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ORIGINAL ARTICLE

Epidural anaesthesia and neural tube defects

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SUMMARY. This is a retrospective record of the analgesic management during labour of 16 patients with spina bifida seen at Leicester Royal Infirmary Maternity Hospital between March 1994 and February 1996. The information highlights the potential difficulties in providing epidural analgesia for this patient group, and demonstrates how an antenatal pre-anaesthetic clinic can help to optimize pain management by providing the opportunity to formulate a realistic analgesic plan, which can be documented in the notes.

INTRODUCTION

Neural tube defects were estimated in 1993 to occur in 2000 pregnancies each year in the UK, of which 1600 end in either stillbirth or abortion,[1] giving an estimated live-birth incidence of about 1:2000. Spina bifida constitutes a survivable form of neural tube defect, and was estimated in 1973 to occur in 3 per 1000 live births (>6-fold higher); 40% of these died in the first year.[2]

Spina bifida describes a group of conditions, including:[3]

- *Spina bifida occulta*: This arises when the two halves of the vertebral arch fail to fuse in the mid-line, but the skin is intact. It has a reported incidence of between 5 and 25% of the population, often only discovered as an incidental X-ray finding,[4,5] so not contributing to the estimated incidence at birth quoted above. Whilst most commonly seen in the lumbo-sacral region, it can also occur in the cervical spine. In its mildest form the overlying tissue is normal, though it can be abnormal, with cutaneous angiomata, pigmented areas, lipoma, a tuft of hair, or simple dimple. Spina bifida occulta is not associated with neurological symptoms.
- *Spina bifida cystica*: Common to these malformations is the presence of a sac-like protrusion through the bony defect in the vertebral arch. This is a collective term to describe the more severe forms of spina bifida, including the next three forms.
- *Spina bifida with meningocoele*: Here the sac consists of meninges and cerebro-spinal fluid (CSF); the spinal cord and nerve roots, while present in their normal position may still be abnormal.
- *Spina bifida with meningomyelocoele*: This is more severe than the above and represents 95% of the cases of spina bifida cystica.[5] Here, in addition to meninges and CSF, spinal cord and nerve roots are incorporated to a variable degree into the wall of the sac. The presence of a neurological deficit below the level of the defect is usual.
- *Spina bifida with myeloschisis*: this is the most severe form of spina bifida cystica, the neural folds fail to meet and fuse, and as a result the neural plate remains open to the air, as a flattened mass of neural tissue.

In recent years, the recorded incidence of spina bifida births has declined. This can be accounted for by the combined effect of improved antenatal screening and dietary supplements of high-dose folate given pre-conception and continued into early pregnancy.[1] Despite these efforts, children are still born with this condition each year. Of those patients surviving to adulthood, the degree of physical disability is largely determined by the extent of neural damage, either as the result of the primary defect, or as a consequence of corrective surgery. When severe, the patient may develop secondary pathology including neuropathic bladder, abnormal pelvic growth, and differential spinal growth causing scoliosis, which when severe is associated with restrictive lung disease.[6]

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In this patient group the choice of regional analgesia is complicated by:

- the increased risk of neural and or dural injury, particularly when conducted at the level of the defect,[7]
- abnormal spread of local anaesthetic due to the alteration in structure of the epidural space, resulting in either excessive cranial or inadequate caudal spread,[8] and
- concerns regarding the conduct of regional anaesthesia in patients with established neurology.

In addition, relevant published experience of the management of these patients is limited to several case reports and a small case series.[8–11] As a consequence, this may result in a reluctance on the part of the anaesthetist to offer regional analgesia. As this particular patient group is at high risk of intervention or operative delivery (due to associated pelvic abnormalities)[12] this cannot be regarded as optimal management.

This case series records the management of labour pain in 16 women with spina bifida seen at the Leicester Royal Infirmary between March 1994 and February 1996. We report our experience of epidural analgesia, using this to highlight potential problems, and demonstrate how anaesthetic antenatal assessment can contribute to improved analgesic management of these patients.

PATIENT DETAILS AND OUTCOME

All 16 patients had been diagnosed as having spina bifida before their current pregnancy, eight had spina bifida occulta, and eight had spina bifida with meningomyelocoele. None of the patients with spina bifida occulta had any neural deficit. The eight patients with spina bifida with meningomyelocoele all had documented neural deficits, ranging from mild dysaesthesia at the level of the defect, to more extensive sensory loss with associated motor weakness. Sphincter function was normal in all patients, and none had an in-dwelling CSF shunt. Six of the eight patients with spina bifida with meningomyelocoele had undergone some form of corrective surgery (see Table 1).

