A COMPARISON OF THE ANTI-EMETIC EFFECTS OF DIMENHYDRINATE, PROMETHAZINE HYDROCHLORIDE AND CHLORPROMAZINE FOLLOWING ANAESTHESIA

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VOMITING during the immediate postoperative period is a frequent complication of anaesthesia in children. Dimenhydrinate, promethazine hydrochloride, and chlorpromazine have all been recommended as effective anti-emetic drugs (1, 2, 3). A comparison of the clinical efficacy of these three agents was made with a carefully selected and controlled group of patients.

A group of patients undergoing operation for correction of squint was chosen for this study for the following reasons:

1. They were reputed to have a relatively high incidence of post-anaesthetic vomiting, a prerequisite for the demonstration of anti-emetic action in a relatively small series of cases

2. There was no operative interference with or disease of the gastro-intestinal tract.

3. All operations lasted between one-half and one hour.

4. All patients were on the same ward with the result that observations were made by the same nursing personnel throughout the project.

5. All cases were elective and had received nothing by mouth for at least four hours prior to induction, and had received no solid food since the evening prior to operation.

The cases used in the study were drawn from both public and private patients of certain eye-surgeons and were either treated or placed in the control group on a completely random basis.

The first comparison was made between 40 cases treated with dimenhydrinate and 40 untreated controls. Towards the completion of this series, optimistic reports of the effectiveness of promethazine hydrochloride and chlorpromazine prompted us to conduct a second series consisting of 20 cases treated with promethazine hydrochloride, 25 cases treated with chlorpromazine and 20 untreated controls.

ANAESTHETIC MANAGEMENT

All cases were treated in the following routine manner:

1. All had atropine alone for preoperative medication, and narcotic drugs, alleged to contribute to post-anaesthetic vomiting, were not administered.

2. Peroral endotracheal intubation was performed in all cases following induction with pentothal sodium and relaxant whenever venepuncture was feasible, or, in smaller children, with ethyl chloride-ether sequence.

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3. Maintenance consisted of nitrous oxide, oxygen, trichlorethylene and/or ether. Three groups can thus be defined:

- (i) patients receiving ethyl chloride and ether,
- (ii) patients receiving pentothal sodium, nitrous oxide, oxygen, relaxant, and ether,
- (iii) patients receiving pentothal sodium, nitrous oxide, oxygen, relaxant, and trichlorethylene.

4. After the child was intubated, the selected drug was administered by the intramuscular route. Dosages employed were:

Dimenhydrinate—1 mg./lb.
 Promethazine —1 mg./3 lb.
 hydrochloride
 Chlorpromazine—1 mg./3 lb.

POSTOPERATIVE HANDLING

The recovery room nurses and the nurses on the ward were informed of the project and their co-operation was obtained. They were not told which of the children had received the drug. On every chart a note was placed to remind the nursing staff to record whether or not the patient vomited, the time and the approximate amount, and the volume of fluid intake.

CONTROL SERIES

Sixty untreated controls were studied. Of these, 39 were given ethyl chloride and ether; 21 had pentothal sodium, relaxant, nitrous oxide, and oxygen. Ether was added to the mixture in 11 of the latter; trichlorethylene was added in the remaining 10 cases. The presence or absence of vomiting as well as the average number of emeses (when present) are shown in Table I.

TABLE I

Agents	Number of cases	Vomiting	No vomiting	No of emeses/case	No of emeses/vomiter
Ethyl chloride and ether	39	28	11	2.1	2.9
Pentothal sod. and ether	11	9	2	2.7	3.3
Pentothal sod. and trilene	10	4	6	0.8	2.0

When ether was administered, the number of emeses remained approximately the same, irrespective of the type of induction. However, there was some improvement when ether was omitted from the sequence.

RESULTS OF TREATMENT

(Throughout the analysis, P values were obtained by the application of the method of chi square (X^2) to the enumeration data and by the calculation of t values for the mensuration data.)

