.5 cc. (10 to 12.5 mg.), is measured into a 20 cc. syringe. It is then diluted with cerebrospinal fluid until its total volume is 10 to 11 cc., and injected. The patient is turned on his back and lies with his knees fully flexed for ten minutes. He is then placed in the position for operation, with his arms hanging over the end of the table resting on a stool under his head, so that it is a simple matter to inject small doses of evipal or pentothal should a supplement prove necessary. A head-up slope of the table is scrupulously maintained for the first thirty minutes. If pain sensation returns before the operation is over, an additional dose of nupercaine, this time of the light 1 to 1500 solution, is injected through a fine needle into the exposed theca after the head of the table has been lowered.

On the whole, the results of this technic were very satisfactory. The circulatory stability was rarely upset and on the few occasions when the blood pressure fell it was at once restored to normal levels by the intravenous injection of ephedrine. The majority of patients required no further hypnotic but a few, though tolerant of the initial stages of the operation, could not bear the paraesthesiae which arose from the handling of the inflamed nerve roots. Several such patients obtained relief from the supplementary dose of light nupercaine. A few, interpreting the tingling sensations which arose from the operation area as pain, insisted on being put to sleep. In such cases very light barbiturate hypnosis sufficed to make the patients comfortable.

SUMMARY

The problems which confront the anaesthetist who works on a unit where operations on the spinal cord and nerve roots are performed have been discussed. The different anaesthetic agents which may be employed have been considered, each in relation to its own particular field of usefulness. The particular dangers of the disk operation have been mentioned and spinal anaesthesia is suggested as the best way to overcome them.

AUTHOR'S NOTE

Since I first read this paper my attention has been drawn to the fact that the type of circulatory disturbance I met during disk operations can quite readily be prevented. If long narrow firm pillows,

about 6 inches in diameter, are placed one on each side lengthwise between the patient and the table just outside the line joining the mid-clavicular to the mid-inguinal point, the circulatory stability remains unimpaired even when the lumbar lordosis is overcome by pressure on the anterior surface of the body. This finding supports the theory advanced in the body of the paper that the source of the trouble lay not so much in the interference with respiration caused by the position necessary during the disk operation as in the fact that the inferior vena cava was compressed against the anterior surface of the bodies of the vertebrae.

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