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Original Research Article

Saline V/S Metronidazole for Peritoneal Lavage in Postoperative Peritonitis Patients: A Comparative Study

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Abstract

Background and Aims: Peritonitis management is challenging due to its high morbidity and mortality rates. Peritoneal lavage, an irrigation technique, is used for peritonitis treatment. This study compares saline and metronidazole lavage effectiveness after surgery to offer insights into optimal management. This study aims to compare saline and metronidazole peritoneal lavage in terms of clinical outcomes like infection resolution, complications, hospital stay, and mortality.

Materials and Methods: 114 patients with perforation peritonitis were divided into two equal groups. One received metronidazole and saline lavage, while the other received saline only. Outcomes like wound issues, abscesses, sepsis, and hospital stay were compared using the chi-square test.

Results: The mean age was similar in both groups. Metronidazole group had fewer wound issues, less sepsis, fewer infections, and shorter hospital stays.

Conclusions: Metronidazole peritoneal lavage is significantly superior to saline in reducing sepsis and hospital stays. It's a safe and effective method for lowering complications and expediting recovery.

Keywords: Peritoneal Lavage, Metronidazole, Abscess, Peritonitis, Sepsis.

Introduction

The peritoneum, the body's largest serosal membrane, is divided into two primary sections: the visceral peritoneum, covering intra-abdominal organs, and the parietal peritoneum, lining the abdominal wall, including the diaphragm and pelvis. With a surface area close to 2 square meters, comparable to the skin's expanse, the peritoneum harbors approximately 75 mL of fluid. This fluid serves as a lubricant between abdominal viscera and the wall, occupying the peritoneal cavity [1]. Peritonitis, a hazardous condition, arises from inflammation of the peritoneum, a thin tissue enveloping the abdominal cavity. Typically caused by infection, often stemming from ruptured hollow organs within the Gastro-Intestinal Tract (GIT) or genitourinary system, or contamination during surgical procedures, peritonitis can be categorized as follows: primary peritonitis, triggered by external sources and primarily monomicrobial; secondary peritonitis, resulting from internal sources, usually perforated hollow viscera; and tertiary peritonitis, evolving after secondary peritonitis [2]. The management of peritonitis poses formidable challenges for healthcare professionals due to its elevated morbidity and mortality rates. Hence, the identification of effective treatment strategies is paramount. Prognosis and outcomes of peritonitis are influenced by an array of interconnected factors, encompassing patient-related attributes, disease-specific variables, and therapeutic and diagnostic interventions [3]. Primary interventions for peritonitis encompass initial resuscitation, exploratory laparotomy, addressing underlying causes, intraperitoneal lavage, and drainage [4-6].

Peritoneal lavage, a therapeutic modality for peritonitis, involves irrigating the abdominal cavity with a solution to eliminate inflammatory debris, pathogens, and toxins. Diverse liquids have been employed for lavage purposes, including the antibiotic and antiprotozoal agent metronidazole. This medication interferes with microbial DNA, impeding nucleic acid formation. Studies have explored the efficacy of various lavage agents, such as saline, metronidazole, chloramphenicol, cephalosporin, and imipenem [7–13]. Research by Bhushan C et al. indicated reduced sepsis and mortality following antibiotic lavage [12]. Contrasting the saline group, the antibiotic lavage

group demonstrated decreased surgical site infections, sepsis, and postoperative abscesses, although statistical significance wasn't reached [7, 9, 10, 13]. Notably, imipenem lavage exhibited a statistically significant reduction in wound infections, intra-abdominal abscesses, and sepsis when compared to saline lavage [11]. This study evaluates the efficacy of peritoneal lavage using saline and metronidazole in surgically treated peritonitis cases. Analyzing outcomes associated with each lavage solution yields valuable insights into optimal management strategies for this potentially life-threatening condition. The primary study objective is to compare the clinical efficacy of saline and metronidazole peritoneal lavage, specifically in terms of infection resolution, postoperative complications, duration of hospital stay, and mortality rates. These evaluations aim to ascertain which lavage solution offers superior therapeutic benefits for peritonitis patients.