The over-all incidence of vomiting for treated and control groups is shown in Table II. Treatment resulted in a significant decrease in the incidence of post-operative vomiting. ($P < 0.05$).

TABLE II

Treatment	Number of cases	Vomiting	No vomiting	No of emeses/case	No of emeses/vomiter
Control	60	41	19	2 0	3 0
Treated	85	41	44	1 0	2 0
Dimenhydrinate	40	18	22	1 0	2 2
Chlorpromazine	25	9	16	0 6	1 7
Promethazine hydrochloride	20	14	6	1 4	1 9

The administration of chlorpromazine reduced the incidence of vomiting to a significant degree ($P < 0.02$). There was no statistically significant reduction in the incidence of vomiting in the series treated with dimenhydrinate or promethazine hydrochloride. However, in the group that did vomit, the frequency of vomiting was reduced by all drugs.

1. GROUP (1) Anti-Emetic Drugs with Ethyl Chloride, Ether Anaesthesia.

The results of this group are given in Table III.

TABLE III

Treatment	Number of cases	Vomiting	No vomiting	No of emeses/case	No of emeses/vomiter
Control	39	28	11	2 1	2 9
Dimenhydrinate	24	15	9	1 5	2 4
Chlorpromazine	15	6	9	0 7	1 8
Promethazine hydrochloride	15	10	5	1 5	2 3

The incidence of vomiting was reduced to a significant degree by chlorpromazine only ($P < 0.05$).

2. GROUP (ii) Anti-Emetic Drugs with Pentothal Sodium, Nitrous Oxide, Oxygen, Relaxant, and Ether Anaesthesia

Because of the small number of cases, the treated groups were combined for the purposes of comparison in Tables IV and V.

TABLE IV

Treatment	Number of cases	Vomiting	No vomiting	No of emeses/case	No of emeses/vomiter
Control	11	9	2	2 7	3 3
Treated	21	6	15	0 3	1 0

TABLE V

Treatment	Number of cases	No vomiting	Vomiting	No of emeses/case	No of emeses/vomiter
Control	10	4	6	0 8	2 0
Treated	14	4	10	0 5	1 3

In this group, treatment resulted in a significant decrease in vomiting ($P < 0.02$).

3. GROUP (iii) Anti-Emetic Drugs with Pentothal Sodium, Nitrous Oxide, Oxygen, Relaxant, and Trichlorethylene Anaesthesia

The treated groups were again combined. As noted in Table I, the incidence of vomiting was low in the untreated group and no improvement was observed on administering anti-emetic drugs.

We considered that a favourable anti-emetic effect of a single injection of any drug should consist of

- (1) a reduction in frequency of postoperative vomiting and/or
- (2) a delay in the onset of vomiting, if it occurred.

An average number of emeses/case together with an average delay in onset of vomiting in hours is shown in Table VI. For purposes of calculation, those patients which did not vomit were considered to have a delay in vomiting equivalent to ten hours. Table VI also shows an arbitrary rating applied to all groups. To obtain this rating, a point value was assigned to each postoperative response on the basis of the two criteria listed above, and an average calculated.

No vomiting postoperatively	5 points
Single emesis 3 hours or more postoperatively	4 points
Repeated emeses starting after 3 hours postoperatively	3 points
Single emesis within the first 3 hours postoperatively	2 points
Repeated emeses starting within the first 3 hours postoperatively	1 point

TABLE VI

Treatment	Onset of vomiting (hours)	Emeses/case	Rating
Control	4 2	2 0	2 8
Dimenhydrinate	6 1	1 0	3 6
Chlorpromazine	7 6	0 6	4 3
Promethazine hydrochloride	4.6	1 4	3 2

According to this scale, chlorpromazine exhibits a highly significant increase in rating over the control value and dimenhydrinate exhibits a significant increase in rating. Promethazine hydrochloride was without effect.

