

Modification of the physiological disturbances produced by whole gut irrigation by preliminary mannitol administration

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SUMMARY

In a prospective non-randomized study of 42 patients it was found that the oral administration of 50 g of mannitol 2 h before whole bowel irrigation (WBI) improved the success rate of the bowel preparation and reduced the time required for the WBI. Mannitol is an osmotic cathartic, and it reduced fluid absorption from a mean value of 2.7 l in patients who had WBI alone to a mean of 1.2 l in those who received mannitol beforehand. Sodium absorption was also significantly reduced.

WHOLE bowel irrigation (WBI) as a means of mechanical bowel preparation was first described by Hewitt and his colleagues in 1973. Since reporting our initial experience with the technique (1), we have been using it to prepare all our patients for elective colonic surgery excepting only those with evidence of intestinal obstruction. We found that it was often unsuccessful in preparing the left colon and that it was frequently very time-consuming, with preparations taking 5 h or longer. To try to improve our method we established a prospective study to evaluate the effect of preliminary administration of 50 g of mannitol, a poorly absorbed carbohydrate which acts as an osmotic cathartic (2). The rationale of this modification was that the mannitol would produce faecal softening before the irrigation fluid reached the colon. In addition, it was hoped that the osmotic cathartic effect of the mannitol would counterbalance the fluid absorption that had been shown to occur during WBI. Love et al. (3) reported a mean fluid gain of 1.52 l and Crapp et al. (1) a gain of 1.9 l.

Patients and methods

Forty-two patients were entered into a prospective study: 21 had whole bowel irrigation alone and 21 received 500 ml of ice-cold orange- or lemon-flavoured 10 per cent mannitol 2 h before irrigation. The diagnoses in the two groups are shown in Table I. The internal diameter of the bowel at the site of the lesion was measured immediately after removal and before fixation using a series of graduated Hegar's dilators: the values are shown in Table II. The allocation was not randomized as at the start of the study patients were given mannitol if difficulties were expected due to constipation or suspected stenosis.

No dietary restrictions were placed on the patients before the day of their preparation. A 14 FG Salem sump tube was placed in the stomach and a warm saline solution (155 mmol/l) was infused with a rotary pump at an initial rate of 3 l/h.

The patient was seated on a padded commode during WBI. The irrigation was continued for at least 30 min after the fluid passed per rectum was entirely clear of faecal material. Once defaecation was established and in the absence of vomiting infusion rates of up to 6 l/h were used. All the patients received 10 mg of metoclopramide immediately before and 2 h after the commencement of irrigation.

Fluid balance was measured during irrigation and estimations of sodium and potassium concentration were made on

each hourly collection of faeces and urine. Serum electrolytes were measured at the beginning and end of the preparation.

The adequacy of bowel preparation was assessed by the surgeon as good if no faecal residue was present in the colon, moderate if a little residue was found, or poor if there was considerable faecal residue. Results were analysed with Student's *t* test.

Table I: REASONS FOR IRRIGATION

	Irrigation alone (n = 21)	Irrigation with mannitol (n = 21)
Carcinoma of rectum	7	9
Carcinoma left colon	3	4
Sigmoid diverticulitis	1	0
Carcinoma right colon	5	1
Villous papilloma	1	2
Adenomatous polyp	1	1
Colostomy closure	1	1
Acquired megacolon	1	0
Colonoscopy	1	3

Table II: INTERNAL DIAMETER AT SITE OF COLONIC LESION

Diameter (mm)	Irrigation alone (n = 21)	Irrigation with mannitol (n = 21)
> 18	8	12
13-18	6	4
< 12	5	5
Unknown	2	0

Table III: ADEQUACY OF BOWEL PREPARATION

Preparation	Irrigation alone (n = 21)	Irrigation with mannitol (n = 21)
Good	11	18
Moderate	3	1
Poor	5	0
Irrigation abandoned	1	2
Unknown	1	0

Table IV: FLUID AND ELECTROLYTE CHANGES

	Irrigation alone (n = 20)	Irrigation with mannitol (n = 19)	<i>t</i>	<i>P</i>
Fluid gain (ml)	2740 ± 274	1160 ± 374	3.4	<0.002
Sodium gain (mmol)	564 ± 44	324 ± 54	3.5	<0.002
Serum sodium rise (mmol/l)	1.9 ± 0.9	0.6 ± 0.5	1.2	n.s.
Potassium loss (mmol)	73 ± 9	47 ± 5	2.6	<0.02
Serum potassium fall (mmol/l)	0.13 ± 0.11	0.07 ± 0.09	0.4	n.s.

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Results

The assessment of the adequacy of bowel preparation in the two groups is shown in *Table III*. Whole bowel irrigation had to be abandoned in 3 patients due to persistent vomiting and the preparation was not assessed in 1 patient in whom the primary growth was inoperable and multiple metastases were present. The patients in whom the irrigation was abandoned have been excluded from the analysis of fluid and electrolyte balance because the preparation was not completed.

The fluid and electrolyte changes in the two groups are shown in *Table IV*. In the mannitol group there was significantly less water and sodium gain and significantly less potassium loss. The time required for the irrigation after mannitol (mean $3.5 \text{ h} \pm 0.3 \text{ s.e. mean}$) was significantly less than that required with irrigation alone (mean $4.5 \text{ h} \pm 0.2 \text{ s.e. mean}$) ($t = 3.2$, $P > 0.004$). The amount of fluid required for the irrigation was also significantly reduced in the mannitol group (irrigation alone, mean = $12.51 \pm 0.8 \text{ s.e. mean}$; irrigation with mannitol, mean = $9.31 \pm 0.8 \text{ s.e. mean}$; $t = 2.9$, $P < 0.08$).

Discussion

The results of the study suggest that preliminary administration of mannitol improves the mechanical bowel preparation; a statistical analysis was not performed because of the subjective nature of the assessment.

Vomiting occurred in half of the patients equally distributed between the two groups but its occurrence was not of value in predicting the efficacy of the final preparation.

The irrigation was abandoned due to persistent vomiting in 3 patients. None of these patients had an obstructing lesion, the diameter of the lesion in the individual cases being greater than 18 mm, 17 mm and 15 mm. We believe that these failures were due to gastric retention of fluid unrelated to colonic obstruction. The incidence of failure may be minimized by

not overloading the stomach with too rapid a rate of infusion at the beginning of WBI.

Ten patients had an internal diameter of less than 12 mm at the site of the colonic lesion (*see Table II*); the 5 who had WBI alone had a poor preparation whereas all 5 in the group who received mannitol before WBI had a good preparation. A poor preparation discovered at surgery jeopardizes the success of the operation and is therefore a more serious problem than that of abandonment of WBI, as in the latter situation the patient may still be prepared by other methods.

The measurements made during irrigation showed that preliminary administration of mannitol reduced water and sodium gain during WBI, which should reduce the risk of producing cardiac failure in elderly patients. The reduction in time required for the preparation is also beneficial for the patient and reduces the demands made on the time of nursing staff. As the individual response to mannitol is variable (2), it may be that an increase in the dose of up to 100 g would produce further benefits.

The diverse nature of the pathology treated would make random allocation meaningless unless there were strict stratification by site and disease. This would obviously need a much larger series. Nevertheless, unfavourable factors such as a narrow lumen and the presence of a left-sided neoplasm were slightly but insignificantly more frequent in the mannitol group.

References

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