Material & Methods

This prospective longitudinal study encompassed a cohort of 114 individuals afflicted with perforation peritonitis, evenly distributed into two distinct groups, comprising 57 patients each. The subjects were dichotomized into two matched groups, each comprising 57 patients afflicted with perforation peritonitis. In one group, patients received a combination of Metronidazole (100 mL) and normal saline lavage (2 L), whereas the other group solely received normal saline lavage (2 L). During the immediate postoperative period, drainage tubes were securely closed for both groups. Comparative analysis of outcomes was conducted concerning parameters including wound dehiscence, intra-abdominal abscess formation, sepsis development, and duration of hospitalization. The eligibility criteria for participant inclusion encompassed patients diagnosed with perforated peritonitis who had undergone laparotomy, demonstrated pneumoperitoneum, and exhibited free fluid as evidenced by Ultrasonography or Contrast Enhanced Computed Tomography (USG/CECT) of the abdomen. Enrollment into the study necessitated voluntary participation following provision of written informed consent by all patients.

Exclusion criteria were established to exclude patients managed non-surgically for peritonitis, those with contraindications for peritoneal lavage, individuals with documented hypersensitivity or allergy to saline or metronidazole, pregnant or lactating women, patients afflicted with severe concurrent medical conditions (such as end-stage renal disease, liver failure, immunodeficiency), and those concurrently participating in other clinical trials or studies.

A standardized regimen of institutional care was extended to all patients during their convalescence period. Integral parameters such as input-output measurements and vital signs were consistently monitored. Appropriate follow-up was undertaken following essential diagnostic investigations. Furthermore, patients were encouraged to engage in active and passive limb exercises and ambulation, in addition to receiving analgesic therapy. Daily physical therapy sessions were administered for the thorax and limbs. Incentive spirometry was conducted thrice daily throughout the patient's postoperative hospital stay. Postoperatively, all patients were uniformly prescribed antibiotics, encompassing metronidazole (500 mg IV every 8 hours) for a duration of seven days, accompanied by piperacillin/tazobactam (4.5 gm IV every 8 hours) and amikacin (500 mg IV every 12 hours). The statistical analysis employed the Statistical Package for the Social Sciences (SPSS) version 24.0. Descriptive and inferential statistics were computed using the Chi-square test, and statistical significance was established at a p-value threshold of less than 0.05.

Results

In both cohorts under investigation, the demographic comprising individuals below the age of 40 exhibited the most prevalent occurrences. The arithmetic mean age within the cohort administered with normal saline was determined to be 42.56 years, accompanied by a standard deviation of 11.87 years. Conversely, the assemblage receiving metronidazole showcased a mean age of 43.78 years, with a standard deviation of 10.89 years, as presented in Table 1 of the study.

Table 1: Age distribution of patients in two study groups.

Age group	Normal Saline		Metronidazole		P-Value
	n	%	n	%	
<40 years	25	43.86	22	38.60	-
41-60 years	19	33.33	20	35.09	-
>60 years	13	22.81	15	26.32	-
Mean ± SD (years)	42.56 ± 11.87		43.78 ± 10.89		0.53

Within the purview of our investigation, the prevailing etiology of perforation was found to be attributed to ileal factors, thereby emerging as the foremost causative agent. Subsequently, gastric perforations and appendicular perforations were responsible for the cases. Notably, instances of rectal perforation were the least frequent, as delineated in Table 3. Upon comparative analysis with their counterparts in the normal saline cohort, patients belonging to the metronidazole cohort

exhibited notably abbreviated durations of hospitalization, as elucidated in Table 4.

Table 2: Gender distribution of patients in two study groups.

Gender	Normal Saline		Metronidazole		P-Value
	n	%	n	%	
Males	39	68.42	40	70.18	0.87
Females	18	31.58	17	29.82	
Total	57	100.00	57	100.00	

Table 3: Etiology of peritonitis in two study groups

GI Perforation in	Normal Saline		Metronidazole		P-Value
	n	%	n	%	
Stomach	11	19.30	13	22.81	0.87
Duodenum	6	10.53	8	14.04	
Jejunum	5	8.77	4	7.02	
Ileum	14	24.56	21	36.84	
Appendix	9	15.79	6	10.53	
Caecum	6	10.53	3	5.26	
Colon	5	8.77	2	3.51	
Rectum	1	1.75	0	0.00	
Total	57	100.00	57	100.00	

Table 4: Comparison of Hospital stay in two study groups

Hospital Stay (Days)	Normal Saline		Metronidazole		P-Value
	n	%	n	%	
< 10	22	19.3	34	22.81	< 0.05
> 10	35	10.53	23	14.04	
Mean ± SD	12.15 ± 1.35		10.27 ± 1.58		

In contrast to the normal saline cohort, the metronidazole cohort demonstrated a noteworthy reduction of in the incidence of postoperative surgical site infections, along with a decrease in the occurrence of intra-abdominal abscesses. Notably, a heightened prevalence of septic episodes was observed among individuals subjected to normal saline lavage. Furthermore, the normal saline lavage cohort exhibited a higher frequency of wound dehiscence, as detailed in Table 5.

