

Mechanical Bowel Preparation for Laparoscopic Surgery in Pigs – A Pilot Study

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ABSTRACT

Objectives: Mechanical bowel preparation (MBP) is performed routinely before several gynecologic surgeries to reduce the risk of postoperative infectious complications and to improve the surgical field. Nevertheless, the available medical literature is not able to demonstrate any benefit of this procedure and some authors even report deleterious outcomes in patients undergoing bowel preparation, with increased rates of septic complications, anastomotic leakages and surgical site infections. The aim of this pilot study is to evaluate three different types of MBP for laparoscopic in an experimental model. **Material and Methods:** Twenty female pigs were randomized into 4 groups to preoperative MBP (sodium phosphate, glycerin or manitol) or surgery without MBP. During surgery, the pneumoperitoneum was inflated using Veress needle puncture at the supra-umbilical region and the 10mm trocar was positioned for the zero degree laparoscope. The abdominal cavity was inspected and the status of the bowel preparation was checked by three different surgeons. **Results:** The MBP could be done in all pigs using an orogastric tube. One pig did not undergo the laparoscopic procedure because it died after the MBP with manitol. One pig of the glycerin group had an intestinal perforation by the Veress needle and it was excluded from the final analysis. According to the surgeons' analysis, MBP using sodium phosphate and glycerin presented the best quality of surgical field, the former being the best one. **Conclusions:** According to this pilot study, the sodium phosphate seems to be the best way to perform MBP in pigs.

Key words: mechanical bowel preparation, colo-rectal surgery, gynecologic laparoscopy.

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INTRODUCTION

Mechanical bowel preparation (MBP) is routinely used by many surgeons before several gynecologic surgeries, either for benign or malign conditions. The rationale for its use would be to decrease the peritoneal contamination in case of iatrogenic injury and empty the bowel of its contents to improve both surgical field visualization and handling of the bowel¹.

Recently the necessity of using bowel preparation as a routine has been questioned by several surgical subspecialties, including urologic² and colorectal surgery³⁻⁷. Some randomized studies performed in elective colorectal surgery have shown no benefit in bowel preparation in the prognosis of these procedures^{5,7}, while other studies even suggest that mechanical bowel preparation may be harmful, with higher rates of septic complications, anastomotic dehiscence and surgical wound infection^{3,4,6}.

Literature about mechanical bowel preparation in gynecologic surgery is still insufficient. MUZII and cols.⁸ compared patients that underwent diagnostic or operative laparoscopy with or without bowel preparation with sodium phosphate, it was not observed any difference in quality of the surgical field and handling of the bowel. The operative time and complications rate were similar in both groups, supporting the idea that bowel preparation does not facilitate the surgery. Moreover, bowel preparation increases patient discomfort the night before the surgery (insomnia, weakness, abdominal distention, hunger/thirst and nausea/vomiting), and neither the postoperative discomfort nor the length of hospital stay are modified.

The objective of this study is to evaluate three different types of bowel preparation for laparoscopic surgery in a porcine experimental model in relation to the ability to improve the surgical field and to facilitate bowel handling.

METHODS

This study was performed during a training course in gynecologic laparoscopic surgery in May 2008 using tricoss pigs (Landrace, Large White and Duroc breed), from pig farms with sanitary control by the Ministry of Agriculture, vaccinated and fed with balanced diet according to the pigs age.

Twenty female pigs weighing from 12 to 18 kg were used. They were randomly divided in 4 groups of 5 animals each as follows:

- Group 1: control group that did not received any bowel preparation;
- Group 2: bowel preparation with 50 ml of sodium phosphate;
- Group 3: bowel preparation with 50 ml of glycerin;
- Group 4: bowel preparation with 125 ml of 20% mannitol solution.

All animals accomplished 12 hours of fasting before the surgical procedure. Animals of groups 2, 3 and 4 received bowel preparation through lavage with an orogastric tube number 12 (Figure 1) after anesthesia using intramuscular ketamine(15mg/kg).

Veterinarian team performed the anesthesia using endovenous infusion with 200 mg of ketamine, 0,4ml of xylazine 2% and 20mg of diazepam diluted in 16,6 ml of isotonic saline solution. The control of the anesthetic plan was based on the evaluation of the corneal-palpebral reflex, respiratory and heart rates.

