A CLINICAL APPRAISAL OF 2-CHLOROPROCAINE IN CONTINUOUS CAUDAL OBSTETRICAL ANESTHESIA

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SINCE 1950 at the Virginia Mason Hospital, the husband has been allowed to be with his wife in the labor room and in the delivery room to observe the labor and to "participate" in the birth of the baby. If the father is to participate, then the mother must be mentally alert. Otherwise, the experience could be considered a way of satisfying the father's curiosity and perhaps educating him, but the effect of "participation" would be lost. To assure that the mother is awake and is having minimal discomfort, regional block analgesia must be used. At our institution, the analgesic technique of choice is continuous caudal block with little sedation, *e.g.*, promethiazine (Phenergan) 25 mg. and meperidine (Demerol) 50 mg. intramuscularly or no sedation at all.

Many local anesthetic agents have been employed for continuous caudal block but all have one or more drawbacks. The ideal local anesthetic agent for continuous caudal block should have the following properties: (1) a rapid onset, 1–5 minutes, (2) adequate potency, (3) diffusibility, (4) a low relative and absolute toxicity, and (5) a reasonable duration of action *i.e.*, 1–3 hours. Previous studies and comparison with other local anesthetic drugs have shown 2-chloroprocaine to have a rapid onset, a high diffusibility, and a low incidence of severe systemic toxic reactions.[1–4] These facts prompted our clinical appraisal of 2-chloroprocaine in continuous caudal anesthesia.

METHOD

From January, 1958, through December, 1958, 2-chloroprocaine was used routinely for continuous caudal block. The technique used was the malleable needle method described by Moore.[5] During this time, 1,030 continuous caudal blocks were attempted. Two patients received 1 per cent 2-chloroprocaine, 934 patients received 2 per cent 2-chloroprocaine and 94 patients received 3 per cent 2-chloroprocaine, all without epinephrine.

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RESULTS

The initial dose necessary to establish satisfactory analgesia in 998 patients varied between 20 and 50 ml. Onset of anesthesia with 2 and 3 per cent solutions occurred within 10 minutes in 878 patients (88 per cent) and within 30 minutes in the remaining 120 patients (fig. 1). The onset of anesthesia was taken to be the number of minutes from the initial injection of the drug to the time of pain relief.

The duration of anesthesia was from 45 to 90 minutes, measured from the time pain relief was noted by the patient to the time the patient again became uncomfortable (fig. 2). The end point of anesthesia was dramatic.

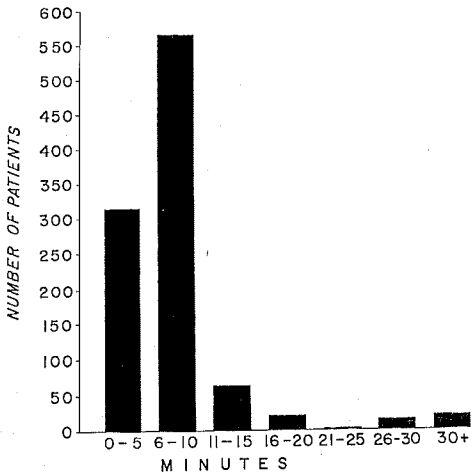

FIG. 1. Time of onset of anesthesia in 998 patients.

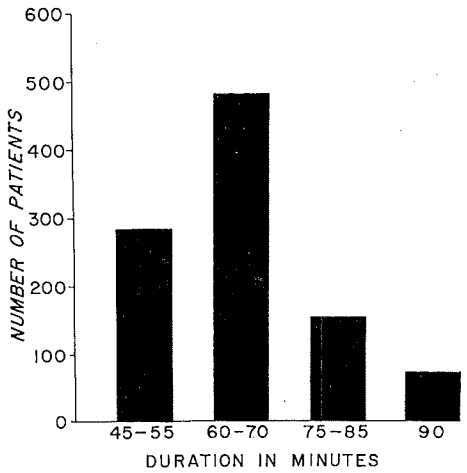

FIG. 2. Duration of anesthesia.

TABLE 1

COMPLICATIONS OF THE SERIES

Spinal anesthesia	1
Hypotension	44
Nausea and vomiting	14
Systemic toxic reactions	
Convulsion from intravascular injection or rapid absorption	8
Tremor	41
Dizziness	4
Tinnitus	9
Numbness (generalized)	9
Restlessness	1
Cerebral vascular accident	1
Total	132

The patient was comfortable one minute, the next she was fully cognizant of pain. Subsequent injections which were added varied between 10 and 50 ml.

