The Use of Lumbar Epidural Analgesia during the First Stage of Labour in High-Risk Pregnancies

W. H. MERCER, E. G. SIMONS, R. H. PHILPOTT

SUMMARY

The high-risk pregnancy is presented as a priority indication for epidural analgesia during labour. This would include cardiac disease, inefficient uterine action, with or without cephalopelvic disproportion, certain cases of antepartum haemorrhage, multiple pregnancy, breech presentation, pre-eclamptic toxaemia and all causes of suspected placental insufficiency.

The intensive care necessary for the management of these patients is simplified when an epidural block is used and the built-in anaesthesia permits immediate recourse to operative interference when indicated.

To ensure safety for mother and fetus, the importance of limiting this procedure to the hands of those who have received supervised training and proved their skill, and the need for meticulous attention to detail, are stressed.

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Lumbar epidural block for analgesia and anaesthesia has been employed in the Department of Obstetrics at Harare Central Hospital, Salisbury, for the past 4 years. Initially, this was used for pain relief in labour and later, with the limited number of anaesthetists available, it was used by the obstetricians for anaesthesia at Caesarean section.[1] With more experience and also a better understanding of the prevention of hypotension, a procedural method has been evolved which, we believe, carries the minimum of risk to mother and fetus.

There are limiting factors as one considers the indications for an epidural block in the first stage of labour. When we depended on anaesthetic staff to provide the service, the indications were extremely limited and inconsistent, because of the many other important commitments carried by the Anaesthetic Department. We then taught our obstetric house-surgeons and registrars to perform the epidural blocks, and this expanded the opportunity to use the technique more frequently and consistently. Even so, there still remains the limitation of the essential supervisory facilities available in the intensive care area of a busy labour ward.

With these limiting factors in mind, we have studied the obstetric indications for epidural analgesia that carry top priority and ensure that these are fulfilled. Only then can we add cases where the indication is just for pain relief in otherwise uncomplicated labours, and the number of these will depend on the staff available and free space in the intensive care area.

In determining the obstetric indications for epidural block in the first stage of labour, we have chosen circumstances where the elimination of maternal pain and distress would make for easier handling in the intensive care ward, and also where immediate decisions may need to be made with regard to operative or manipulative intervention. As a consequence, some conditions that were formerly regarded as contra-indications to the use of the block have been prospectively studied, initially in a pilot study and now in a larger series.

Department of Obstetrics and Gynaecology, Harare Central Hospital, and University of Rhodesia, Salisbury, Rhodesia
W. H. MERCER, M.B. CH.B.
E. G. SIMONS, M.B. CH.B., M.R.C.O.G.
R. H. PHILPOTT, M.B. CH.B., F.R.C.O.G.

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MATERIALS AND METHODS

Patients

In a prospective study from 1 July 1971 to 30 June 1972, lumbar epidural block was performed on 259 high-risk Black patients in the first stage of labour. These were quite apart from epidural blocks given for pain relief in otherwise uncomplicated labours, and for Caesarean sections. The majority were performed by two of the authors. The indications for first-stage labour epidural block are set out in Tables I and II. There were 125 primigravidas and 134 multigravidas in the series, with an average age of 17,5 years.

TABLE I. INDICATIONS FOR EPIDURAL BLOCK—MATERNAL HIGH RISK

Cardiac disease	3
Cervical dystocia	8
Severe pain with maternal distress	17
Antepartum haemorrhage ending in normal vaginal delivery	32
Antepartum haemorrhage ending in Caesarean section	17
Total	77

TABLE II. INDICATIONS FOR EPIDURAL BLOCK—FETAL HIGH RISK

Trial of labour for suspected cephalopelvic disproportion	96
Multiple pregnancy	33
Breech presentation	12
Pre-eclamptic toxaemia	33
Postmaturity	8
Total	182

The following features were studied:

Maternal: Hypotension; dermatome level of anaesthesia; method of delivery; doctor's, midwife's and patient's estimation of the effectiveness of the epidural block; and side-effects.

Fetal: Fetal heart changes: Apgar score; and perinatal mortality.

