Caudal Block Analgesia in Labouring Women

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Introduction

ANIMAL STUDIES BY Henn and Brattsand (1966) showed that bupivacaine has a potency and toxicity of about four times that of lignocaine and mepivacaine. Widman (1964) has shown the same result using bupivacaine intravenously in mice. However, the longer lasting action of bupivacaine in caudal block analgesia (Kuah & Yates 1968) makes it the local anaesthetic of choice.

This double-blind trial compares the analgesic effects of bupivacaine hydrochloride 0.25 percent with 1 : 400,000 adrenaline and lignocaine hydrochloride 1.0 percent with 1 : 400,000 adrenaline. This study is designed to compare the two analgesic agents in concentrations when they are of equal potency and equal toxicity.

Material & Method

This trial studied 59 labouring women who were given caudal block analgesia to relieve labour pain. All the patients were in the first stage of labour with a cervical dilation of 3 cm or more. Technical failures and cases with inadequate records were excluded from the final analysis.

A standard programme of observation was carried out in assessing the results. A standard form is completed for each patient as the trial progresses. Before the anesthetic solution is injected into the extradural space, and with the patient lying on her back, the blood pressure and fetal heart rate were recorded. These observations were repeated every 30 minutes thereafter. Analgesic effect was assessed subjectively by the patient, and its duration recorded as the time interval between the first painless contraction and the return of painful contractions. Any untoward side effects were noted.

The study was started in the Nuffield Department of Obstetrics and Gynaecology, Oxford University, and continued in the University Hospital, Kuala Lumpur.

Anaesthetic Agents

The two test solutions are:–

1. Lignocaine 1 percent with adrenaline 1 : 400,000. A dose of 17 ml (170 mgm) was administered to each patient. There were 23 patients in this group.

2. Bupivacaine 0.25 percent with adrenaline 1 : 400,000. A dose of 17 mls (42.5 mgm) was used. There were 36 patients in this group.

It will be noted that in each case the dosage administered was well within the recommended limits for safety. The two solutions are packed in identical ampoules and these are numbered serially.

These ampoules are randomly allocated to the patients taking part in the trial. The code to the ampoule is not broken unless an emergency arises.

Table I shows the average age of the patients taking part in this study.

Table I
Patients and their Average age.

	Bupivacaine	Lignocaine
No. of Patients	36	23
Average Age	26	24

Results

Duration of Labour

These results are shown in Table II. There is no significant difference between the two groups of patients. The average duration of the first and second stages of labour are: 1196 minutes for the bupivacaine group and 1065 minutes for the lignocaine group.

Table II
Duration of the three stages of Labour

	Bupivacaine	Lignocaine
1st stage labour	1177 mins.	1928 mins.
2nd stage labour	19 mins.	37 mins.
3rd stage labour	6 mins.	5 mins.

Latency Period

There was no significant difference between the latency periods for the two groups of patients. (See Table III). The average latency period for the bupivacaine group is 5.56 minutes and that for the lignocaine group is 5.09 minutes.

Table III
Latency period for the two groups of patients.

	Bupivacaine	Lignocaine
1st Injection	6.3 mins.	6.0 mins.
2nd Injection	4.4 mins.	4.8 mins.
3rd Injection	6.0 mins.	4.5 mins.
Average	5.56 mins.	5.09 mins.

Duration of Analgesia

The duration of action of the two anesthetic agents studied are shown in Table IV.

This study shows that bupivacaine 0.25 percent with adrenaline 1 : 400,000 has a longer effect than lignocaine 1.0 percent with adrenaline 1 : 400,000. The difference is statistically significant.

Table IV
Duration of action of bupivacaine and lignocaine in caudal block analgesia.

	Bupivacaine	Lignocaine	Significant Difference
1st Injection	192 mins.	121 mins.	$P < .001$
2nd Injection	161 mins.	99 mins.	$P < .01$
3rd Injection	184 mins.	108 mins.	$P < .01$

Blood Pressure, Pulse Rate and Fetal Heart Rate

Variations of these are shown in Table V. In none of these is there any significant difference between the bupivacaine group and the lignocaine group.

In the first injection, the fall in the systolic and the diastolic blood pressure in both the groups is statistically significant ($P < .001$).

It is interesting to note that the fall in blood pressure is not statistically significant for the second and the third injections. The fall in the systolic blood pressure for patients receiving the second injection of lignocaine is an exception, ($P < .01$).

Although there is a constant increase in the fetal heart rate, the increase is statistically not significant. The increase in the fetal heart rate following the third injection in the bupivacaine group is statistically significant ($P < .001$).

There is no significant variation in the maternal pulse rate.

Discussion

Lignocaine hydrochloride 1% and bupivacaine hydrochloride 0.25% are of comparable potency and toxicity in animal studies (Widman 1964; Henn and Brattsand 1966). Lignocaine hydrochloride (Lidocaine) 1 percent in a dosage of 200 mg. is reported to be a very satisfactory agent for continuous caudal analgesia in obstetrics (Ellis and DeVita 1962). Since its introduction, bupivacaine (LAC 43, marcaine) has stimulated a great deal of excitement because of its long lasting action (Kuah and Yates 1968; Moore et al 1970),

The present study shows that bupivacaine 0.25 per cent with adrenaline 1 : 400,000 consistently has a longer lasting action than lignocaine 1.0 per cent. On the average, the analgesia produced by bupivacaine lasts 75 minutes longer than lignocaine. (71 minutes, 60 minutes and 84 minutes for the 3 injections). This is statistically significant.