Largely as the result of poor communication, only 11 of the 16 patients were reviewed in the antenatal anaesthetic assessment clinic (five patients with spina bifida occulta and six with spina bifida with meningomyelocoele). Individual expectations regarding analgesia during labour, combined with previous obstetric history, was recorded. All patients were carefully examined and the extent of any neurological deficit was recorded in the notes. The benefits and risks of regional analgesia were discussed, including the technical difficulty and the potential for incomplete analgesia. At the end of the consultation an analgesic plan for labour was formulated and recorded in the patient's notes. The opportunity was also taken to encourage self-motivation with the use of relaxation exercises and transcutaneous nerve stimulation (TENS).

Table 1. Summary of the neural tube defects in all 16 patients

Case	Neural tube defect	Neural deficit	Site of defect
1	SBO	none	sacral
2	SBO	none	L/S
3	SBO	none	L/S
4	SBO	none	sacral
5	SBO	none	L/S
6	SBO	none	L/S
7	SBO	none	L/S
8	SBO	none	sacral
9	MMC*	none	L/S
10	MMC*	mild	L/S
11	MMC*	mild	L/S
12	MMC*	mild	L/S
13	MMC*	none	L/S
14	MMC	none	sacral
15	MMC	mild	C
16	MMC*	mild	L/S

NTD = neural tube defect; SBO = spina bifida occulta, MMC = meningomyelocoele, L/S = lumbo-sacral, C= cervical. *Denotes previous corrective surgery.

Of these 16 patients, 10 received an epidural in labour. This included eight of the 11 patients seen in the anaesthetic assessment clinic, and only two of the others (see Table 2). A standard technique was used for all 10 patients who received epidural analgesia. The defect was first palpated and the first normal spinous process immediately above was identified. The intervertebral space immediately above this point was chosen as the site of injection. Using a mid-line approach, the epidural space was identified by loss of resistance to either air or saline. The catheter was then advanced to leave 3 cm in the epidural space and after negative aspiration of blood or CSF, a test dose of 3 ml of 2% lignocaine was given.

Of the 10 epidurals, six resulted in symmetrical sensory blockade that extended from the sacral to low thoracic dermatomes after 8–10 ml of 0.25% bupivacaine. In each case the sensory block did not extend above T10. Of the remaining four epidurals there was:

- One asymmetric block (this became symmetrical, and provided good analgesia once the catheter had been withdrawn by 0.5 cm).
- One dural puncture (the epidural space was not particularly superficial at 5 cm, and the procedure was carried out by a consultant). The catheter was re-inserted in the space immediately above, and

Table 2. Analgesia during labour

Case	Planned technique	Technique in labour	Technique for delivery	Mode of delivery	Development of block	Adverse effects
1	epidural	epidural	epidural	NVD	normal	none
2	not seen	nil	pudendal/LA	Ventouse	–	–
3	epidural	epidural	epidural	Ventouse	normal	none
4	not seen	nil	none	NVD	–	–
5	epidural	epidural	epidural	NVD	asymmetric	dural tap
6	epidural	epidural	epidural	low forceps	normal	none
7	epidural	–	spinal/GA	CS	–	none
8	not seen	epidural	epidural	Kjellands	normal	none
9	epidural	pethidine	pudendal/LA	low forceps	–	–
10	epidural	epidural	epidural	NVD	normal	none
11	epidural	–	epidural	CS	normal	none
12	epidural	pethidine	pethidine	NVD	–	–
13	not seen	peth/epi	epidural/LA	Ventouse	excessive height (T3)	none
14	not seen	–	GA	CS		–
15	epidural	epidural	epidural	NVD	normal	none
16	epidural	epidural	epidural/LA	NVD	poor sacral analgesia	none

NVD = normal vaginal delivery, CS = elective lower segment caesarean section, GA = general anaesthesia

good analgesia was achieved following small volume top-ups of bupivacaine given by the anaesthetist. After delivery the patient developed a mild headache, treated with simple analgesics.

- One excessively high block (sensory level measured to T3 following 10 ml of 0.25% bupivacaine).
- Failure of the block to extend below the level of the spinal defect led to sub-optimal perineal analgesia in 2 of the 4 epidurals. In both cases, the patients had extensive defects, and had undergone corrective surgery.

