Scopolamine patch reduces postoperative emesis in paediatric patients following strabismus surgery

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Scopolamine patch was evaluated for the prevention of postoperative emesis in 50 children undergoing strabismus surgery. All subjects were premedicated, with none receiving narcotic premedicants. Anaesthesia included controlled ventilation with the use of muscle relaxants, atropine, and halothane. Before operation, the subjects were randomly assigned to one of two groups: a treatment group received a scopolamine patch at a dose of either 0.75 mg or 0.375 mg, and a control group received no patch. Both the incidence and frequency of vomiting in the scopolamine-treated group were significantly ($P < 0.05$) lower than in the control group.

Une patch de scopolamine fut évaluée pour la prévention du vomissement postopératoire chez cinquante enfants subissant une chirurgie pour strabisme. Tous les sujets furent prémédiqués mais aucun d'eux n'a reçu de prémédications au narcotique. L'anesthésie fut conduite sous une ventilation contrôlée utilisant des relaxants musculaires, de l'atropine et de l'halothane. Avant l'opération, les sujets furent randomisés en deux groupes : un groupe ayant reçu les traitements avec la scopolamine patch à une dose soit de 0,75 mg ou 0,375 mg, et un groupe contrôle n'avant reçu aucun traitement. L'incidence et la fréquence des vomissements dans le groupe traité avec la scopolamine furent significativement ($P < 0.05$) plus basses que le groupe contrôle.

Key words
COMPLICATIONS: nausea, vomiting;
PREMEDICATION: scopolamine;
VOMITING: antiemetics.

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Many paediatric patients vomit after strabismus surgery. The incidence of vomiting in patients who have not received some form of prophylactic antiemetic treatment ranges from 40–85%.[1,2] Apart from being unpleasant for patients, potentially hazardous dehydration and pulmonary aspiration are associated with vomiting. Many investigators[3–7] have tried to find an effective drug to prevent this undesirable postoperative complication. This study was designed to determine whether transdermal scopolamine patches, which are usually used to prevent motion sickness, could reduce the incidence or frequency of postoperative vomiting in paediatric patients undergoing strabismus surgery.

Methods

This study was approved by the institutional Ethics Committee and informed consent was obtained from the parents of 54 children (ASA physical status I or II, aged 1–11 yr). They were assigned randomly to either a control or a transdermal scopolamine patch group: each group contained 25 subjects, as four were excluded. The scopolamine patches (one full patch contained 1.5 mg of scopolamine, Scopoderm®, Ciba) were reduced to one-quarter their original size for patients under two years of age or to one-half for those over two, and placed behind the ears of children on the ward the evening before surgery. Nothing was applied to patients in the control group.

All children were prohibited from eating solid food or drinking milk products after midnight. However, they were allowed to consume some clear fluid until three hours before surgery. Prior to induction of anaesthesia patients received premedication with a bromazepam suppository 3 mg, oral diazepam 10 mg or oral triazolam 0.25 mg as premedication. No narcotics were given.

Anaesthesia was induced with halothane (maximum 2% inspired) with 67% nitrous oxide in oxygen. After administration of either 0.1 $mg \cdot kg^{-1}$ pancuronium bromide or vecuronium bromide, the trachea was intubated and ventilation was controlled until completion of surgery. Shortly after tracheal intubation the gastric contents

were aspirated via an Argyle double-lumen sump tube. Anaesthesia was maintained with 0.5–1.0% halothane with 40% nitrous oxide in oxygen. Atropine 0.01 $mg \cdot kg^{-1}$ was administered intravenously prior to eye manipulation to attenuate the oculo-cardiac reflex during surgery, in accordance with our anaesthetic protocol for paediatric strabismus surgery. Upon completion of surgery, 0.06 $mg \cdot kg^{-1}$ neostigmine and 0.02 $mg \cdot kg^{-1}$ atropine were administered to all patients to reverse the residual effects of the muscle relaxants, although the degree of muscle relaxation was not monitored. The trachea was extubated when spontaneous ventilation was adequate and the gag reflex was present. Oral intake of clear fluid was allowed a minimum of one hour after surgery if the patients felt thirsty. No postoperative antiemetic or analgesic drugs were given.

Vomiting was recorded by the ward nurses, who were unaware of the individual treatment regimens. Retching and nausea were discounted, since these left no evidence. The scopolamine patches were peeled off in the morning of the first postoperative day. The patients remained on the ward for a few days after surgery, which is routine in our hospital, enabling us to follow up all incidences of vomiting.

Age and weight differences between the two groups were analyzed by Student's t test. Sex distribution and the incidence and frequency of postoperative vomiting were compared by chi-squared analysis. P values < 0.05 were considered to be statistically significant.

Results

Demographic data are shown in Table I. Sex distribution, age and body weight of the groups did not differ between groups.

Nine patients in the scopolamine patch group and 15 in the control group took 11.7 ± 5.3 (mean ± SD) $ml \cdot kg^{-1}$ and 11.7 ± 2.9 $ml \cdot kg^{-1}$ of clear fluid, 264 ± 55 min and 291 ± 78 min before anaesthetic induction, respectively. There were no significant differences between the two groups with respect to the number of patients who took fluid before surgery, the amount of fluid per unit body weight consumed or the time which elapsed between the last drink and anaesthetic induction.

