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TRILENE ANALGESIA IN PAEDIATRIC PRACTICE

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Various minor diagnostic procedures in paediatrics, such as venepuncture, lumbar puncture, marrow puncture, testing electrical reactions of muscles, abdominal palpation, and chest exploration, cause apprehension and discomfort, often sufficient to render a child uncooperative or even actively resistant. Many other painful and uncomfortable undertakings occur in the course of treatment, such as intravenous injections and burn and wound dressings.

It is possible to diminish apprehension with such sedatives as chloral hydrate or "seconal" and still leave the patient co-operative; but often at the first appreciation of pain the child becomes resistant. The use of anaesthesia or local analgesia would seem to be justified where there is likely to be more than trivial discomfort or where it is essential that the patient should remain still and not resist. General anaesthesia eventually eliminates the patient's resistance but deprives us of his co-operation, and is not without a certain minimal risk. Local analgesia, with its attendant first stab of pain, often renders the child apprehensive, so that he becomes restless and uncooperative.

It occurred to one of us (J. T.) that analgesia produced by a simple inhaler might overcome the disadvantages of sedatives and of anaesthesia. In this communication the apparatus, indications for its use, the technique of administration, and the results obtained in a series of 60 consecutive administrations are described.

Apparatus

The apparatus used was the Blease inhaler. This is a simple draw-over type of inhaler, which can give three concentrations of "trilene" (trichlorethylene) suitable for analgesia and an additional one for anaesthesia by adjusting

a simple screw setting. On occasions when induction was slow it was necessary to increase the concentration to "anaesthesia." The only modification required in the standard equipment was the provision of a small face-mask. We used the smallest obtainable (B.O.C. type, small size). At times an even smaller size would have been an advantage.

Indications.—We define analgesia as the loss of sensation of pain without loss of consciousness. The apparatus was used when a diagnostic or therapeutic measure was likely to cause pain, discomfort, or undue apprehension, and where formerly we would have employed sedatives or local or general anaesthesia. When analgesia is desirable, trilene would seem to have no special contraindication.

Our series of 60 cases represents a cross-section of patients admitted to a children's medical ward for investigation and treatment. Analgesia was given for lumbar puncture (34 cases), cisternal puncture (3 cases), venepuncture (7 cases), chest aspiration (8 cases), marrow puncture (3 cases), burn and wound dressings (3 cases); and in one case each for abdominal palpation and electrical reactions.

Age.—The ages ranged from 8 months to 11 years. In infants under 9 months old inhalational analgesia has little to recommend it. We found its greatest use in children over 1 year old. In those in the group aged 1 to 5 years it prevents resistance; and in those over 5 years it will also often secure actual co-operation.

State of Health.—The state of health varied from the acutely ill newly admitted child to the chronically ill case from the waiting-list for investigation or the comparatively healthy convalescent.

Procedure to be Undertaken.—The predominant symptom, or the suspected lesion, along with the diagnostic procedure undertaken in the various cases, is shown in the Table. In the course of treatment, intravenous injections, toilet of burns, suture of lacerations, and burn and wound re-dressings were all carried out under analgesia.

Administration

No premedication was given, and analgesia was induced without special regard to the interval since the last meal. One patient received trilene as early as five minutes after a meal without untoward effect. Several have been given trilene soon after meals, because of urgency in getting samples for laboratory examination. It is not suggested that a recent meal should be ignored, but when circumstances warrant haste trilene analgesia can justifiably be employed soon after a meal. The child, if old enough to understand, is told the purpose of the inhaler and asked to take extra deep breaths if he should feel anything hurt. The mask is applied and a conversation is kept up with the child to allay fear and encourage regular breathing. The older children, aged 5 to 11, were more or less co-operative during the administration and responded to the instruction to take regular deep breaths, usually becoming analgesic in two or three minutes. The younger children struggled and cried in some instances, but after a few deep breaths, associated with the effort of crying, they quieted down, became analgesic, and were usually drowsy. Coughing and spluttering were unusual. When we had become more conversant with the signs of analgesia (see below), if induction seemed a little slow the control screw was turned to "anaesthesia" and returned to "maximum analgesia" when analgesia was obtained. No increase in concentration of trilene was required for older children. Indeed, the younger ones were usually more resistant; but

this may have been due to the difficulty in getting a snugly fitting mask which would allow an effective concentration of trilene to be inhaled.