Pain relief failed to materialize in 32 patients (3.1 per cent). These patients had either inadequate or no anesthesia, necessitating supplementation with general anesthesia or with a lumbar epidural block. In order to establish anesthesia with the caudal technique, some patients necessarily received large total doses of 2-chloroprocaine. One patient received a dose of 4.9 Gm. of 2-chloroprocaine in one and one-half hours without evidence of a systemic toxic reaction; 83 ml. of a 3 per cent solution (2.5 Gm.) was given in the first one-half hour and 30 ml. (2.4 Gm.) the next hour.

The 132 complications (12.8 per cent) noted during this series of 1,030 cases included the usual complications of caudal block anesthesia (table 1). Of these nine (0.88 per cent) were considered serious. Eight systemic toxic reactions progressing to convulsions and one cerebral vascular accident were observed. The postpartum cerebral vascular accident occurred following the use of a vasoconstrictor drug in conjunction with an oxytocic drug and will be reported elsewhere.[6]

DISCUSSION

In the greater number of patients (934), 2 per cent 2-chloroprocaine produced satisfactory anesthesia. When the patient interpreted pressure as pain, 3 per cent was utilized. Three per cent solutions of 2-chloroprocaine in the caudal canal produced profound anesthesia. With a 2 per cent solution most patients retained some motor function in the lower extremities. On the other hand with a 3 per cent solution, motor function in the lower extremity usually was absent. A concentration of 1 per cent of the drug was inadequate. Onset was slow and excessive volumes of solution were necessary to relieve pain. Consequently, the use of 1 per cent solutions was abandoned after only two patients had been given that concentration.

When continuous caudal anesthesia is used for the obstetrical patient, the rapid onset of analgesia with 2-chloroprocaine is appreciated by the patient, obstetrician and anesthesiologist. Insufficient initial dosage, excessive sterilization or incorrect placement of the needle account for the majority of the cases where anesthesia was not established within 10 minutes. When 2-chloroprocaine was exposed to more than two heat sterilizations (one at the factory and one in the caudal tray) it

appeared to lose potency. This fact was observed clinically and substantiated by analysis by the manufacturer.*

The cephalad spread of the drug is of no particular disadvantage as long as the anesthesiologist is cognizant of its occurrence. Brachial plexus blocks have been observed following the injection of 30 ml. of the drug into the caudal canal even in patients who were tall (5 feet 7 inches or more) and, therefore, presumed to have an epidural space that would accommodate more solution than would the epidural space of a shorter patient.

The relatively short duration of anesthesia from this drug is not a serious drawback. The continuous technique permits intermittent injections of the anesthetic solution, and, even when delivery is difficult the minimum duration of anesthesia of the drug, *i.e.*, 45 minutes, assures most obstetricians sufficient time to deliver the infant and repair the episiotomy.

During this study, the majority of the patients were not given a vasoconstrictor drug prophylactically. Vasoconstrictor drugs were administered to correct hypotension only when the patient's systolic pressure reached 80 mm. of mercury or less, and remained there for longer than 3 to 5 minutes or if the fetal heart tones became slow. The omission of a prophylactic vasoconstrictor drug undoubtedly accounts for a reasonable number of the hypotensions and associated nausea and vomiting which occurred in this series (table 1). The nausea and vomiting disappeared when the patient's blood pressure returned to 90 mm. of mercury or more, either from normal physiologic mechanisms or the intravenous use of a vasoconstrictor drug. It should be emphasized that if vasoconstrictor drugs are used either to correct a hypotension or added to the local anesthetic solution, the obstetrician must be notified and the oxytocic drug should be omitted. Otherwise, a severe, persistent hypertension and even rupture of a cerebral blood vessel may occur in the immediate postpartum period.[6]

The one spinal anesthetic without sequelae which occurred in this series followed the injection of the test dose of 5 ml. of the drug. No treatment was required as the anesthesia was at approximately the eighth thoracic level.

Unintentional intravenous injection of the drug accounted for 6 of the 8 convulsions. Manipulation of the needle while aspirating produced frank blood in these 6 patients. In all, the needle was adjusted and the patient was delivered under continuous caudal analgesia. The other 2 cases of convulsions were probably caused from rapid absorption of the drug from the plexus of vessels which lie in the sacral canal. Subsequent doses of the drug were reduced and these patients also were delivered under continuous caudal anesthesia. All 8 patients were treated by the inhalation of oxygen from bag and mask. All the convulsive episodes were short, less than 5 seconds in duration, and once oxygen was started the convulsions ceased.