After the animal was placed in appropriated surgical table (Figure 2), it was performed the puncture of the Veress needle at the supraumbilical region to



Figure 1 - Orogastric tube insertion to perform bowel preparation.

insufflate de abdominal cavity with carbon dioxide to a pressure of 10mmHg. The first 10mm trocar was blinded inserted and a zero-degree optical system was inserted to investigate the abdominal cavity.

The analysis of the bowel loops was individually performed by three different surgeons based on the degree system depicted in table 1, without previously knowing the method of bowel preparation that was used. After evaluation of each surgeon, it was chosen the most voted result. In case of three different opinions the surgeons went back to the surgery room to reach a consensus.

After the procedure, the animals remained in observation in a postoperative ward where they received nourishment and antibiotics. These animals were sent back to the swine farm two days after the procedure.

RESULTS

Bowel preparation was possible in all of the animals as they were under the effect of ketamine; therefore, medication was administered through an orogastric tube.



Figure 2 - Placement of the animal on the surgical table.

Table 1 - Classification of the quality of bowel preparation to the small and large bowel loops and global evaluation.

Classification	Laparoscopic Findings
Excellent (Figure 3)	Bowel loops occupying less than 25% of the insufflated abdominal cavity
Good (Figure 4)	Bowel loops occupying 25 a 50% of the insufflated abdominal cavity
Regular (Figure 5)	Bowel loops occupying 50 a 75% of the insufflated abdominal cavity
Poor (Figure 6)	Bowel loops occupying more than 75% of the insufflated abdominal cavity

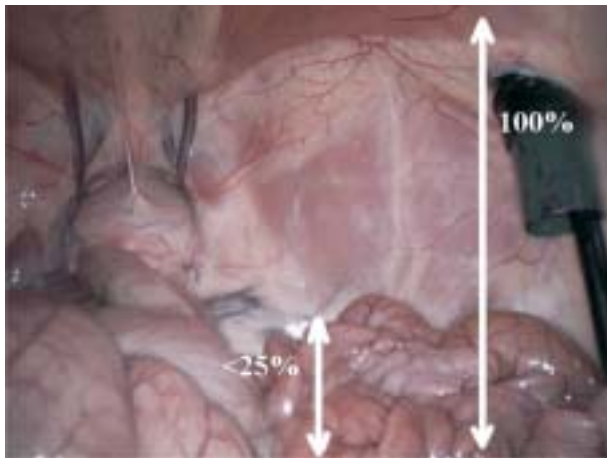


Figure 3 - Excellent bowel preparation.

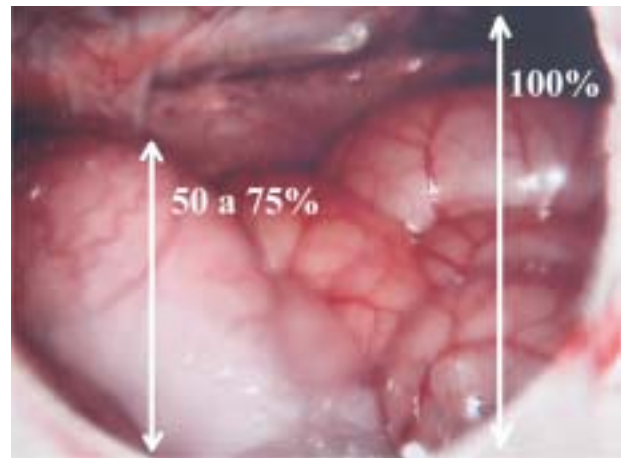


Figure 5 - Regular bowel preparation.

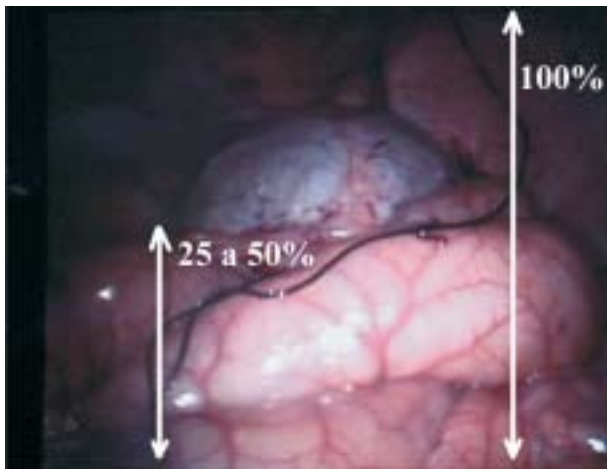


Figure 4 - Good bowel preparation.