Once satisfactory analgesia was obtained, the finger was removed from the air port over the facepiece, thus permitting the patient to breathe air. The port was again occluded if analgesia diminished.

The signs indicating effective analgesia were not defined clearly enough to allow any hard-and-fast rules to be laid down, but the following observations were made when analgesia was effective: the breathing was regular, the eyelids were closed, and there was diminishing response to

that the onset of tachypnoea corresponded with a satisfactory degree of analgesia.

Observations

We all gained the impression that trilene facilitated the performance of these minor procedures for both patient and operator. This conclusion, so far as it concerns the patient, was based upon objective findings in the younger children, and in the older children upon both objective and subjective findings.

Before questioning the older children a day was usually allowed to elapse, because when still analgesic the child

Table Showing Prominent Symptoms, Suspected Lesions, and Diagnostic Procedures Undertaken

Provisional Diagnosis or Predominant Symptom	Age			Procedure Required	Co-operation in Induction of Analgesia			Degree of Analgesia Obtained			Effect			After-effects		Relation to Meals (Hrs. after)			Tachypnoea							
	No. of Cases	Under 5 Years	5-11 Years		Non-Cooperative	Passive	Active Co-operation	No Analgesia	Pure Analgesia	Analgesia and Drowsiness	Second Stage Anaesthesia	No Effect; Resistant	Not Resisting; Passive or Drowsy	Actually Co-operative	Nil	Drowsy	Vomiting	Less Than ‡		‡-2	More Than 2					
Meningitis, meningismus ..	14	12	2	Lumbar puncture ..	3	9	2	1	—	11	2	1	2	1	1	13	—	—	7	7	2					
Intracranial space-occupying lesion, severe persisting headaches	8	—	8	Lumbar puncture with spinal manometry ..	—	1	7	—	1	6	1	—	3	5	5	3	—	—	5	1	—					
Epileptiform convulsions ..	8	5	3	Lumbar puncture ..	1	2	5	—	—	6	2	—	6	2	3	5	—	—	4	4	—					
Paralysis of limbs, facial palsy ..	4	3	1	Cisternal puncture (1) ..	2	1	1	—	—	4	—	—	3	1	—	4	1	1	1	2	—					
				Cisternal puncture (2) ..	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
Hydrocephalus, spina bifida ..	3	2	1	Lumbar puncture (1) ..	1	1	1	—	1	2	—	—	2	1	—	3	—	1	1	1	—					
				Venepuncture, blood salicylate levels ..	—	1	1	—	1	1	—	—	1	1	1	1	—	—	—	—	2	—				
Rheumatic fever ..	2	—	2	Venepuncture, blood picture, and biochemical estimations ..	—	1	1	—	—	1	1	—	1	1	—	2	—	—	—	—						
Primary blood disorder, leukaemia, purpura ..	2	1	1	Venepuncture, W.R. ..	—	1	1	—	—	2	—	—	1	1	—	2	—	—	2	—						
Congenital syphilis ..	2	—	2	Venepuncture, therapeutic "ferrivenin" ..	1	—	—	—	—	1	—	—	1	—	—	1	—	—	—	—						
Coeliac disease ..	1	—	1																							
Pleural effusion, serous and purulent types ..	8	1	7	Diagnostic chest aspiration ..	1	3	4	—	1	4	3	—	5	3	4	4	—	—	4	4	—					
Aplastic anaemia, leukaemia ..	3	3	—	Marrow puncture ..	—	—	1	—	1	2	—	—	3	—	2	1	—	—	3	2						
Intussusception ..	1	1	—	Abdominal palpation ..	—	—	1	—	—	1	—	—	1	—	—	1	—	—	1	—						
				Electrical reactions of muscles ..	—	1	—	—	1	—	—	—	1	—	1	—	—	—	—	—						
Polyneuritis ..	1	1	—																							
Burns and wounds ..	3	3	—	Toilet and dressings ..	—	1	2	—	—	2	1	—	3	—	—	3	—	—	1	2	1					
Total ..	60	32	28		9	25	26	1	6	43	10	1	43	16	17	43	1	4	27	29	5					
% ..		53	47		15	42	43	2	10	72	16	2	72	26	28	72	2	7	45	48	8					
																					Satisfactory analgesia 98%			Inhaler of value in 98%		