Procedure of Lumbar Epidural Block

The block is administered to patients in the intensive care area of the labour ward, where they are nursed until their delivery is completed. If absolute safety for mother and fetus is to be maintained, these patients need to be meticulously supervised, with recording of the pulse and blood pressure at 5-minute intervals during the first half-hour following the block, and thereafter at 30-minute intervals. The fetal heart rate in relation to uterine contractions should be recorded by an accurate clinical observer (midwife) or, if possible, with the use of a cardiotocograph.

Further, to maintain safety, it is important to ensure that the obstetrician administering the block has been adequately trained in the technique. We require that, before a doctor is permitted to perform a block on his own, he should have given at least 25 blocks under the supervision of an expert. He should show evidence of being fully cognisant of the indications, contra-indications, techniques and hazards of the procedure, and be able to perform intermittent positive pressure respiration if needed. The Boyle's anaesthetic machine must be checked, and a functioning laryngoscope and endotracheal tube kept available. An intravenous infusion of 5% dextrose in water should be set up and any dehydration corrected before giving the block.

Equipment and Technique

The epidural space was cannulated between vertebrae L1 and L3, by using a Tuohy needle, and with the patient sitting. The loss of resistance technique utilising air was employed. We used bupivacaine 0,375% with 1 ml as a test dose and a further 8 ml over 4 minutes.[2,3]

Top-up Injections

Top-up injections are given at the earliest evidence of returning pain. A test dose of 1 ml of 0,375% bupivacaine is given. A further 4 - 8 ml are then given over 5 minutes, with the patient in the supine position. After 10 minutes the patient is once again turned onto her left side. These top-up injections must be given with the same care and attention to detail as the initial injection, and must never be delegated to personnel who are not trained in the administration of epidural blocks.

Injection Before Delivery

The patient may feel no pain with contractions and yet complain of low backache or perineal discomfort when instrumental delivery is attempted. A further injection of 0,375% bupivacaine should be given, with the patient sitting, until perineal analgesia is achieved.

Dermatome Level

The level of the epidural block is judged by a pin-prick. Efficacy of the block must be ensured before proceeding with an instrumental delivery, symphysiotomy or Caesarean section. This is particularly pertinent when using an epidural block for the examination in theatre of a patient who has had an antepartum haemorrhage, as there may be need to proceed immediately to Caesarean section.

Removal of Epidural Catheter

After delivery the catheter should be removed with the patient's back fully flexed, and the catheter checked.

Monitoring

Earlier in the study the fetal heart rate was monitored with the fetal stethoscope throughout a contraction. In the later stages of the project all high-risk pregnancies were monitored on a cardiotocograph in conjunction with fetal blood sampling.

Oxytocin Infusion

A continuous infusion of oxytocin was administered to 137 patients. The indications are given in Table III.

TABLE III. INDICATIONS FOR OXYTOCIN

Delay during trial of labour	96
Postmaturity	8
Pre-eclamptic toxaemia	31
Cervical dystocia	2
Total	137

Drug Therapy

Diazepam was used as an anticonvulsant in all cases of pre-eclamptic toxaemia and eclampsia. In the less severe cases of pre-eclamptic toxaemia, diazepam 10 - 20 mg was given by a single intravenous injection. In severe pre-eclamptic toxaemia and eclampsia, an initial intravenous injection of 10 - 20 mg diazepam was given, followed by a continuous infusion of diazepam, 40 mg in a litre of dextrose in water, administered at a rate sufficient to keep the patient well sedated. The epidural block was used only to provide analgesia and not primarily to reduce the blood pressure.

RESULTS

Out of a total of 7 269 deliveries between 1 July 1971 and 30 June 1972, 259 high-risk pregnancies were managed with epidural analgesia (3,5%). Of these, 182 were for fetal high-risk factors and 77 for maternal problems.

Dermatome Level of Epidural Block

The highest block reached to T4 but, with few exceptions, T7 was the upper limit of the block. In only one patient did the dermatome level reach T4, and in that case there was a definite error in the operator's technique.

