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Preoperative bowel preparation in children: Polyethylene glycol versus normal saline

Ashok Kumar, Akhlak Hussain[1]

ABSTRACT

Background: Colorectal surgeries frequently require bowel preparation. In children, (is this standard of care?: this method is mostly followed) this is usually performed using normal saline, which is very cumbersome and causes unnecessary discomfort. This study compared polyethylene glycol (PEG) with normal saline for preoperative bowel preparation in children. **Patients and Methods:** Thirty patients, admitted in the Department of Paediatric Surgery, Rajindra Hospital, Patiala, for colonic and colorectal surgical procedures, were divided into two groups, I (PEG) and II (NS), randomly for bowel preparation with PEG and normal saline, respectively. **Results:** It was found that there was no significant difference in the quality of preparation ($P > 0.05$), but PEG use was found to be easier, more comfortable and acceptable for the patients, their relatives and the hospital staff. Overall, complications are significantly lesser for PEG preparation ($P < 0.05$). There was no significant difference in the overall cost. **Conclusion:** Thus, it can be inferred that PEG may be a safe, cost-effective and acceptable option for large bowel preparation.

Key words: Bowel preparation, normal saline, polyethylene glycol

INTRODUCTION

Mechanical cleansing of the bowel has been done traditionally by admitting the child 3-5 days prior to the surgery and then keeping the child on clear fluids or nil by mouth, giving oral antibiotics, enemas and bowel washes. Following this traditional method of bowel preparation is very cumbersome, tedious and causes unnecessary suffering to the child. Mechanical cleansing of the bowel using whole-bowel irrigation was first described by Hewitt in 1973.[1] In 1980, Davis *et al.*, introduced Golytely (Braintree Laboratories, Braintree, MA) as a bowel irrigant.[2] This polyethylene glycol (PEG) electrolyte lavage solution was designed to avoid electrolyte shifts and dehydration.[3-5] Many studies in adults have demonstrated its safety and efficacy; therefore, it has been widely used in adults, but there has been some hesitancy in its use in infants. This necessitated further studies on methods of bowel preparation to resolve the issues of safety and effectiveness in children. Studies are therefore performed on one-day bowel preparation with PEG and normal saline.[6,7]

This study compared PEG with normal saline for preoperative bowel preparation and to assess the safety and efficacy of PEG in infants.

PATIENTS AND METHODS

A randomized study was conducted in the Department of Paediatric Surgery (Rajindra Hospital, Patiala) in infants who underwent bowel preparation for various surgical procedures like ASARP, PSARP, colostomy with PSARP, Duhamel's operation for Hirschsprung's disease, colostomy closure, etc.

Thirty patients were admitted on the day before surgery. Their attendants were counselled about the procedure. They were randomly assigned into one of the two groups (PEG and NS). Only clear liquids were allowed orally one day before the surgery. In group I, normal saline was given through nasogastric tube at the rate of 40 ml/kg/h, started 18-24 h before surgery. The washout was done until the returning effluent was clear. The total amount of normal saline used during each washout session was recorded. The patients were also evaluated for vomiting, oedema and abdominal discomfort. In group II, PEG was started 10-12 h prior to the surgery. PEG was

Departments of Paediatric Surgery and [1]Surgery, Rajindra Hospital, Patiala, Punjab, India

Address for correspondence:
Dr. Akhlak Hussain, Department of Surgery, Rajindra Hospital, Patiala - 147 001, Punjab, India.
E-mail: akku5658@gmail.com

administered orally or via nasogastric tube at the rate of 3-9 ml/kg/h, until a clear effluent was obtained per rectum or through the colostomy. Weight, abdominal girth, pulse, blood pressure and serum electrolytes were recorded before, after and during (hourly) the bowel preparation. After completion of bowel preparation, patients were kept in fasting condition and orally maintained on intravenous (I/V) fluids based on their body weight. All patients received prophylactic antibiotics (cefotaxime/ceftriaxone+metronidazole) preoperatively as well as in postoperative period. At the time of operation, adequacy of bowel preparation was graded by the same operating consultant surgeon in all cases, as very good (clean preparation), good (some particulate matter) or bad (gross stools) (what scale used: Arbitrary grading). Postoperatively, complications including nausea, vomiting, abdominal distension, oedema, bowel obstruction, surgical site infection, anastomatic leakage, wound dehiscence, prolonged paralytic ileus and any complication of colostomy were recorded. The compiled data was analysed using adequate statistics. The level of statistical significance was set at 0.05.

RESULTS

A total of 30 patients (total 17 females and 13 males) were randomised into two groups, I (PEG) and II (NS), with 15 each. The age range of the patient was 1 month to 7 years. Common diagnoses were rectovestibular fistula, imperforate anus, perineal trauma and Hirschsprung's disease [Table 1]. No significant difference in the quality of bowel preparation was observed and most patients showed satisfactory preparation results with both the methods [Table 2]. But, preparation with normal saline was associated with more distress to the patients and their relatives. In the PEG group, only one patient developed symptomatic obstruction that required decompressing colostomy. No other patient manifested any complication. Complications after normal saline preparation were significantly higher with common symptoms being vomiting, facial swelling, abdominal distension and wound infection [Table 3].

