Low spinal anaesthesia combined with local anaesthesia for caesarean section — an evaluation

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Summary

A combination of low spinal anaesthesia using hyperbaric cinchocaine (Nupercaine; Ciba) 0,25% and local anaesthetic abdominal wall infiltration for caesarean section was evaluated for use in peripheral hospitals in the developing world. The technique described is not suitable for this purpose.

Further research into this technique is desirable, and recommendations regarding an improved protocol are made.

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There is no ideal form of anaesthesia for caesarean section,[1] and anaesthesia for this procedure is more hazardous than anaesthesia in the non-pregnant woman.

In developing countries, medical staff who have not had much postgraduate training in anaesthetics are frequently faced with the problem of anaesthetizing women who need caesarean section in peripheral hospitals; in these hospitals, this operation is in fact often the commonest abdominal operation performed. In such situations the doctor's difficulties are often compounded by the fact that he is alone or there is only one other doctor to assist with resuscitation.[2] A very safe but effective technique of anaesthesia for routine caesarean section is therefore desirable. One possibility is the combination of local anaesthesia and neuroleptic agents[3] with or without analgesic doses of ketamine (0,25 - 0,5 mg/kg).

The disadvantages of this technique are that no retractor can be used in the lower end of the wound and that the pelvis and its contents are not anaesthetized. This may result in the surgeon having difficulty with exposure when dealing with tears of the lower segment which extend behind the bladder. Many women also experience discomfort when the fetal head is disengaged from the pelvis.

In an attempt to overcome these disadvantages it was decided to combine local anaesthesia with low spinal anaesthesia, and to assess the safety and efficacy of this combination compared with those of spinal anaesthesia alone.

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Patients and methods

The study was carried out in August and September 1981 at the Charles Johnson Memorial Hospital, Nqutu, Kwazulu, and involved 120 consecutive women requiring caesarean section. Eleven women were excluded from the study because of the following reasons: (*i*) a catheter for continuous epidural anaesthesia was already in place; (*ii*) spinal anaesthesia was contraindicated because of a spinal deformity, antepartum haemorrhage or rupture of the uterus; or (*iii*) there was very severe fetal distress or cord prolapse (1 patient's records were lost). This assessment was carried out in the labour ward, and on arrival in the operating theatre the suitable patients were allocated alternately to the study and control groups.

Pre-operative preparation

Both groups were prepared as follows: (*i*) a magnesium trisilicate mixture (30 ml) was given orally; (*ii*) atropine 0,6 mg and pethidine 100 mg were given intramuscularly 30 minutes before commencement of anaesthesia (when there was evidence of fetal distress pethidine was omitted and intramuscular droperidol 5 mg given instead); and (*iii*) a rapid fluid load to 500 ml was given intravenously shortly before administration of the spinal anaesthetic.

Anaesthetic technique

The anaesthetic technique employed in the study group was as follows: 1 ml of a 0,25% solution of hyperbaric cinchocaine (Nupercaine; Ciba) was injected over 2 seconds via the L2-3 or L3-4 interspace into the subarachnoid space with the mother in a sitting position, using a 21G spinal needle. Immediately after the injection she was laid flat at 15° left lateral tilt with a pillow under her head. The abdomen was then prepared and draped, and the level of analgesia assessed. Local abdominal anaesthesia was then employed using 0,75% lignocaine with adrenaline (1:200 000) to extend the level of anaesthesia as required. Infiltration was primarily directed at the skin and parietal peritoneal layers.

No packs were used during the operation, and a Doyen retractor only in the lower end of the wound was permitted. Supplementary oxygen was routinely given by face-mask until the baby was delivered. Unpleasant awareness was treated with intermittent intravenous ketamine 0,25 - 0,5 mg/kg as necessary. The mother was told that this was available before the operation commenced.

Ergometrine was avoided, but oxytocin 10 U was given intravenously after the birth of the baby. It was followed by an infusion of oxytocin 10 U/l at 30 drops/min.

The control group was anaesthetized with 1,6 ml 0,25% cinchocaine solution injected into the subarachnoid space. No local anaesthetic was used. The operative technique was similar. Prophylactic ephedrine or mephentermine was not employed in either group.

Patient response

The patients' response to the anaesthetic and procedure was assessed as follows:

Blood pressure and pulse rate were recorded twice before induction and every 5 minutes throughout the operation.

Awareness was graded as follows after the infiltration with local anaesthetic had been completed: negligible — the mother conversed with her attendants and took an active interest in the baby; moderate — the mother grimaced, stopped the conversation, but did not request further analgesia; unacceptable — the mother complained of pain, moved her hand toward the wound, and/or demanded further analgesia (analgesia was never deliberately withheld to this point of discomfort). The worst level of pain felt at any time during the procedure was always that which was recorded. For example, if the mother only felt pain at the end of the operation, having been free of pain up to that point, her level of awareness was graded as unacceptable.

