INTRAVENOUS REGIONAL ANAESTHESIA*

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THE INTRAVENOUS ADMINISTRATION of local anaesthetic drugs in clinical medicine was initiated by Bier in 1908 Holmes,¹ in February 1963, reported thirty cases for which he employed a modification of Bier's "venous anaesthesia" The technique has been readily adopted by the Anaesthetic team in the new Teaching Hospital in Lagos, where many patients appear for emergency treatment of lesions of the extremities The 514 patients in this series were anaesthetized during the eight-month period from April to December, 1963 They were unpremedicated and unprepared in that food had possibly been eaten within a short time of arrival

METHODS

A sphygmomanometer cuff was applied to the affected extremity of the recumbent patient and the blood pressure was measured prior to drainage of the extremity and again one minute after final release of the tourniquet For hand infections the anaesthetist had the choice of applying the cuff above or below the elbow

A 20-c c syringe loaded with lignocaine was attached to a needle (SWG 22), which was introduced into a suitable vein distal to the cuff After elevating the extremity for one minute to allow venous drainage, the cuff was inflated above the systolic pressure, the extremity was returned to the horizontal position, and the solution of lignocaine was administered in a single injection The surgeon then prepared the extremity and performed the necessary operation, the dressing was applied, and the sphygmomanometer cuff was deflated

Holmes and Bier preferred the Esmarch bandage for the exsanguination of the extremity, but in the few cases in which it was used here, it afforded no particular advantage over the method of gravitational drainage

The concentration of lignocaine used varied between 0.5 and 2.0 per cent, while the injected volume ranged from 10 to 40 c c for the first 150 patients Then it was decided that a 1 per cent lignocaine solution was the most satisfactory and that 20 c c would be adequate for an adult The majority of the patients were 20 to 60 years of age and required this chosen lignocaine dosage of 200 mg Children up to 15 years of age and patients over 60 years were given smaller doses as determined by each investigator for the individual patient

The surgical procedure was begun two to five minutes after the injection of the lignocaine, and was completed usually in less than five minutes, so that the

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estimated period of analgesia was ten minutes. The range of surgical period was from 2 to 70 minutes. For two orthopaedic procedures on bone and tendon the patients comfortably withstood the surgical onslaught for 70 minutes. In a limited number of cases the duration of analgesia after removal of the tourniquet was determined by testing response to a pin-prick. A painful stimulus was experienced by many patients within one minute of re-establishing the circulation to the limb, following a very short procedure, and in another four minutes the limb was completely sensitive to pin-prick. The longer the period of inflation of the cuff, the longer was the period of analgesia after it was deflated.

The majority of the patients (465) had operations performed on the upper extremity and only 39 on the lower. (It was often impossible to find a vein in the leg.) Most of the patients had infections necessitating wide-spread incision and drainage, but lacerations, ganglia, and fractures were also treated.

RESULTS

The largest dosage of 800 mg was injected with no complications into the upper limbs of an 18-year-old boy with bilateral severe wrist lacerations. A 21-year-old man undergoing a closed reduction of his right forearm, who also received 800 mg, developed generalized twitchings, which soon subsided without treatment.

The oldest patient, an 86-year-old woman, received 200 mg of lignocaine for incision of her index finger. The surgical procedure lasted six minutes, with an estimated period of analgesia of ten minutes, and there was no untoward effect. The youngest patient, a 4½-year-old boy, who received 60 mg of lignocaine for needling of subungual haematomata and incision of a boil on the forearm, cried at the beginning of the surgical procedure.

For the 24 patients 5 to 10 years of age, the usual dosage was 100 mg of lignocaine. Some neurological complications were observed in this group of patients. The first was in a 7-year-old boy who received 200 mg for incision of a finger. After the operation, which lasted five minutes, the child had nystagmus and facial twitching on release of the tourniquet. The second was in a 7-year-old girl who received 100 mg of lignocaine for drainage of a hand infection. She developed mild convulsions on release of the tourniquet after an operation lasting three minutes. Neurological complications were also exhibited by two 18-year-old boys who received 200 and 300 mg of lignocaine respectively, the first manifested nystagmus, ataxia, and complained of dizziness, while the second had a major seizure, which was controlled by the use of thiopental. In the same age group four patients receiving 400 mg of lignocaine exhibited neurological or cardiovascular complications. In all, nine patients had neurological complications ranging from mild headache to frank, generalized convulsions.

Blood pressure changes determined within one minute of removing the tourniquet were equivocal. There were two cases with orthostatic hypotension and syncope on rising which reverted in the supine position.

Each investigator recorded the evaluation of the analgesic response over the complete dosage range. The anaesthesia was graded as good, moderate, fair, or

poor. Good results were obtained for 95 per cent of the cases, while the analgesia was definitely poor for fewer than 15 per cent. Of the 373 patients who received the chosen standard dosage of 200 mg of lignocaine in 20 c.c., 92 per cent showed good results and fewer than 1 per cent poor results. There was some difficulty in assessing the degree of analgesia in the majority of patients because of the language barrier.