Estimation of Analgesic Success

The estimation of the efficacy of the block, as judged by maternal, doctor and nurse opinion, is recorded in Table IV.

TABLE IV. ESTIMATION OF ANALGESIC SUCCESS

	Complete block	Short duration	Failed block
Maternal opinion	255	3	1
Doctor's opinion	253	5	1
Nurse's opinion	255	3	1

The block which failed was due to an error of judgement on the part of the operator. The epidural needle was inserted through a spinal deformity, resulting in a puncture of the dura. The spinal anaesthesia which followed produced alarming hypotension. Spinal deformity is an absolute contra-indication to lumbar epidural anaesthesia.

The blocks of short duration required a further top-up with bupivacaine to re-establish analgesia during a procedure. We have modified our technique to prevent this occurring by giving a top-up dose before starting an operation.

Side-Effects

Hypotension: We regarded a blood pressure fall of 20 mmHg systolic, while the patient was being nursed on her side, as hypotension. Only one hypotensive problem occurred and that case is described above.

Vomiting: Six patients vomited when the analgesic effect of the epidural block was wearing off.

Headache: Eight patients complained of headache following the block. All were relieved with aspirin and codeine.

Method of Delivery

There were 292 babies born to 259 mothers. The method of delivery is recorded in Table V.

TABLE V. METHOD OF DELIVERY

	Primigravidas		Multigravidas	
Spontaneous	51	(38%)	56	(37%)
Vacuum extractor	35		36	
Forceps	4		4	
Symphysiotomy	10		0	
Assisted breech delivery	11		30	
Destructive operation	3		3	
Caesarean section	21	(16%)	28	(18%)
Total	135		157	

TABLE VI. PERINATAL MORTALITY RATE

Babies born		292
Fresh stillbirths	13	
Macerated stillbirths	2	
Neonatal deaths	2	
Total	17	

Uncorrected perinatal mortality rate for these high-risk pregnancies is 60/1 000; and uncorrected over-all perinatal mortality rate for the same period in the obstetric unit at Harare Central Hospital is 76/1 000.

Taking into consideration that 7 of the fresh stillbirths were dead on arrival at hospital, and that 2 of the stillbirths were macerated, the corrected perinatal mortality rate in this series of high-risk pregnancies was 27/1 000.

Stillbirths

Six fresh stillborn babies were delivered vaginally after destructive operations. These 6 patients arrived at hospital in advanced obstructive labour with no fetal heart present. There were 7 other fresh stillbirths, one following several eclamptic convulsions at an outstation. The fetus was dead on arrival at the unit. The remaining 6 were all premature babies.

Neonatal Deaths

There were 2 deaths, neither of which was related to the use of the epidural block.

Apgar Score

The Apgar score was estimated at 1 and 5 minutes. At 1 minute the range was 1 - 10, with an average score of 7,8; at 5 minutes the range was 3 - 10 with an average score of 9,4.

Twin Study

There were 33 sets of twins born. The method of delivery is recorded in Table VII. Internal podalic versions

were performed on the second twin in 10 cases. The Apgar scores of the twin babies are recorded in Table VIII. Among the twin deliveries, the only perinatal deaths were 2 macerated stillbirths, both of which were second twins.

TABLE VII. METHOD OF DELIVERY OF TWINS

	Primi-gravidas	Multi-gravidas
Spontaneous	8	17
Vacuum extractor	3	8
Forceps	1	0
Assisted breech with forceps to aftercoming head	8	21
Total	20	46

TABLE VIII. APGAR SCORES OF 33 SETS OF TWINS

	First twin		Second twin	
	Range	Average	Range	Average
Apgar score	4 to 10	7,37	4 to 10	6,85
	6 to 10	9,25	7 to 10	9,25

Examination in Theatre for Antepartum Haemorrhage

This was performed on 49 cases of antepartum haemorrhage with possible placenta praevia at 38 weeks of pregnancy. In 32 cases, the placenta was found to be in the upper segment, and these patients proceeded to normal vaginal delivery. Seventeen patients, after examination in theatre, were delivered by Caesarean section. Of these, 14 were for placenta praevia and 3 developed fetal distress in the first stage of labour, requiring section.

