Intravenous atropine treatment in infantile hypertrophic pyloric stenosis

H Kawahara, K Imura, M Nishikawa, M Yagi, A Kubota

Aims: To assess the efficacy of a new regimen of intravenous atropine treatment for infantile hypertrophic pyloric stenosis (IHPS) with special reference to regression of pyloric hypertrophy.

Methods: Atropine was given intravenously at a dose of 0.01 mg/kg six times a day before feeding in 19 patients with IHPS diagnosed from radiographic and ultrasonographic findings. When vomiting ceased and the infants were able to ingest 150 ml/kg/day formula after stepwise increases in feeding volume, they were given 0.02 mg/kg atropine six times a day orally and the dose was decreased stepwise.

Results: Of the 19 infants, 17 (89%) ceased projectile vomiting after treatment with intravenous (median seven days) and subsequent oral (median 44 days) atropine administration. The remaining two infants required surgery. No significant complications were encountered. Ultrasonography showed a significant (p < 0.05) decrease in pyloric muscle thickness, but no significant shortening of the pyloric canal after completion of the atropine treatment. The patients exhibited failure to thrive at presentation, but were thriving at 6 months of age (p < 0.01).

Conclusions: This atropine therapy resulted in satisfactory clinical recovery. Pyloric muscle thickness was significantly reduced.

Treatment regimen

Atropine was administered intravenously at a dose of 0.01 mg/kg six times a day five minutes before feeding. During atropine infusion, the heart rate was continuously monitored by electrocardiography. Oral feeding was started at a volume of 10 ml formula, six times a day. The volume was increased day by day until patients tolerated 150 ml/kg/day (418 J/kg/day), unless vomiting occurred more than twice a day. Concentrated formula was not given. When patients were able to tolerate the full volume of formula without vomiting more than twice a day, 0.02 mg/kg atropine was administered orally six times a day before feeding. Intravenous atropine treatment was considered unsuccessful if patients failed to tolerate half of the full volume within a week or the full volume within two weeks. They were discharged from the hospital when vomiting was controlled with oral atropine. When patients were free of vomiting and showed steady weight gain, atropine was decreased in three steps (0.12 mg/kg/day, 0.06 mg/kg/day, 0.03 mg/kg/day). If patients vomited more than twice a day for three days after discontinuation of atropine treatment, oral administration was restarted.

Follow up

Successfully treated patients were followed up.

Clinical symptoms

Daily frequency of vomiting, recorded in medical charts during intravenous treatment and in guardians’ diaries during oral treatment, was examined at three weeks, three months, and six months after completion of oral atropine administration.

Physical development

Serial changes in body weight were examined at presentation and at the ages of 3 months, 6 months, 1 year, and 2 years. Weights were converted into standard deviation scores (SDS) using data from Japanese infants, published in the national survey for 1990 (Ministry of Health and Welfare, Japan).
Ultrasonographic evaluation of the pylorus

Ultrasonographic evaluations were conducted at presentation, at three weeks and six months after completion of oral atropine administration, and at 1 year of age. Ultrasonography was performed by the same paediatric radiologist (MN) using a Yokogawa Medical RT4600 and 7.5 MHZ linear probe. The patients were fasted for more than three hours before ultrasonographic examination and were not sedated. The examination was performed on several planes. The thickness of the pyloric muscle and the length of the pyloric canal were measured on transverse views, which showed the pylorus along its long axis. Transpyloric flow of gastric contents was also examined. All patients were followed up until 2 years of age.

Statistical analysis

All data are presented as median (range). Tests for statistically significant differences in weight SDs and ultrasonographic measurements were analysed using the Kruskal-Wallis test. Categorical variables were compared using the Tukey test.

RESULTS

At the time of presentation, 12 patients had previously received infusions at other hospitals, and dehydration and/or electrolyte imbalance were not noted. Of the 19 patients, 17 became free from projectile vomiting during atropine treatment. The remaining two required surgery after 9 and 18 days of intravenous atropine administration, and at 1 year of age. Ultrasonography was performed by the same paediatric radiologist (MN) using a Yokogawa Medical RT4600 and 7.5 MHZ linear probe. The patients were fasted for more than three hours before ultrasonographic examination and were not sedated. The examination was performed on several planes. The thickness of the pyloric muscle and the length of the pyloric canal were measured on transverse views, which showed the pylorus along its long axis. Transpyloric flow of gastric contents was also examined. All patients were followed up until 2 years of age.