Four patients in the scopolamine patch group were excluded from the study and their data were not included in the analysis because two peeled off their patches during the observation period, one demonstrated profound cyanosis after intubation, and one was intubated using a rapid-sequence induction technique. Vomiting occurred from as early as 16 min after the end of surgery, in the recovery room, to as late as 40 hr after surgery. Of all vomiting episodes, 37% and 93% occurred within six hours and during the first 24 hr after surgery, respectively.

TABLE I Patient characteristics

Group	*Sex (F/M)*	*Age (years) (Mean ± SD)*	*Weight (kg) (Mean ± SD)*
Scopolamine patch	10/15	5.7 ± 2.9	19.7 ± 7.8
Control	15/10	5.3 ± 2.7	18.1 ± 5.8

The overall incidence was 16% in the transdermal scopolamine patch group, which was lower than that in the control group (48%) ($P < 0.05$) (Table II). Only single post-anaesthetic vomiting episodes occurred in the scopolamine patch group, whereas patients in the control group suffered between one and seven (median: 3.1) episodes each. No patients complained of any side-effects either upon arrival at the operating room or postoperatively on the ward. The time taken to oral fluid intake after surgery did not differ significantly between the two groups (172 ± 60 min in the scopolamine patch group, 151 ± 58 min in the control group).

Discussion

Although scopolamine is antiemetic,[8] it has been little used for this purpose in the postoperative period. Scopolamine, *iv* or *im*, is sometimes associated with undesirable side-effects, including excessive sedation, agitation, and hallucination.[8,9] Furthermore, its short elimination half-life limits its usefulness as a parenterally administered antiemetic.[9] During eye surgery, impulses from the extrinsic eye muscles are relayed to the vestibular nuclei via nuclei III, IV, and VI of the medial longitudinal fasciculi.[4] The vestibular nuclei lie in the brainstem reticular formation and are closely associated anatomically with the vomiting centre.[4] The vomiting centre contains abundant muscarinic cholinergic receptors,[10] at which scopolamine, which crosses the blood-brain barrier, exerts an anticholinergic and consequently antiemetic effect. Transdermal scopolamine patches, which have been used to prevent motion sickness,[11] produce a low steady plasma concentration of scopolamine and may, therefore, provide a more consistent antiemetic action with fewer side-effects than parenteral scopolamine. Several reports have stated that the patches reduce emesis or nausea in adult postoperative patients who have received general anaesthesia, with[12,13] or without[14–16] epidural morphine. As yet, there have been no reports of application of scopolamine patches to children. Our data have shown that transdermal scopolamine is a safe and effective antiemetic following strabismus surgery in children.

A visual image from unpatched eyes, different from that in the neural "store," may cause intense sensory input, which results in nausea and vomiting, as described

TABLE II The incidence and frequency of postoperative emesis

Group	*Incidence*	*Frequency*
Scopolamine patch	4/25 (16%)*	1†
Control	12/25 (48%)	3.1 (1–7)

*$P < 0.05$ (chi-squared test); †$P < 0.01$ (Student's t test); compared with control group.

by Warner *et al.* If this occurs we recommend that, as well as applying transdermal scopolamine, the patients are allowed to lie down and rest quietly with their eyes closed until accommodation is achieved. The administration of *iv* droperidol 0.075 $mg \cdot kg^{-1}$, for prevention of post-anaesthetic emesis in paediatric patients undergoing strabismus surgery, is well established.[3] However, droperidol, which acts primarily as a dopamine antagonist at the chemoreceptor trigger zone, where dopamine receptors are abundant,[17] may cause prolonged sedation,[18,19] resulting in delayed oral intake or discharge, although some workers have not confirmed this.[3,7] Transdermal scopolamine patches do not produce prolonged sedation, but the dose administered should be reduced, according to body weight, to prevent side-effects such as visual disturbances,[14,19] dry mouth[15,16] and dizziness.[13,15] In order to prevent these complications, the patch size was reduced arbitrarily to one-quarter or one-half the original size, depending on patient age. Although scopolamine has been reported to enhance markedly the sedative effects of concomitantly administered benzodiazepines which are used as premedicants,[20] this was not observed in the present study. The patients in the scopolamine group were able to take some fluid at a similar time after surgery as the control group, and thus treatment with scopolamine patches did not appear to delay post-anaesthetic awakening. Although we did not observe any side-effects in this study, a pharmacokinetic study in paediatric patients will be required before this method can be promoted further. Recently, contact dermatitis caused by prolonged use of transdermal scopolamine has been reported by Gordon *et al.*,[21] so this complication must also be considered.

After reaching therapeutic blood levels, which generally takes 3–12 hr,[13,16] scopolamine patches release a small amount of the drug, at a constant rate, for over three days.[12,15] Therefore, we recommend attachment of these patches the evening prior to surgery, even if the operations are scheduled on a day-care surgery basis.

This study has achieved one of the lowest incidences (16%)[3,4] of postoperative emesis after paediatric strabismus surgery, compared with various treatment strategies reported in papers published previously.

In conclusion, prophylactic transdermal scopolamine patches reduce the incidence and frequency of vomiting in paediatric patients undergoing strabismus surgery. These patches may become the treatment of choice to prevent postoperative vomiting in paediatric strabismus surgery by virtue of their potent antiemetic action, ease of application, and low incidence of complications. However, the size of the existing patches should be reduced for children.

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