Table 5: Comparison of post-operative Complications in two study groups

Complications	Normal Saline		Metronidazole		P-Value
	n	%	n	%	
Surgical site infection	23	34.85	12	40.00	< 0.05
Intra-abdominal abscess	8	12.12	5	16.67	0.43
Sepsis	28	42.42	9	30.00	< 0.05
Wound dehiscence	7	10.61	4	13.33	0.21

Discussion

Perforation peritonitis stands as a prevailing surgical emergency, marked by a persistently elevated post-operative complication rate. Despite notable strides within the surgical domain, these complications continue to contribute to elevated morbidity and mortality rates. A pivotal procedure in the surgical intervention for perforation peritonitis encompasses peritoneal lavage. The choice of lavage fluid may wield influence over postoperative complications. Predominant causative agents of peritonitis included ileal, gastric, and appendicular perforations. The therapeutic regimen involved either saline or a combination of saline and metronidazole lavages for the management of perforation peritonitis.

Across all aspects examined, metronidazole lavage emerged as the superior intervention, with statistically significant distinctions apparent in terms of decreased sepsis rates and abbreviated hospital stays. Moreover, a noteworthy reduction in mortality was evidenced within the antibiotic lavage cohort, as corroborated by Bhushan C et al. [9]. However, in the study by Sulli D and Rao MS, while a decline in infection, sepsis, hospital stays, and mortality was observed in the metronidazole group, statistical

significance was not achieved for any parameter [10]. In the comparative analysis by Choudhary V and Dhankar AA, a reduction in wound infections, sepsis, abscess formation, and mortality was noted in the metronidazole group when contrasted with the saline group, albeit without attaining statistical significance [11]. Conversely, the imipenem group, as explored by Santosh CS et al., exhibited statistically significant decreases in wound infections, intra-abdominal abscesses, sepsis, and mortality when compared to the saline lavage [12, 13].

Incidence of Surgical Site Infection: Within the ambit of this trial, it was observed that the metronidazole group exhibited a reduction in the occurrence of wound infections. However, it is noteworthy to mention that this reduction did not reach statistical significance. A comprehensive review of published trials has indicated that the application of super oxidized solution lavage does not confer superiority over regular saline lavage in any aspect. Comparatively, both povidone-iodine and regular saline lavage were found to be more effective in preventing wound infections than metronidazole lavage. Notably, the most favorable outcomes were observed with the implementation of imipenem lavage, demonstrating a substantial 33% reduction in wound infections and a statistically significant distinction [1].

Intra-abdominal Abscess Incidence: Our study revealed a marginal 6% decrease in postoperative intra-abdominal abscess occurrences within the metronidazole group. However, similar to wound infections, this reduction did not achieve statistical significance ($p=0.418$). A consistent trend was observed in prior investigations as well, with no appreciable differences identified among metronidazole lavage, povidone-iodine lavage, or super oxidized solution lavage in mitigating intra-abdominal abscess incidents. Notably, only imipenem lavage exhibited a statistically significant reduction in intraperitoneal abscess occurrences [9].
Sepsis Occurrence: Our study demonstrated a noteworthy statistical significance in sepsis reduction within the metronidazole group. This aligns with findings from other investigations wherein metronidazole lavage exhibited reduced sepsis rates when compared to normal saline lavage. However, it is important to highlight that comparable reduction in sepsis was not observed when metronidazole lavage was pitted against povidone-iodine lavage [14–16]. The most marked reduction in sepsis, statistically significant at 23.3%, was discerned with imipenem lavage [9].

Hospital Stay Duration: Our study underscored a tangible benefit in the metronidazole group, manifesting as a significantly abbreviated hospital stay duration. Corroborating this observation, Schein M et al. documented a shorter hospital stay for the chloramphenicol lavage cohort (10 days) as opposed to the saline lavage cohort (13 days) [8].

Study Limitations: It is imperative to acknowledge the potential influence of operator bias as a constraint within the study, stemming from the involvement of different surgeons administering surgeries across the study population

Conclusion

This study unequivocally posits the superiority of metronidazole peritoneal lavage over saline lavage in mitigating sepsis and curtailing hospital stay durations, with the observed differences attaining statistical significance. As a result, metronidazole peritoneal lavage emerges as a robust and efficacious therapeutic approach in the management of peritonitis. The findings of this study distinctly showcase that the application of metronidazole peritoneal lavage not only stands as a secure procedure but also stands as an efficient and judicious method for addressing the challenges posed by this medical condition.

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