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Of the 17 patients, 13 experienced little vomiting three weeks after completion of oral atropine administration. The remaining four occasionally vomited once or twice a day three weeks after completion of oral atropine, but rarely vomited three and six months after completion.

Weight SDs showed significant changes during atropine treatment (p < 0.01) (fig 1). There was a significant (p < 0.01) increase at 6 months of age (−0.3 (−1.7– +1.8), but not at 3 months (−0.6 (−3.1– 0)), compared with that at presentation (−1.4 (−4.1– −0.2)). There was no further significant change at 1 year (+0.2 (−1.7– +2.1)) and 2 years of age (−0.4 (−1.2– +2.4)).

Ultrasonography showed significant (p < 0.01) changes during atropine treatment. Figure 2 shows serial changes in pyloric muscle thickness and pyloric canal length. Pyloric muscle thickness decreased significantly (p < 0.05) from 5 (4–6) mm at presentation to 3 (2–5) mm three weeks after completion of oral atropine. Pyloric canal length was 19 (15–25) mm at presentation and 15 (12–20) mm three weeks after completion of oral atropine (not significant). Transpyloric flow of intragastric fluid was not observed by ultrasound in any patient before treatment, but was detected in all three weeks after completion of oral atropine. Pyloric muscle thickness was 2 (2–4) mm six months after completion of oral atropine and 2 (2–3) mm at 1 year of age, both of which were significantly (p < 0.01) less than that at presentation. Pyloric canal length

**Table 1** Characteristics of subjects

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Ultrasonographic measurements were made before and three weeks after atropine administration. IV, Intravenous atropine administration.
Atropine for infantile hypertrophic pyloric stenosis

Figure 2  Serial changes in pyloric muscle thickness (A) and pyloric canal length (B) of patients successfully treated with atropine. Box, interquartile range; horizontal bar, median; whiskers, 10th and 90th centile. *p < 0.01, **p < 0.05.

was 14 (11–19) mm six months after completion of oral atropine and 12 (9–19) mm at 1 year of age, both of which were significantly (p < 0.01) less than that at presentation.

Significant complications were not encountered. One patient had a urinary tract infection and one a transient slight increase in serum aspartate aminotransferase and alanine aminotransferase (< 60 IU/l) during intravenous atropine administration. Facial flushing was not reported during treatment. The resting heart rate remained less than 160 beats/min.

DISCUSSION

Medical treatment with atropine has been reappraised as an option for IHPS treatment, using a step up dosage technique with intravenous atropine administration and was associated with a successful short term outcome. The clusters of tonic and phasic pyloric contractions characteristic of IHPS recently reported are transiently abolished by an intravenous atropine injection of 0.01 mg/kg. We thought that this dose of atropine would improve transpyloric flow by inhibiting the contractions. We therefore used this as a fixed dose before feeds six times a day. This was in contrast with the regimen of Nagita et al., in which the dose of atropine was increased until projectile vomiting was controlled. In that study, the dose of atropine actually given was 0.07 (0.04–0.11) mg/kg/day, and 12 of 22 patients received a dose greater than that used in our study. The success rate in our regimen (89%) was similar to that at presentation.

The optimum treatment for IHPS remains controversial. It has not gained wide acceptance mainly because it requires a prolonged hospital stay and treatment at home. Although pyloromyotomy has been regarded as the optimum treatment of IHPS, the actual and potential consequences of surgery cannot be ignored. The patient has an abdominal scar, and there is a small long term risk of complications due to adhesion. Expert paediatric surgery is not universally available. A randomised controlled trial comparing the outcomes and cost effectiveness of intravenous atropine versus surgery is required.

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REFERENCES


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Arch Dis Child 2002 87: 71-74
doi: 10.1136/adc.87.1.71

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