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Caudal block for analgesia after paediatric inguinal surgery

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Summary

Two hundred and eleven children aged 1 - 5 years were studied after undergoing herniorrhaphy or orchiopexy. In 111 cases a caudal block was used for postoperative analgesia. This was administered immediately after induction of anaesthesia, using bupivacaine 0,25% plain (0,7 ml/kg lean body mass), and was successful in 100 patients. A mean analgesic level (± SE) of T9,9 ± 0,47 was achieved (range L2 -T6). In 5 cases no block occurred and in 6 the level was below T12. The other 100 children acted as controls.

Behaviour patterns were more restful in the caudal block group on awakening and less opiate was required during the first 5 postoperative hours. No complications resulted.

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In perineal and lower abdominal surgery, caudal block has been recommended as an easy, safe procedure with a high success rate.[1-3] The volumes recommended vary from 0,5 ml/kg[2] to 1,5 ml/kg and higher.[4,5] However, serious complications such as cardiac arrest and total body block and even death have been reported with large doses.[4]

This variation in the literature led us to study the analgesic levels achieved by our use of bupivacaine 0,25% plain (0,7 ml/kg lean body mass). This has been our routine dose and volume since 1977 and is based on Schulte-Steinberg and Rahlfs'[6] figure of 0,1 ml per dermatome per year of age.

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Patients and methods

Two hundred and eleven children aged 1 - 5 years and undergoing herniorrhaphy or orchiopexy were entered into the study, which was approved by the Ethical Committee of Tygerberg Hospital. All patients were graded as ASA 1 or 2. One hundred and eleven received a caudal block with bupivacaine 0,25% plain (0,7 ml/kg lean body mass) for postoperative analgesia (group A) and 100 received no block (group B).

Premedication consisted of methadone 0,1 mg/kg, trimeprazine 2 mg/kg and atropine 0,02 mg/kg, administered orally 60 minutes before operation. Induction was with halothane in oxygen via an Ayres T-piece system, 50% nitrous oxide being added once the patient was asleep. Maintenance of anaesthesia was with nitrous oxide and oxygen via a Rendell-Baker Soucek mask and spontaneous respiration. Once the group A patients were asleep an intravenous line was established and the caudal block administered aseptically. Monitoring and recovery procedures were routine.

Once the child was awake in the recovery room the analgesic level was tested by pinprick.[2,5] A level of T12 was required for admission to the caudal block group for comparison of postoperative analgesia.

Recovery time was noted from the time the anaesthetic gases were turned off until the oral airway was removed. The time to first crying or moving was also noted. Behaviour in the recovery room was graded by the nursing staff as follows: grade 1 — no crying; grade 2 — crying easily soothed; grade 3 — crying not soothed. The staff were unaware which children had received a caudal block.

Behaviour was graded at 15-minute intervals for 60 minutes, after which the child left the recovery room for the ward. Analgesia (pethidine 1 mg/kg by intramuscular injection) was supplied at the discretion of the nursing staff from 30 minutes after the child emerged from anaesthesia onwards.

Student's *t*-test for unpaired data was used to analyse recovery times and the chi-square test to analyse behaviour. $P < 0,05$ was taken as significant.

Results

The two groups were comparable, mean ages and weights being 29 ± 1,4 months and 14,1 ± 0,3 kg for group A and 31 ± 1,0 months and 13,8 ± 0,30 kg for group B.

A total of 111 caudal blocks were attempted — in 3 cases the caudal space could not be found, in 2 the needle was thought to be correctly located but no block resulted, and in 6 the analgesic level was below T12. In 100 cases the caudal block produced an

analgesic level of T12 or above. The mean level reached was T9,9 ± 0,47 (range L1 - T6), the level being T6 in 7 cases.

Recovery times were similar in the two groups (Table I), but group A subjects moved rather than cried, while those in group B cried and moved on awakening. This persisted into the recovery phase (Table II), during which group B patients were significantly more distressed ($P < 0,05$ at 30 minutes).