Table V
Variations in blood pressure, pulse rate and fetal heart rate.
Blood pressure (BP), Pulse Rate (PR), Fetal Heart Rate (FHR)
(B.P. – mm Hg. P.R. & F.H.R. – per min.)
Mean difference between measurements taken at injection time and measurements taken post injection.

		Bupivacaine	Significance of difference	Lignocaine	Significance of difference
1st INJECTION	B.P. (SYST)	14.7 decrease	$P < 0.01$	14.3 decrease	$P < 0.01$
	B.P. (DIAST)	8.5 decrease	$P < .001$	9.0 decrease	$P < .001$
	P.R.	2.0 increase	Not significant	1.5 decrease	Not significant
	F.H.R.	0.4 increase	Not significant	4.7 increase	Not significant
2nd INJECTION	B.P. (SYST)	8.8 decrease	Not significant	11.2 decrease	$P < .001$
	B.P. (DIAST)	3.3 decrease	Not significant	6.0 decrease	Not significant
	P.R.	4.7 decrease	Not significant	2.3 decrease	Not significant
	F.H.R.	3.4 increase	Not significant	1.4 increase	Not significant
3rd INJECTION	B.P. (SYST)	4.3 decrease	Not significant	4.9 decrease	Not significant
	B.P. (DIAST)	7.8 decrease	Not significant	4.1 decrease	Not significant
	P.R.	2.3 increase	Not significant	2.3 decrease	Not significant
	F.H.R.	6 increase	$P < .001$	38 increase	Not significant

The other finding of this study is that there is a significant fall in blood pressure (systolic and diastolic) following the initiation of caudal block. This has been observed before, Ellis and DeVita 1962; Kuah and Yates (1968); Dawkins (1969); Moore et al (1971); Kuah (1974). This fall in blood pressure is significant for the bupivacaine as well as the lignocaine group. The fall in blood pressure following the top-up doses (second and third injections) was not significant.

The degree of motor blockade was not studied in this trial. Moore et al 1971 reported that with 0.25 and 0.5 per cent bupivacaine, adequate motor blockade of the perenial musculature but only varying degrees of motor blockade of the muscles of the abdomen and lower extremities was produced.

The dosage of the drugs used in the present trial is very low, viz. lignocaine 170 mgm in 17 mls mls and bupivacaine 42.5 mgm in 17 mls. The dose recommended by the manufacturer for bupivacaine 0.25 per cent in caudal block is 37.5 mg to 100 mg (15 ml – 40 ml). Moore et al 1971, using a dosage of 23.8 $\pm$ 2.3 mls of 0.25 per cent bupivacaine with adrenaline were able to maintain analgesia for 219.3 $\pm$ 73.4 minutes. On the other hand, Ellis and DeVita (1962) used 200 mg – 300 mg of lignocaine 1.0 per cent reported the duration of action to be 30 minutes to 60 minutes.

Peak levels of bupivacaine hydrochloride in the blood was reached in 15 – 30 minutes. The venous whole blood level was 0.45 to 1.01 ug/ml., and the arterial whole blood was 20 per cent to 40 per cent higher following injection of 125 mg or 150 mg in a caudal block (Moore et al 1971). The same workers also showed that blood from the umbilical vein and artery (93 – 315 minutes following injection) contained 0.06 to 0.24 ug/ml of bupivacaine hydrochloride. The umbilical-maternal bupivacaine hydrochloride concentration ratios

(0.2 to 0.4) at delivery were significantly lower than the corresponding ratios (0.5 to 0.7) for lignocaine hydrochloride and mepivacaine hydrochloride reported by Tucker et al 1970. The same workers are of the opinion that this difference may, in part, be due to the difference in the plasma-binding of the agents. The risk of fetal intoxication may be lower following bupivacaine hydrochloride when compared with lignocaine hydrochloride.

Intravenous infusion studies in man showed that the convulsive arterial plasma level of bupivacaine hydrochloride is about 4 ug/ml (approximately equivalent to 2 ug/ml whole blood) or higher (Jorfeldt et al 1968). Hench the peak arterial, venous and umbilical vessels levels reported by Moore et al (1971) are well within the safety level. The present study using 42.5 mg bupivacaine hydrochloride is even lower than that used in that study, viz. 125 mg to 150 mg bupivacaine hydrochloride.

There was no significant difference in the latency period between the two anaesthetic agents used.

Summary

A double-blind technique is used to study bupivacaine 0.25 per cent with 1 : 400,000 adrenaline and lignocaine 1.0 per cent with 1 : 400,000 adrenaline in caudal block analgesia. These concentrations are chosen because they are of comparable toxicity and potency.

Bupivacaine 0.25 per cent has a significantly longer lasting action than lignocaine 1.0 per cent. There was no other significant difference between the two test anaesthetic agents.

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