Inefficient Uterine Action

Progress in labour is plotted on the cervicograph, as described by Philpott and Castle.[2] Inefficient uterine action is defined as cervicographic progress which crosses the action line on the graph. In the primigravida, an oxytocic stimulus is then administered to show which cases have cephalopelvic disproportion and which have primary inefficient uterine action. An epidural block is administered to all patients whose cervicographic progress crosses the action line.

A total of 96 patients with inefficient uterine action were given epidural blocks. Thirty-three had major cephalopelvic disproportion warranting later symphysiotomy or Caesarean section. The method of final delivery in the 96 patients is recorded in Table IX.

TABLE IX. METHOD OF DELIVERY FOLLOWING TRIAL OF LABOUR

Spontaneous	21
Vacuum extractor	38
Forceps	4
Symphysiotomy and vacuum extractor	10
Caesarean section	23
Total	96

DISCUSSION

Safety

An epidural block is a potentially lethal procedure and can only be made safe when it is done by a skilled, experienced person, who pays absolute attention to detail, and who ensures intensive care of mother and fetus until the block has worn off. We have been able to meet these requirements by using resident obstetric staff and good nursing supervision.

Avoidance of Hypotension

Out of the 259 patients in this series, there was only one who developed hypotension. This case, already described, should never have been submitted to an epidural block, as a spinal deformity is an absolute contra-indication. She developed a high spinal anaesthesia, but fortunately responded to ventilation and intravenous fluid therapy.

Hypotension can result from a central cardiac effect by depressing cardiac work, or peripherally by reducing venous return to the heart. The former is prevented by ensuring that the block is low, and the latter by attention to detail in technique.

Bromage[4] showed that the spread within the epidural space is more extensive during pregnancy, and that a cardiac sympathetic block is produced by upper thoracic epidural analgesia, leading to decrease in cardiac output, despite adequate filling pressure. Bearing this in mind, we aimed at an epidural block no higher than T7. Including the case of accidental puncture of the dura resulting in a high spinal anaesthetic, low epidural block was achieved in all but one other case. In the second case the block reached, according to the pin-prick test, a level of T4. This was due to an error on the part of the operator, who introduced the needle in the interspace between T11 and T12. The patient showed no ill-effects, however, and no hypotension resulted.

Peripheral pooling is caused by direct vasospasm of Batson's vertebral venous plexus or sympathetic blockade which allows arteriolar and venous wall relaxation with decreased venous blood return. Bromage[4] has shown that slow infusion of fluid into the epidural space reduces leakage along the nerve roots to paravertebral tissues. We are clinically satisfied that the emphasis on introducing bupivacaine at 1 ml/30 sec is closely linked with low incidence of hypotension in this series.

Hypotension has occurred in two further cases since the completion of this series. Both patients were obese with severely hypertensive pre-eclampsia. On both occasions a top-up dose was administered to help control a further rise in blood pressure, although an adequate block for analgesia was already present. Profound hypotension en-

sued. We now feel strongly that epidural block must be aimed solely at providing safe analgesia for the mother. If one goes beyond this to obtain hypotension by giving larger amounts of the drug, or by administering it rapidly, the effect can be unpredictable and dangerous. Our present policy in the management of severe hypertension during labour is to use the minimal dose of bupivacaine necessary for analgesia and then to control any hypertension with an intravenous infusion of diazepam, supplemented, if necessary, by titrated doses of intravenous hydralazine.

Fetal Condition

Noble *et al.*,[5] in their study of the fetus, showed that babies enter the second stage of labour in a better biochemical state when an epidural block is used than when conventional methods of analgesia are administered. The Apgar scores of the babies delivered in our study of high-risk labour would seem to confirm these findings.