The mothers were all interviewed on the 2nd postoperative day by a midwife, who asked the following questions:

1. 'What do you remember of the operation?' Analgesia was graded as satisfactory if the mother gave a response such as 'the big light' or 'the baby crying'. It was graded as unsatisfactory if she referred immediately to pain.

2. If the above answer indicated satisfactory analgesia the mother was asked: 'How much pain did you feel in your abdomen during the operation?' Analgesia was graded as satisfactory if the mother remembered no pain or pain which was less than labour pain. It was graded as unsatisfactory if she remembered pain which was as bad as or worse than labour pain.

3. All mothers were then asked: 'Would you agree to have your next caesarean section done this way if a general anaesthetic is difficult for you?' Analgesia was graded as satisfactory if the mother replied 'Yes', doubtful if she replied 'I don't know', and unsatisfactory if she replied 'No' (if the reason given involved abdominal pain).

The well-being of the neonate was carefully assessed at 1 and 5 minutes using the Apgar score.

Most of the spinal anaesthetics and all of the operations were carried out by 4 of the authors, who were working in the Charles Johnson Memorial Hospital obstetric unit at the time of the study. None of them has any postgraduate qualification in anaesthetics or obstetrics. All medical officers at this hospital are instructed in the techniques of spinal anaesthesia on arrival at the hospital. None had more than a little previous experience in the use of local anaesthesia for caesarean section.

Results

The mean ages of the patients in the study and control groups were comparable (24,3 years and 25,7 years), and the parity groupings did not vary significantly.

The indications for caesarean section are set out in Table I. The study group was loaded with more women who had had a previous caesarean section (a caesarean section scar makes local abdominal infiltration more difficult and adequate analgesia more difficult to achieve[2]). The control group was loaded with more caesarean sections indicated by fetal distress.

The level of anaesthesia achieved was different in the two groups (Table II). This difference was statistically significant, but it is notable that there was a considerable variation in the levels of anaesthesia obtained in both groups with the techniques employed.

TABLE I. INDICATIONS FOR CAESAREAN SECTION

	Study group (54 patients)		Control group (55 patients)	
	No.	%	No.	%
Previous LSCS	33	61	26	47
CPD	24	44	29	53
Fetal distress	3	6	12	22
Breech presentation	3	6	3	5
Multiple pregnancy	4	7	3	5
Other	13	24	11	20

LSCS = lower-segment caesarean section; CPD = cephalopelvic disproportion.

TABLE II. LEVEL OF ANAESTHESIA

	Study group		Control group	
	No.	%	No.	%
Below T12	7	13	2	4
T8-T12	25	47	17	32
T6-T8	12	23	21	40
Above T6	9	17	13	25
Total*	53		53	

$0,1 > P > 0,05$.
* The information for 1 patient in the study group and 2 in the control group was not filled in on the questionnaire.

The mean blood pressures in the two groups are recorded in Table III. In 22% of the patients in the study group and 39% of those in the control group the blood pressure was 150/100 mmHg at the start of the anaesthetic. Thirty-five per cent of the study group and 40% of the control group had maximum blood pressures of > 150/100 mmHg during the anaesthetic.

TABLE III. MEAN RECORDED BLOOD PRESSURES (mmHg)

	Starting	Maximum	Minimum
Study group	137/89	142/91	105/72
Control group	144/93	145/94	104/68

There was no significant difference between the two groups as regards the incidence of hypotension (defined as a systolic blood pressure of ≤ 100 mmHg); 34% of the study group and 35% of the control group became hypotensive by this criterion. However, fewer of the patients in the study group developed a blood pressure of < 80 mmHg (study group 6%, control group 10%).

The amounts of local anaesthetic used varied, going up to 50 ml 0,75% lignocaine in the study group. The mean was 23,9 ml.

The amount of ketamine required in the two groups is set out in Table IV. Significantly more ketamine was required by the study group. Factors influencing this are the following: (*i*) the longer duration of the operations in this group (Table V) — this in turn is partly due to the loading of the study group with women who had caesarean section scars; (*ii*) the difficulty in

TABLE IV. AMOUNT OF KETAMINE GIVEN

Amount given (mg)	Study group		Control group	
	No.	%	No.	%
Nil	24	44	45	82
25	5	9	3	5
50	9	17	5	9
75	8	15	0	0
100	6	11	2	4
150	2	4	0	0
Total	54		55	

$P < 0,01$.

TABLE V. DURATION OF ANAESTHESIA

	Study group*	Control group†
< 40 min	8	15
41-60 min	26	30
61-90 min	12	7
> 90 min	8	3
Total	54	55

* Range 33-120 min.
† Range 25-110 min.

achieving adequate infiltration of previous caesarean scars with local anaesthetic; and (*iii*) the relative inexperience of the surgeons in local anaesthetic infiltration for caesarean section.