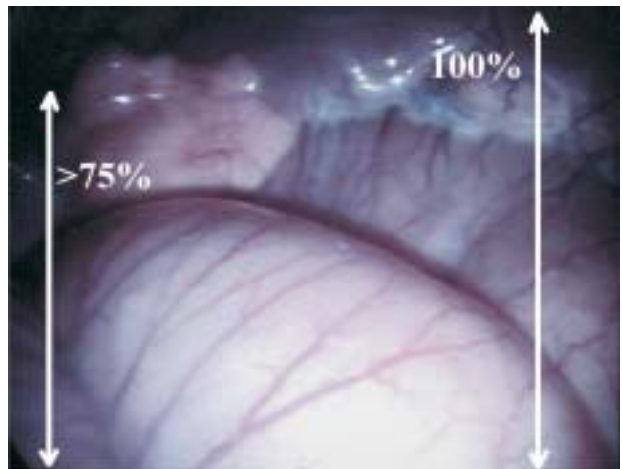


Figure 6 - Poor bowel preparation.

Of the 20 animals included in this study, only 19 animals were submitted to surgery in view of a death caused by the depletion of the extracellular space as the bowel preparation was done with mannitol.

During the surgical procedure there was a case of complication in one animal that received bowel

preparation with glycerin. There was bowel perforation caused by the Veress needle insufflating carbon dioxide into the small bowel loop. The injured area was identified and sutured; however, this animal was excluded from our study. Consequently, of the 20 animals selected for the study, only 18 were included in the final analysis.

Table 2 depicted the evaluation of small and large bowel loops and the global evaluation in accordance with the type of bowel preparation used. Groups 2 and 3 depicted less distension of the bowel loop and better quality of the surgical field in the evaluation of the surgeons, in which the best group the one prepared with sodium phosphate. In the group treated with mannitol it was observed a higher incidence of bowel distension, even when compared with the group that did not received any preparation.

DISCUSSION

Mechanical bowel preparation is used to: (1) remove the bulky intraluminal contents to improve the surgical field visualization and to facilitate the handling of the bowel and (2) decrease peritoneal and wound contamination by the intraluminal content in case of bowel opening¹. The former argument is true for any intra-abdominal surgical procedure, mainly the laparoscopic ones in which carbon dioxide insufflation compete for the same space of the bowel loops. Therefore, theoretically, mechanical bowel preparation could decrease stool and gas content, reducing the volume of bowel intraluminal contents and ameliorating the surgical field. The second justification, however, is only true for cases of iatrogenic bowel injury or complicated cases (advanced or recurrent cancer, radiotherapy complications and some benign gynecological conditions such as severe endometriosis,

severe adhesions, pelvic abscess and ovarian remnant syndrome in which bowel opening can be anticipated^{9,10}. The other gynecological procedures have a low incidence of bowel injury^{9,10}.

Few studies about bowel preparation in gynecologic surgery are available in the literature. However, the result obtained with randomized studies in elective colorectal surgery may be extrapolated to gynecologic surgery in which iatrogenic bowel injury occur.

BROWNSON and cols.⁴ compared 179 patients submitted to elective colorectal surgery with or without bowel preparation using PEG (polyethylene glycole). It was observed 5,8% of wound infections in patients receiving bowel preparation and 7,5% in patients receiving no bowel preparation (*p* is not significant). The rate of intrabdominal sepsis (9.3%, vs. 2.2%) and the rate of anastomotic leakage (11.9%, vs. 1.5%) were significantly higher in the bowel preparation group. The conclusion of this study was that bowel preparation using PEG does not reduce the rate of septic complications of colorectal surgery, and may even be detrimental. In a randomized study published in 1994, Burke et al.⁵ compared 169 patients submitted to elective colorectal surgery receiving bowel preparation using sodium picosulfate 10 mg and patients receiving no bowel preparation. The overall morbidity rate was 18% in both groups (*p* is not significant). Anastomosis leakage rates were similar in both groups of patients. The authors

Table 2 - Correlation between the type of bowel preparation and the classification of the quality of bowel preparation.