NEW INDICATIONS

Examination in Theatre of Selected Cases of Antepartum Haemorrhage

Although epidural anaesthesia is contra-indicated in cases of acute antepartum haemorrhage where there has been recent hypovolaemia or there is a risk of shock from further severe haemorrhage, it has an important place in the treatment of the non-acute case. The majority of our cases of antepartum haemorrhage present with a history of one or more vaginal haemorrhages, which have since ceased. Accurate methods of placental localisation are not always available, and so an examination needs to be carried out in the theatre at the 38th week of gestation to exclude a major degree of placenta praevia. In this study there were 49 such patients with antepartum haemorrhage, who were examined in theatre by using an epidural block. None of these patients were in immediate danger or risk from haemorrhage.

It must be stressed that an epidural block can take 20 minutes to become effective. This is another reason why it is not used in acute cases. It also underlines the need to ensure that the block is effective for possible surgery before commencing the examination.

The lower segment of the uterus can be explored as systematically with an epidural block as under general anaesthesia, and immediate safe Caesarean section can be performed if a major degree of placenta praevia is discovered. If this is excluded, labour is induced in the usual way by rupture of the forewaters, and the patient enjoys the analgesia of the continuous epidural block during her subsequent labour. It is well recognised that any patient who has had antepartum haemorrhage is liable to develop fetal distress during her induced labour. Immediate recourse to Caesarean section is possible without the usual practical and psychological problems of reinduction of a general anaesthetic.

Abruptio placentae, with the hazards of shock and clotting defects, should be regarded as a contra-indication to the use of epidural anaesthesia.[5]

Twin Deliveries

Although Little and Friedman[7] noted an increased incidence of depression of the second twin when the mother had been given an epidural block, not all workers accept twin delivery as a contra-indication. Chaplin and Renwick[8] and Moir and Willocks[6] consider that epidural block is well suited to twin delivery. We found that the second twin fared no less favourably than the first.

The epidural block does not interfere with spontaneous delivery and facilitates manipulative or operative intervention when this is indicated for malpresentations, fetal distress, cord prolapse or delay in delivery of the second twin.

Breech Presentation

In the case of a breech delivery, the epidural block should be provided by the time cervical dilatation has reached 5 cm. This facilitates thorough pelvic assessment and avoids the problem of premature bearing down before full cervical dilatation. Manoeuvres, such as the Lövset technique and the application of forceps to the after-coming head, can be done with ease. Exploration of the vagina, cervix and lower segment of the uterus, for the detection of injury following delivery, can be conducted without discomfort to the patient.

Trial of Labour for Suspected Cephalopelvic Disproportion

One of the key features of trial of labour in the primigravida is the recognition of delay in the progress of the labour. This is best recognised by plotting the rate of cervical dilation on a cervicograph. When delay does occur, it can be due to primary inefficient uterine action, or to inefficient uterine action resulting from various degrees of cephalopelvic disproportion. The differentiation can be determined by correcting the inefficient uterine action and observing maternal and fetal response.[2] We find that this is best done by using an epidural block and then an augmentation of uterine action with a carefully controlled oxytocic infusion.

The epidural analgesia makes the augmentation of the difficult labour comfortable for the patient, allows careful clinical observation, and there is even evidence that the block itself has the effect of improving the inefficient uterine action. In those cases in which Caesarean section or operative vaginal delivery becomes necessary, the epidural block will provide sufficient anaesthesia for the operation.

Intensive Care Monitoring during Labour

The modern methods of cardiotocographic monitoring and fetal blood sampling can cause discomfort, and even

doctors from doing all the analyses indicated in the at-risk patients in labour. We have found that an epidural block completely alters this situation. The patient is now pain-free and the doctor can carry out full monitoring accurately and in an atmosphere of absolute relaxation.

ESTABLISHED INDICATIONS

Pain Relief

The ideal time to provide epidural analgesia for the relief of pain is when the cervix has reached 4 - 5 cm dilatation. Before that time the block can cause delay in the progress of the labour.

Cardiac Disease

The occurrence of pain in the first stage of labour can itself be the precipitating factor that puts a patient with cardiac disease into cardiac failure. We have confirmed the findings of Moir and Willocks,[6] who showed that an epidural block given to a patient in cardiac failure in the first stage of labour can bring the patient out of her cardiac failure. We therefore electively provide all cardiac patients with an epidural block at the time they enter the active phase of the first stage of labour.

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