DISCUSSION

Bowel preparation remains important for large intestinal surgeries, especially rectum surgeries, and adequate bowel preparation is essential prior to surgeries. Many preparative methods are known. Whole gut irrigation consisting of irrigation of the bowel with an electrolyte solution through a nasogastric tube the day before surgery until clear effluent is visualized rectally was first proposed for the treatment of cholera and later modified for preoperative bowel preparation in 1973. Strict contraindications for this method are obstruction, perforation of the gastrointestinal tract and a toxic megacolon. Relative contraindications are renal insufficiency, congestive heart failure and bowel stenosis.[1,8,9] Although whole bowel irrigation produced a well-cleansed colon, the main problems were fluid retention and shift retention, along with addition issues of requiring nasogastric tube placement and special toilet facilities. By the end of the 1970's methods of orally administered solutions to clean the human colon preoperatively were introduced. These methods are now referred to as mechanical bowel preparation. The first agent to be used was mannitol, a non-absorbable oligosaccharide. In 5, 10 or 20% solutions, it draws fluid into the lumen of the bowel by osmotic action. Mannitol, however, is fermented by enteric organisms and thus resulted in an increased postoperative rate of septic complications and risk of bowel explosions.[10] In 1980, Davis *et al*., introduced PEG as a means of cleansing the colon. PEG, an isotonic solution containing hyperosmotic PEG (macrogol) and sulphate, is resorbed and induces

Table 1: Demography comparison

	Group I	Group II
Age (mean, years)	1.73	1.46
Female	10	7
Male	5	8
AVF	6	9
Imperforate anus	5	5
Perineal trauma	1	0
Hirschsprung's disease	1	1

Table 2: Comparison of quality of bowel preparation

	Group I	Group II	*P* value (Fisher's exact test)
Very Good	3	5	0.6817
Good	11	10	1
Bad	1	0	1

Table 3: Comparison of complications

	Group I	Group II	*P* value (Fisher's exact test)
Vomiting	0	2	0.4828
Facial swelling	0	1	1
Wound infection	0	1	1
Abdominal distension	0	6	0.0421
Bowel obstruction	1	0	1
Electrolyte imbalace	5	7	0.7104
Hospital stay (mean, days)	12.45	13	
Overall symptomatic complication	1	7	0.0352

a water secretion of 60 cc/h with electrolyte shifting. Over the years, it has been used as a balanced electrolyte solution (Golytely, Kleanprep) to clean the preoperative bowel. It is generally recommended that the patient should drink 4 l fluids to achieve a clean colon, although the addition of bisacodyl can reduce this amount. The salty taste of sulphate has been partially nullified by flavouring the solution. Although patient discomfort in the form of abdominal cramping, nausea and vomiting remains, PEG solution is still currently one of the agents that is mostly used for mechanical bowel preparation.[3,11,12] Another agent used is sodium picosulphate that is hydrolysed in the colon and induces a reduced water and electrolyte resorption. Combined with magnesium citrate, this therapeutic agent causes an osmotic diarrhoea. This agent may lead to dehydration that can aggravate cardiovascular disturbances and the possibility of formation of explosive gases.[13,14] Similarly, sodium phosphate is a powerful osmotic agent that reduces electrolyte secretion to the bowel lumen and water resorption. The advantage of this agent is the low volume of administered solution that makes it very suitable for preoperative bowel preparation. The rate of electrolyte shifting is negligible, although a potassium deficit can be induced. The high osmotic pressures on the mucosa of the stomach can induce nausea. This can be prevented by dilution of natrium phosphate with water.[15,16] The concept of selective bowel decontamination was introduced by Stoutenbeek *et al.*, to protect critically ill patients by reducing faecal flora by ways of antibiotics.[17]

The current standard in preoperative prophylaxis in colorectal surgery is adequate mechanical bowel preparation and short antibiotic prophylaxis. Although PEG, sodium picosulphate and sodium phosphate are frequently used in adults, many hospitals in India continue to use whole gut irrigation with electrolyte solutions for paediatric patients. The reason is however unclear. This may be due to the lack of proper evidences or simply the fear of using them on children. Previous studies have documented the safety of polyethylene gastrointestinal lavage solution in paediatric population.[18-20] However, oral antibiotics and enemas were also administered in these studies. The present study was done focussing especially on the safety parameter. It was found that PEG is equally efficacious, but much safer than the whole gut irrigation. Due to small sample size, strict recommendations cannot be made. We advise further studies to achieve the adequate level of evidence.