DISADVANTAGES

The only disadvantage of treatment noted during the study was a sedative effect which could lead to a reduction in fluid intake. Accordingly, the sedative effect was studied by observing the average time to regain consciousness. ("Conscious time" is defined as the time from admission to the recovery room until the child answers questions coherently.)

Each anti-emetic drug increased the period of unconsciousness postoperatively as shown in Table VII.

TABLE VII

	Control	Dimenhydrinate	Chlorpromazine	Promethazine hydrochloride
Aver. conscious time (minutes)	31	41	37	49

The fluid intake was studied by noting volumes of liquid ingested and vomited by each child until midnight of the day of operation. The entire series was divided into 2 classes—vomitters and non-vomitters—and average net fluid intakes were calculated for both classes in each of the four series (See Table VIII.)

Each anti-emetic drug reduced the average fluid intake but only to a slight degree for both classes. When a combined average net intake (vomitters and non-vomitters) was calculated for each series, promethazine hydrochloride was found to be the only drug which decreased the fluid intake.

SUMMARY AND CONCLUSIONS

One hundred and forty-five patients undergoing operation for the correction of squint were studied with respect to the effectiveness of three anti-emetic

TABLE VIII

Treatment	Non-vomitters aver fluid intake (ounces)	Vomiters			Combined aver net fluid intake (ounces)
		Aver fluid intake (ounces)	Aver output (ounces)	Net (ounces)	
Control	18	14	6	8	11
Dimenhydrinate	17½	13	2½	10½	14
Chlorpromazine	14	13	3½	9½	12
Promethazine hydrochloride	17	12	5½	6½	10

drugs Dimenhydrinate (40 cases), Promethazine hydrochloride (20 cases), Chlorpromazine (25 cases), and a control group (60 cases).

Chlorpromazine reduced the incidence of vomiters to a significant degree, reduced the frequency of vomiting in cases that did vomit, produced only a slight prolongation in the time of recovery from anaesthesia, and did not decrease the average fluid intake.

Dimenhydrinate reduced the incidence of vomiters and frequency of vomiting to a less marked degree than chlorpromazine, produced a somewhat more prolonged recovery time than chlorpromazine, and did not decrease fluid intake.

Promethazine hydrochloride did not significantly decrease the incidence of cases of vomiting post-operatively, although the frequency of vomiting was decreased. Recovery time was more prolonged than with either of the other drugs and the fluid intake was slightly reduced.

We conclude that, of the three drugs investigated, chlorpromazine is the most effective anti-emetic drug with a minimum of side-effects in children undergoing operation for the correction of squint.

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RÉSUMÉ

On a étudié cent quarante-cinq malades soumis à une opération pour la correction du strabisme sous le rapport de l'efficacité de trois médications anti-émétiques: Dimenhydrinate (40 cas), Chlorhydrate de Prométhazine (20 cas), Chlorpromazine (25 cas), il y avait un groupe-témoin (60 cas).

La *Chlorpromazine* a réduit l'incidence des vomissements dans une appréciable proportion, a réduit la fréquence des vomissements dans les cas où ils se produisaient, a produit seulement une légère prolongation de la période de rétablissement post-anesthésique et n'a pas diminué l'absorption moyenne de fluide.

Le *Dimenhydrinate* a réduit l'incidence et la fréquence des vomissements à un degré moindre que la chlorpromazine, a provoqué un allongement sensible de la période de rétablissement et n'a pas diminué l'absorption de fluids.

Le *Chlorhydrate de Prométhazine* n'a pas sensiblement diminué l'incidence des vomissements post-opératoires, bien que la fréquence en ait été diminuée. La période de rétablissement a été prolongée davantage qu'avec les deux autres drogues et l'absorption de fluids a été légèrement réduite.

On conclut que, des trois drogues étudiées, la Chlorpromazine est le plus efficace anti-émétique présentant un minimum d'effets secondaires chez les enfants soumis à une opération pour la correction du strabisme.

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