The mean Apgar score at 1 minute was better in the study group (7,8) than in the control group (7,0). The difference was much more significant when the infants with Apgar scores of 5 or less were analysed — 13% of the study group and 23% of the controls fell into this group. At 5 minutes there was no significant difference in the mean Apgar scores (9,4 and 9,2).

One patient in the study group complained of difficulty with respiration and speech after the spinal anaesthetic was injected . She was comfortable when given oxygen. Two patients in the control group developed high spinal anaesthesia necessitating intubation and ventilation. The spinal anaesthetic did not work in 1 patient in the control group in spite of a repeat injection — she was delivered with the aid of infiltration of local anaesthetic.

When maternal discomfort was assessed by the anaesthetist, significantly more women in the study group complained of discomfort (Table VI). In the mothers' assessments on day 2, this difference was far less significant (Table VII). This may be due to the powerful amnesic effect of even low doses of ketamine.[4]

TABLE VI. MATERNAL AWARENESS, COMPLICATIONS AND HEADACHES AS ASSESSED BY THE ANAESTHETIST

	Study group		Control group	
	No.	%	No.	%
Awareness*				
Negligible	28	52	44	80
Moderate	19	35	5	9
Unacceptable	7	13	6	11
Total	54		55	
Complications				
Severe hypotension	3	5	3	5
Respiratory difficulty	0	0	2	4
Cardioresp. arrest	0	0	0	0
Nil	51	95	50	91
Total	54		55	
Headaches				
Yes	21	39	15	28
No	33	61	38	72
Total†	54		53	

* $P < 0,01$ (moderate-negligible).
† The information for 2 patients in the control group was not filled in on the questionnaire.

TABLE VII. RESULTS OF QUESTIONNAIRE

	Study group		Control group	
	No.	%	No.	%
Intra-operative pain				
Mentioned	13	25	8	15
Not mentioned	40	75	46	85
Total*	53		54	
Amount of pain				
Worse than labour	3	6	2	4
Less than labour	51	94	52	96
Total*	54		54	
Agree to next CS this way				
Yes	50	93	50	93
Don't know	2	3,5	2	3,5
No	2	3,5	2	3,5
Total*	54		54	

* In some cases the information was not filled in.
CS = caesarean section.

Discussion

The results of this study were disappointing. Using the technique described, low spinal anaesthesia combined with infiltration of local anaesthetic into the abdomen appears safer than the standard technique for spinal anaesthesia used in this hospital. However, the incidence of high spinal anaesthesia recorded in the control group in this study is higher than the overall incidence (1%) of this complication at this hospital.

The incidence of maternal hypotension in the study group was such that the technique used here cannot be recommended to the lone doctor who is forced to do a caesarean section without the assistance of a colleague.

The higher Apgar scores of the infants born to the mothers in the study group may reflect better uterine perfusion resulting from lower levels of anaesthesia. It is more likely, however, that it reflects differences in the condition of the fetuses before anaesthesia was commenced, there being more fetal distress in the control group than in the study group.

The design of the project was hampered by difficulty in obtaining any hyperbaric spinal anaesthetic other than cinchocaine 0,25%. The disadvantage of this agent is that according to the package insert patients should not be allowed to remain sitting for 2-5 minutes after it has been injected into the subarachnoid space because of the danger of permanent damage to nerve roots from high concentrations of the local anaesthetic.[5] To meet the manufacturer's recommendations, patients must therefore be laid flat soon after the injection. This probably accounts in large measure for the very variable levels of anaesthesia obtained.

There is evidence (R. H. Philpott — personal communication) that very reliable levels of anaesthesia between T10 and T12 can be obtained if a suitable hyperbaric anaesthetic solution is used and the mother is kept seated for 5 minutes while the local anaesthetic 'fixes'. Suitable agents may be 1% hyperbaric pontocaine or tetracaine or 5% hyperbaric xylocaine.

Another retrospective deficiency in the design of this study is the use of xylocaine for local abdominal infiltration. Xylocaine is an amide which readily crosses the placental barrier, and affects the neurological status of the neonate. An 'alert but floppy' baby may result from its use. Bupivacaine 0,5% (an amide with a high level of protein binding) or 2-chloroprocaine 3% (an ester which is rapidly destroyed by pseudocholinesterase in the circulation) would have been a better choice because neither has any effect on the neonate.[5]

Conclusion

It is our hope that this communication will stimulate further research into the use of a combination of low spinal anaesthesia plus local anaesthetic abdominal wall infiltration for caesarean

section in peripheral hospitals where there is a shortage of suitably trained anaesthetists.*

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* Following discussions with other Kwazulu doctors about spinal anaesthetic techniques it has been decided to undertake a combined research study at several different centres with the aim of arriving at a standard technique for spinal anaesthesia, with suitable variations for doctors working on their own in isolated areas.

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