CONCLUSION

This study in paediatric patients comparing the bowel preparation with PEG and that with normal saline irrigation seems to have motivating results:

- There is no significant difference in the quality of preparation. However, this may be biased as the quality also depends on the diagnosis. Preparation of colostomy is easier than that of rectovestibular fistula. This was partly overcome as we have nearly similar type of cases in two groups.
- There is significant difference in overall complications; it was more in the normal saline irrigation group and thus favouring PEG use.
- Compliance, comfort and satisfaction of patients, their attendants and nursing staff is in favour of PEG use. (was this tested?: This was according to our study)
- Study sample is small, preventing any recommendation to be made in favour of PEG. (Please place this in the discussion part: Already mentioned in discussion)

REFERENCES

1. Hewitt J, Rigby J, Reeve J, Cox AG. Whole gut irrigation in preparation for large bowel surgery. Lancet 1973;2:337-40.
2. Davis GR, Santa Ana CA, Morawski SG, Fordtran JS. Development of a lavage solution associated with minimal water and electrolyte absorption or secretion. Gastroenterology 1980;78(5 Pt 1):991-5.
3. Thomas G, Bronzinsky S, Eisenberg J. Patient acceptance and effectiveness of a balanced lavage solution (Golytely) versus the standard preparation for colonoscopy. Gastroenterology 1982;82:435-7.
4. Fleites RA, Marshall JB, Eckhauser ML, Mansour EG, Imbembo AL, McCullough AJ. The efficacy of polyethylene glycol electrolyte lavage solution versus traditional mechanical bowel preparation for elective colonic surgery: A randomized, prospective, blinded clinical trial. Surgery 1985;98:708-15.
5. Ernstoff JJ, Howard DA, Marshall JB, Jumshyd A, McCullough AJ. A randomized blinded clinical trial of a rapid colonic lavage solution (Golytely) compared with standard preparation for colonoscopy and barium enema. Gastroenterology 1983;84:1512-6.
6. Singh D, Singh S, Diwakar G, Bhagwat SS. Bowel preparation with PEGLEC in infants: Safe, effective and expeditious way. Bombay Hosp J 2003;45:410-2.
7. Chattopadhyay A, Prahash B, Vepakomma D, Nagendhar Y, Vijayakumar. A prospective comparison of two regimes of bowel preparation for pediatric colorectal procedures: Normal saline with added potassium vs. polyethylene glycol. Pediatr Surg Int 2004;20:127-9.
8. Crapp AR, Powis SJ, Tillotsen P, Cooke WT, Alexander-Williams J. Preparation of the bowel by whole-gut irrigation. Lancet 1975;2:1239-40.
9. Avgerinos A, Kalantzis N, Rekoumis G. Bowel preparation and the risk of explosion during colonoscopic polypectomy. Gut 1984;25:361-4.
10. Goldman J, Reichelderfer M. Evaluation of rapid colonoscopy preparation using a new gut lavage solution. Gastrointest Endosc 1982;28:9-11.

11. DiPalma JA, Brady CA, Steward DL. Comparison of colon cleansing methods in preparation for colonoscopy. Gastroenterology 1984;86:856-60.
12. Keighley MR. A clinical and physiological evaluation of bowel preparation for elective colorectal surgery. World J Surg 1982;6:464-70.
13. Barker P, Trotter T, Hanning C. A study of the effect of Picolax on body weight, cardiovascular variables and haemoglobin concentration. Ann R Coll Surg Engl 1992;74:318-9.
14. Yoshioka K, Connolly AB, Ogunbiyi OA, Hasegawa H, Morton DG, Keighley MR. Randomized trial of oral sodium phosphate compared with oral sodium picosulphate (picolax) for elective colorectal surgery and colonoscopy. Dig Surg 2000;17:66-70.
15. Marshall JB, Pineda JJ, Barthel JS. Prospective, randomized trial comparing sodium phosphate solution with polyethylene glycol-electrolyte lavage for colonoscopy preparation. Gastrointest Endosc 1993;39:631-4.
16. Dudley HA, Radcliffe AG, McGeehan D. Intra-operative irrigation of the colon to permit primary anastomosis. Br J Surg 1980;67:80-1.
17. Stoutenbeek CP, van Saene HK, Miranda DR, Zandstra DF. The effect of selective decontamination of the digestive tract on colonization and infection rate in multiple trauma patients. Intensive Care Med 1984;10:185-92.
18. Tuggle DW, Hoelzer DJ, Tunnel WP, Smith EI. The safety and cost-effectiveness of polyethelene glycol electrolyte solution bowel preparation in infants and children. J Pediatr Surg 1987;22:513-5.
19. Donahue MC, Evangelista JK, Shamberger RC. Effect of Golytely on serum electrolytes and hydration status of infants. J Pediatr Surg 1994;29:1095-6.
20. Engum SA, Carter ME, Murphy D, Breckler FM, Schoonveld G, Grosfeld JL. Home bowel preparation for elective colonic procedures in children: Cost savings with quality assurance and improvement. J Pediatr Surg 2000;35:232-4.

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