One of the anaesthetists, who was given this form of anaesthesia three times for incision of boils on his arm, considered it completely satisfactory. During the injection of the 20 c.c. of 1 per cent lignocaine there was a slight feeling of fullness of his hand but no discomfort (some patients made grimaces suggesting suffering, and some complained of a burning sensation). His hand was numb to pin-prick two minutes after an injection in the forearm, however, after injection into the antecubital fossa, the whole hand did not become completely anaesthetized. There was some loss of muscle power. Both pin-prick sensation and power returned completely in five minutes. On one occasion he experienced tinnitus and mild disorientation on release of the tourniquet after a very short procedure.

DISCUSSION

An intravenous regional anaesthetic technique has been presented in this paper as being relatively harmless and certainly effective in surgery on the extremities. The mechanism of action of lignocaine when employed intravenously for regional anaesthesia in this manner needs to be elucidated. Subsequent neurophysiological investigations should help to solve this mystery.

Neurological complications were manifested by fewer than 2 per cent of the patients in this series. These were mostly of the minor variety, consisting of disorientation, extreme talkativeness, disequilibrium on standing, and tinnitus. Fewer than 1 per cent convulsed and in only one instance was it necessary to administer thiopental. De Clive-Lowe *et al*² reported three cases of convulsion in 900 intravenous administrations at a dosage rate of 0.75 mg of lignocaine per hour for operative procedures lasting approximately one hour. Subsequently, they stated in a report of 400 administrations of intravenous lignocaine for postoperative analgesia that no convulsions occurred if the maximum dosage of 500 mg in the first hour was not exceeded.³ In the present series, early removal of the tourniquet after injection may have released toxic amounts of lignocaine into the circulation. Cardiovascular complications occurred in fewer than 0.5 per cent of the patients.

The method permitted expeditious treatment of out-patients with no prolonged recovery period necessitating extra space and attendants. An advantage over brachial block anaesthesia was the immediate return of motor function.

SUMMARY

Regional anaesthesia for surgery of the extremities was produced by intravenous injection of lignocaine into the limb. A sphygmomanometer cuff was placed on the limb of the recumbent patient and inflated to occlude the venous drainage.

Venipuncture was then done with a small needle (22 SWG) attached to a syringe containing lignocaine solution. The cuff was then deflated, the limb was elevated for one-half to one minute to permit venous drainage, the cuff was then inflated above the systolic pressure, the arm was lowered, and the lignocaine solution was injected. Intravenous lignocaine solution was given in this manner to 514 patients between the ages of 4½ and 86 years, the dose varying from 60 mg to 800 mg. Of these patients, 373 received 200 mg of lignocaine in 20 c c, which is now considered an adequate standard dose in the adult. Over the whole dosage range 95 per cent had good analgesia, and 15 per cent were classified as poor. Of the group receiving 20 c c of 1 per cent lignocaine, 92 per cent had good analgesia, while fewer than 1 per cent had poor analgesia, there was a reduction in neurological and cardiovascular complications on release of the tourniquet for the patients who received the smaller quantities. Surgical anaesthesia was good for at least 60 minutes. This method of anaesthesia of the extremities is recommended for the efficient operation of a casualty theatre service.

RESUME

Pour la chirurgie des extrémités, on a fait une anesthésie régionale en injectant de la lignocaine dans les veines d'un membre. On a placé à la racine du membre le manchon d'un sphygmomanomètre et on l'a gonflé pour empêcher le retour veineux. On a alors ponctionné une veine à l'aide d'une aiguille 22 reliée à une seringue contenant la solution de lignocaine. On a alors dégonflé le manchon, et on a élevé le membre durant 30 à 60 secondes pour permettre le drainage veineux, puis, on a gonflé le manchon à une pression supérieure à la pression systolique, on a replacé le membre en position horizontale et on a injecté la solution de lignocaine. 514 malades, dont l'âge variait de 4½ ans à 86 ans, ont reçu une solution de lignocaine d'après cette technique. La dose a varié de 60 à 800 mg. 373 de ces malades ont reçu 200 mg de lignocaine dans 20 cc, ce qui est considéré comme une dose suffisante chez l'adulte. Dans l'ensemble, 95 pour cent ont bénéficié d'une bonne analgésie, et 15 pour cent d'une analgésie médiocre. Parmi ceux qui ont reçu 20 cc de lignocaine à 1 pour cent, 92 pour cent ont bénéficié d'une bonne analgésie et moins de 1 pour cent, d'une analgésie médiocre, par ailleurs, les complications neurologiques et cardio-vasculaires ont été moins fréquentes lorsqu'on a enlevé le garrot, pas rapport à ceux qui avaient reçu de plus fortes doses. L'anesthésie chirurgicale a duré au moins une heure. Cette technique d'anesthésie des extrémités est particulièrement efficace si l'on doit intervenir chez les accidentés.

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