Minor systemic toxic reactions caused by relatively high blood levels of 2-chloroprocaine and by the emotional lability of the unsedated obstetrical patient included: tremors, dizziness, tinnitus, numbness and restlessness. It was our observation that these reactions were milder and of shorter duration than those produced by other drugs which we have used, *e.g.*, piperocaine (Metycaine) 1.5 per cent in 6,650 deliveries, hexylcaine (Cyclaine) 2 per cent in 120 deliveries, and lidocaine (Xylocaine) 2 per cent in 200 deliveries. These reactions also cleared rapidly with oxygen.

The short duration of even the severe systemic toxic reactions which occurred following administration of 2-chloroprocaine is probably due to the rapid enzymatic hydrolysis in human plasma of the drug.[1] It must be emphasized that while this drug appears to have a low toxicity in most instances, inadvertent intravascular injection or rapid absorption may produce a severe systemic toxic reaction.

* Letter from Maltbie Laboratories May 29, 1958, reporting on analysis of vials of 2-chloroprocaine sterilized in our institution stated:

	Per Cent Hydrolysis
"Unopened (vials), autoclaved once	3.58
	3.4
Unopened (vials), autoclaved twice	6.01
	6.36
	6.36
	6.01

Calculations based on 2 per cent Nesacaine present initially."

SUMMARY AND CONCLUSIONS

2-Chloroprocaine was administered to a series of 1,030 obstetrical patients by the continuous caudal technique. The evidence collected demonstrated its low toxicity, rapid onset, and high diffusibility. The maximum dose used was 4.9 Gm. in a period of less than one hour and one-half. Satisfactory anesthesia failed to appear in 3.1 per cent of the patients. The onset of anesthesia occurred within ten minutes in 88 per cent of the remaining patients. The duration of anesthesia ranged from 55 to 90 minutes.

There were 132 complications (12.8 per cent) observed during this series of 1,030 cases. Nine (0.88 per cent) were considered serious. There were no fatalities or near fatalities in this series.

Two per cent solution of 2-chloroprocaine is now being used by us as the drug of choice for continuous caudal anesthesia.

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BACKACHE Epidural administration of a solution of vitamin B_{12}, procaine (0.5 per cent solution) and penicillin (150,000–200,000 units) was carried out on 26 patients with lumbo-sacral radiculoneuritis of marked severity. In 12 cases acute deterioration was curtailed by a single blockade, in 9 by two blockades, in 3 by three blockades and in one by four. In one case there was no effect. No complications were observed. There was diminution or disappearance of manifestations of tenseness, scoliosis and limitation of trunk movements. Degenerative phenomena remained static. No recurrence was observed in 15 patients over a period of 8–22 months; all were working. (*Khait, Y. B., and Kupchik, B. M.: Experience in the Treatment of Lumbo-Sacral Radiculoneuritis by Epidural Administration of Vitamin B_1, Penicillin and Procaine, Zh. Nevropat. i Psikhiat. 58: 1211 1958.*)

THERAPEUTIC BLOCK Areas of skin hyperaesthesia were infiltrated intradermally with 100–200 ml. of 0.5 per cent solution of procaine on 4–5 occasions with 3–4 days intervals. Intradermal injections of procaine were frequently combined with parenteral block. Procaine therapy combined with other measures is a very useful method of management of visceral pain such as accompanies angina pectoris, peptic ulceration, cholecystitis, etc. (*Dyadkin, K. P.: The Use of Procaine for the Relief of Visceral Pain in the Clinic of Internal Diseases, Sov. Med. 5: 88 1957.*)

SKIN OXYGEN TENSION Using an open tipped platinum electrode in the skin of the lower extremities of normal subjects, it was found that preganglionic sympathetic denervation (from spinal, epidural anesthesia or paravertebral sympathetic blocks) resulted in a decrease in skin oxygen tension. This, in the presence of cutaneous hyperemia, suggests a decreased rate of capillary blood flow during the period of denervation, or in other words, capillary stagnation. (*Davis, M. T., and Greene, N. M.: Polarographic Studies of Skin Oxygen Tension Following Sympathetic Denervation, J. Appl. Physiol. 14: 961 (Nov.) 1959.*)