Prepare	Small Bowel	Large Bowel	Global Evaluation
Group 1	60% Poor	20% Poor	20% Poor
	40% Good	40% Good	40% Regular
Group 2	40% Good	40% Good	40% Good
	60% Excellent	60% Excellent	60% Excellent
Group 3*	25% Regular	25% Regular	25% Regular
	50% Good	50% Good	50% Good
	25% Excellent	25% Excellent	25% Excellent
Group 4**	25% Poor	100% Regular	25% Poor
	50% Regular		50% Regular
	25% Good		25% Good

* One bowel perforation during the placement of the Veress needle.

** One death due to bowel preparation.

concluded that mechanical bowel preparation does not influence the prognosis of elective colorectal surgery. SANTOS and cols.⁶ randomized 149 patients admitted for elective colorectal surgery in two groups (bowel preparation using laxatives and enemas versus no bowel preparation), it was observed the incidence of wound infection was significantly higher in the bowel preparation group. The incidence of anastomotic dehiscences in the bowel preparation group was 10% and in the no bowel preparation group was 5%. OLIVEIRA and cols.¹¹ compared PEG and NaP (sodium phosphate) administered preoperatively to 200 patients submitted to elective colorectal surgery. Patients who received PEG had significantly more side effects. However, evaluation of bowel cleansing in the intraoperative time revealed no significant differences between the two regimens. One anastomotic leak occurred in each group (1% vs. 1%), whereas four septic complications occurred in the PEG group (4%) versus 1 in the NaP group (1%; *p* is not significant). The authors concluded that the efficacy of PEG and NaP solutions was similar; however, the NaP solution was better tolerated. In 2000, MIETTINEM and cols.⁷ published randomized study including 267 consecutive patients submitted to elective colorectal surgery that received either PEG or no bowel preparation. No difference was observed in regard to anastomotic leaks (4% in the PEG group vs. 2% in the control group) or in other surgical site infections (6% vs. 5%). Median time to restoration of normal bowel function and median postoperative hospital stay were similar in the two groups. A meta-analysis recently published³ evaluated the role of mechanical bowel preparation in reducing the risk of anastomotic leakages and other septic or non-septic complications in 1454 patients submitted to colorectal surgery. It was observed a higher rate of anastomotic leakage in the mechanical bowel preparation group (5,6% vs. 3,2%; *p*=0,032).

MUZII and cols.⁸ conducted a prospective randomized study to evaluate the effect of bowel preparation in patients that underwent gynecologic laparoscopic surgery. The patients were divided in 2 groups (with or without preparation), thus the night before surgery, the bowel preparation was performed with 90ml of oral sodium phosphate. The next morning, the intensity of different symptoms resulting from the bowel preparation (insomnia, weakness, abdominal distension, nausea and thirst, difficulty in drinking the

solution and overall discomfort) was evaluated with a visual analogue scale and all the symptoms were significantly more severe in patients that received bowel preparation. During surgery, it was not observed any advantage regarding the improvement in the surgical field visualization or handling of the bowel loops comparing both groups. The operative time, complications rates and subjective evaluation of the procedure were similar in both groups. There was no significant difference in regard to reduced postoperative discomfort and length of hospital stay.

The objective of our study was to evaluate three methods of bowel preparation in swine that underwent gynecologic laparoscopic surgery. It was only a pilot study to identify the best bowel preparation method in female pigs that will enable us to conduct other experimental studies comparing surgeries with or without bowel preparation. In spite of the limited number of animals used in each group our results showed the sodium phosphate as the ideal bowel preparation method in swine, since only this substance was able to prepare the small and colon loops with 100% of efficacy (good and excellent results). Mannitol provided a regular bowel preparation in most of the cases and caused the death of one animal due to dehydration. Results with glycerin were good, but in one case the bowel preparation was regular and in other there was bowel perforation during the Veress needle insertion which might have occurred due to a bad bowel preparation or bad surgical technique.

CONCLUSIONS

Studies evaluating the role of bowel preparation in gynecologic surgeries are still necessary in the literature. When we extrapolate the results obtained in colorectal surgery studies, it was observed that bowel preparation does not offer any advantage in the intraoperative time or in the reduction of postoperative complications, which could even worsen the surgical outcomes. This pilot study evaluated three bowel preparation methods in swine and our preliminary results seem to suggest that the sodium phosphate could be the best method to bowel preparation in swine. Once the best bowel preparation method in animal model is chosen we are performing new experimental investigation to establish the real role of bowel preparation in gynecologic laparoscopic surgeries.

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