Satisfactory analgesia 98%

Inhaler of value in 98%

the eyelid reflexes. The patient was drowsy, but, if old enough, readily, almost automatically, responded to requests such as, "Turn on your side" or "Put your arm out."

When ether was used in skin preparation the absence of resentment to its coldness was a good indication that analgesia was satisfactory.

If the administration was continued with the control screw at "maximum analgesia" some cases showed a little increased motor activity, suggesting that the second stage of anaesthesia had been reached. Administration was stopped at this point and the stage of analgesia and drowsiness returned. Where the operation was to be of short duration, administration was continued until the painful stimulus—for example, the prick of the needle—was effected; then the facepiece was removed and the residual analgesia usually afforded enough time for the completion of the procedure. In one case not in this age group an intelligent 12-year-old boy successfully administered trilene to himself to the stage of analgesia, during which lumbar puncture and cerebrospinal fluid manometry were carried out.

In five cases tachypnoea developed, and the administration was stopped. However, subsequent events showed

was obviously very amenable to suggestion. Although no set series of questions was asked, it was clear that memory for the procedure was hazy and the child would state that no pain was felt.

Lack of Pain.—No attempt was made to estimate the degree of analgesia quantitatively. However, the following observations led us to conclude that in every case pain was either abolished or greatly diminished. (1) There was never any cry caused by pain or any noticeable vocal or motor response due to the painful stimulus. (2) When subsequent similar procedures were indicated the children showed less apprehension. (3) The painful stimulus evoked little or no resistance—e.g., there was much less extending of the spine when the needle entered the skin for lumbar puncture, and the child was much more easily held in position.

Co-operation or Lack of Resistance.—Active co-operation or at least lack of resistance was apparent when some unusual position had to be maintained. At lumbar puncture the patient lay still and relaxed, allowing full flexion of the spine. In one girl, aged 8, we twice easily performed lumbar puncture under trilene analgesia and later transferred her to another hospital, where a lumbar

puncture, attempted without analgesia, had to be abandoned because of resistance. In another case, a child who had shown violent opposition submitted readily to a difficult intravenous injection after a few breaths into the trilene inhaler. In a case in which electrical reactions were investigated in a child of 3, we first attempted it without analgesia, but at the first stimulus she became restless. Satisfactory assessment of her reactions could be made only after analgesia had been induced.

Relation to State of Health.—The acutely ill children were more easily made analgesic, but otherwise showed no different response and suffered no more after-effects from the trilene than the chronically ill or convalescent. Where development of empyema was suspected, chest aspiration was effected easily and comfortably under trilene, and the patient suffered no ill effects from it. Trilene in low concentration is practically non-irritant to the respiratory passages. This suggests that the presence of acute or subacute inflammatory lesions of the chest may be no contraindication to trilene analgesia. No cases of primary liver disease occurred in our series, but as trilene has only a transient slight hepatotoxic effect (Armstrong, 1947) it would seem quite justifiable to use it for the short period required unless very extensive liver damage was suspected.

After-effects.—In this series no untoward effects resulted from the administration of trilene analgesia, apart from vomiting. This occurred in only one patient, who had had a large meal half an hour before trilene was administered. The child was not seriously ill or toxic, and no explanation was forthcoming why she had vomited. Vomiting did not occur in any other case in the series. All the children were able to take their next meal at the usual time and did not require additional nursing. Post-analgesic drowsiness was not infrequent (72% of total cases). It lasted from a quarter of an hour to two hours. The child awoke as from natural sleep. It was regarded as one of the advantages that a child should have this short sleep after an unusual experience, as he awoke with apparent amnesia for it.