TABLE I. RECOVERY TIMES*

	Group A	Group B
Airway out	**19,4 ± 1,86**	**18,9 ± 1,12**
Moving or crying	**21,6 ± 2,06**	**19,5 ± 2,22**

*In minutes, mean ± SE.
Student's *t*-test for unpaired data: $P > 0,05$ (not significant).

TABLE II. BEHAVIOUR IN RECOVERY ROOM AT 30 MINUTES

	No. of patients	
	Group A	Group B
No cry	**70**	**50**
Cry soothed	**26**	**34**
Cry not soothed	**4**	**16**

Chi-square test: $P < 0,05$ (significant).

TABLE III. ANALGESIA GIVEN

	No. of patients	
	Group A	Group B
In recovery room	**6**	**16**
During 1st 5 hours	**3**	**7**

Chi-square test: $P < 0,01$ (significant for both times).

Numbers of patients receiving postoperative pethidine are set out in Table III. During the first 5 postoperative hours group A patients required significantly less pethidine ($P < 0,01$). Thereafter no differences were found.

Discussion

Administration of a caudal block using a 'single-shot' technique is never a very precise method of blocking a given area.[1,4,5] We found this to be the case, analgesic levels ranging from a mean of T9,9 ± 0,47 to L2 in 4 cases and to T6 in 7. Unfortunately the volume must be well controlled, owing to the proven dangers of excessive spread.[4]

The toxic dose of bupivacaine given by the manufacturers is 2 mg/kg, and Scott[7] has given similar figures, with a toxic plasma level of 2 μg/ml depending on the rate of rise in the plasma concentration. Bearing these figures in mind, 0,8 ml/kg of a bupivacaine 0,25% solution is the theoretical maximal dose. Up to 3 mg/kg[3] has been used, and plasma levels were measured at a mean peak of 1,4 μg/ml 20 minutes after injection; however, in Eyres *et al.*'s[3] study 2 of 45 patients had plasma levels of 2 μg/ml. In another study,[8] using similar high doses but in combination with adrenaline 1 : 200 000, there was found to be a similar peak plasma level but at 45 minutes. While adrenaline may decrease the absorption[2,8] of bupivacaine and thereby perhaps decrease plasma levels, the use of adrenaline with halothane in the spontaneously breathing patient is not recommended. Johnstone *et al.*[9] and Katz *et al.*[10] have concluded that 1 μg/kg is the safe dose of adrenaline when halothane is being used. Adrenaline 1 : 200 000 contains 5 μg/ml; hence only 0,21 ml/kg would be allowable, far less than the volume needed for caudal block.

While the procedure was unsuccessful in 11 cases no complications occurred, indicating its safety when dose and volume are controlled. This has been our experience over 10 years of clinical use. Caudal block has been reported as having failure rates ranging from a low 2%[1] to a more realistic 10%.[11] There is much anatomical variation in the sacral area, and hence a 100% success rate cannot be expected. Our failure rate was 9,9% and included total failures (4,5%) and cases in which the block was at L1 or below (5,4%).

Both groups of patients had low postoperative analgesic requirements, but this is not unexpected. The operations were relatively minor and premedication included methadone 0,1 mg/kg, which would have acted well into the postoperative phase.

Postoperative distress in small children may be due to other factors besides pain, such as fear and thirst. In these cases sympathic soothing by the nursing staff should be beneficial. However, pain is less amenable to sympathy and hence the more distressed behaviour in group B is of significance. Secondly, the higher pethidine requirements in this group up to 5 hours after the operation indicate a higher pain level.

In conclusion, we can state that caudal block in children under 5 years of age using bupivacaine 0,25% plain (0,7 ml/kg lean body mass) gives a mean analgesic level of T9,9 ± 0,47 and provides postoperative analgesia beneficial to the child, with significantly less distress on recovery and less analgesic requirement up to 5 hours postoperatively.

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