All 16 women delivered healthy babies, 13 delivered vaginally and the remaining three by elective caesarean section. Apart from the one case of dural puncture, there were no other reported complications in the regional analgesic group. On follow-up after delivery, neurological examination of those patients who were seen in the anaesthetic assessment clinic was unchanged. In those who had not been seen, assessment was more difficult as there was no baseline for comparison. Despite this, we could not find any record in the notes of any new neurology following delivery.

DISCUSSION

Despite efforts to reduce the number of spina bifida births for the foreseeable future, obstetric anaesthetists will encounter pregnant patients with spina bifida. This case series serves to demonstrate some of the problems encountered when using epidurals in this patient group.

As described, the conduct of an epidural in a patient with spina bifida can be technically difficult.[7] The increased risk of dural injury means that the point of injection should be either above or below the level of the spinal defect. In our series, all the epidurals were sited above the spina bifida (with the obvious exception of cervical defect), and the margins of the defect were determined by simple palpation; others have relied on spinal X-rays.[11]

Effective management of epidural analgesia in this patient group relies on the understanding that the spinal defect, by distorting and in some cases obliterating the epidural space, can seriously influence the spread of the local anaesthetic solution.[7,13] The clinical consequences largely depend on whether the epidural catheter is inserted above or below the level of the defect. Assuming, as in our series, that all the epidurals were sited above the level of the defect, this may cause both excessive cranial spread with 'normal' volumes of local anaesthetic (8–10 ml) and poor perineal spread, resulting in inadequate analgesia for the third stage of labour. These complications were seen in our own series have previously been reported by others; and most likely to occur in patients with spina bifida cystica, particularly those who have undergone corrective surgery.[6] To avoid the consequences of sympathetic block caused by excessive cranial spread, we advise the use of smaller volumes (3–5 ml) of local anaesthetic for epidural top-ups. The problem of impaired caudal spread is more difficult, and during the second stage it may be necessary to rely on additional methods of analgesia such as opiates and/or pudendal block. Other options, where appropriate, include the insertion of a second epidural catheter below the level of the defect, epidural opiates and a continuous spinal technique with in-dwelling catheter.

The advantage of pre-anaesthetic assessment in this context has already been established and provides the opportunity for:[11]

- review by a senior anaesthetist with the relevant notes and X-rays to establish the extent of the defect
- a base line record of neurological function
- thorough discussion with the patient, providing informed consent to any regional technique and a realistic expectation of achievable analgesia
- collection of comprehensive records which could be used as the basis for the creation of a database, either on a local, regional, or national level.

REFERENCES

1. Department of Health. Latest phase of campaign to prevent spina bifida babies announced. Press release H93/1047. London: Department of Health, 1993.
2. Duthrie R B, Ferguson A B. In: Mercer's Orthopaedic Surgery, 7th Edn. London: Edward Arnold, 1973.
3. Moore K. The Developing Human. In: Clinically Orientated Embryology, 3rd Edn. London: W B Saunders, 1982.
4. Rothman R H, Simeone F A. The Spine 2nd Edn, Vol 1. Philadelphia: W B Saunders, 1982.
5. Merrit H H. Textbook of Neurology. Philadelphia: Lea & Febiger, 1975.
6. Wynn J S, Mellor S, Moorewood G A. Pregnancy in patients with spina bifida cystica. Practitioner 1979; 222: 543–546.
7. Bromage P R. Epidural Analgesia. Philadelphia: W B Saunders, 1978.
8. Vaagenes P, Fjarstad I. Epidural block during labour in a patient with spina bifida cystica. Anaesthesia 1989; 36: 299–301.
9. Broome J. Spinal anaesthesia for caesarean section in a patient with spina bifida cystica. Anaesth Intensive Care 1989; 17: 377–378.
10. McGrady E M, Davis A G. Spina Bifida Occulta and Epidural Anaesthesia. Anaesthesia 1988; 43: 867–869.
11. Roseag O P, Yarnell R W. The obstetrical anaesthesia assessment clinic: a review of 6 years' experience. Can J Anaesth 1993; 40: 346–356.
12. Richmond D, Zaharierski I, Bond A. Management of pregnancy in mothers with spina bifida. Eur J Obstet Gynecol Reprod Biol 1987; 25: 341–345.
13. Ingraham F C. Spina Bifida and Cranium Bifidum. Massachusetts: Harvard University Press, 1944.