Failure of Analgesia.—This was observed in one case, that of an infant aged 14 months. The child cried and struggled throughout. This was thought to be due to a poorly fitting face-mask.

Advantages and Disadvantages

Advantages.—(1) The apparatus is simple, safe to use, and inexpensive to maintain. (2) Administration of the analgesia presents no difficulty and takes no longer than local analgesia. (3) Trilene analgesia causes the patient no discomfort. Apprehension is greatly diminished and pain is abolished or greatly reduced. (4) Trilene analgesia affords enough scope for the performance of most of the painful diagnostic and therapeutic procedures in paediatrics. It avoids having to make the choice between full anaesthesia with its risk and possible upset, and no anaesthesia with its safety but greater discomfort. (5) Trauma, physical and psychological, is minimized. (6) The diagnostic and therapeutic procedure can be carried out more quickly, adequately, and deftly, and asepsis is more readily maintained. (7) Satisfactory analgesia allows more comprehensive investigation to be undertaken. (8) The post-analgesic effects include a beneficial period of drowsiness associated with apparent amnesia for the procedure. Nausea is infrequent and meals can be resumed in nearly every case when the patient awakes.

Disadvantages.—(1) The point at which analgesia becomes effective is not easy to appreciate. (2) There is no uniformity in the response to a given concentration of

trilene, and the same vigilance must be observed as when administering any anaesthetic. (3) Tachypnoea may occur.

Conclusions

Analgesia which is safe, easily induced and controlled, and devoid of untoward after-effects would appear to be desirable in many of the painful or frightening diagnostic and minor therapeutic procedures in medical paediatric practice.

Local analgesia produced by procaine or similar substances is safe, but causes initial pain and thereafter apprehension and resistance.

Drugs such as chloral hydrate and the barbiturates have not sufficient analgesic effects. Trilene is one of the safest analgesic agents (Ostlere, 1948). It is well taken and well tolerated by children. When administered from an inhaler of the Blease type it produces satisfactory analgesia (98% in this series). It allowed a variety of procedures to be carried out without pain or resistance, or the inconvenience and risk of general anaesthesia.

Psychological upsets are greatly diminished, thus allowing frequent investigations of a disturbing nature to be carried out.

Apart from occasional post-analgesic vomiting (2%) trilene produced no undesirable after-effects. Trilene given with an inhaler of the Blease type secures analgesia more effectively and with a greater margin of safety than any other method with which we are familiar.

Summary

The need for analgesia of short duration in medical paediatrics is discussed.

Trilene analgesia in 60 consecutive cases is analysed. Satisfactory analgesia was obtained in 98%. Beneficial drowsiness occurred in 72%. Tachypnoea occurred in 8%, but analgesia was already present. Psychological benefits are noted.

It is claimed that trilene from a Blease-type inhaler produces satisfactory analgesia for use in medical paediatric practice.

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The report of the River Pollution Prevention Subcommittee of the Central Advisory Water Committee was published recently by the Ministry of Health. The subcommittee was asked to investigate measures for strengthening the law regarding the prevention of pollution of rivers and streams. Its recommendations mark a further stage in the steps proposed for safeguarding and improving the conditions of rivers in England and Wales. The new River Boards, which are now being set up under the River Boards Act, 1948, will provide a new administrative organization based on natural catchment areas instead of local government areas. The next stage is to equip these boards with up-to-date and effective legal powers. The subcommittee considers that the Rivers Pollution Prevention Act, 1876, which is the principal Act now in force, needs considerable revision and strengthening. One of its main recommendations is that effluents discharging into a river or stream should be required to comply with standards prescribed by the River Boards. The standards would be prescribed by by-laws, subject to confirmation by the Minister of Health under a procedure which would give those affected an opportunity to raise objections and to be heard in support of them. Under the Act of 1876 legal proceedings in respect of pollution by trade and mining wastes may be taken only with the consent of the Minister of Health. The subcommittee recommends that once standards have been prescribed consent should not be necessary in the case of failure to comply with a standard, since the effect of the standard on industrial interests will have been considered when the standard was applied.