



# Intra-operative peritoneal lavage: normal saline, super-oxidized solution, antibiotics, or chemotherapy dilemma

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## Introduction

Intra-operative peritoneal lavage (IOPL) is a widely used approach to lid off and control the source of infection in patients undergoing laparotomies and laparoscopic surgeries<sup>[1–3]</sup>. However, resuscitation, aspiration of gross contaminants, use of systemic antibiotics, and controlling the source of infection are regarded as the initial management of septic abdomen<sup>[2,4]</sup>. IOPL is a widely used approach in reducing contamination of the peritoneal cavity, although this treatment is controversial among surgeons on when and why this practice should be done<sup>[1]</sup>. It is used as a cleanser by washing away bacteria debris and body fluids such as blood or bile, as a dilution effect when administered and then aspirated from the abdomen, as disinfectant when antiseptics or antibiotics are used, and as a treatment method for cancer prevention and control<sup>[2,5]</sup>.

Despite the fact that IOPL possesses a number of clinical benefits when implemented appropriately according to the indication, the routine practice of IOPL without clinical indication has been associated with an increased risk of intra-abdominal abscess and incision surgical site infection<sup>[6]</sup>.

There are several types of lavage fluids that are used by surgeons in IOPL; these include water, normal saline, warm normal saline, normal saline with antibiotics, aqueous betadine, super-oxidized agents, and chemotherapy. However, there is no clear consensus on when and why to use which specific agent for lavage. This article highlights on peritoneal lavage, types of fluids used and their indications so as to address the dilemma among surgeons on when and why to use a specific agent for peritoneal lavage.

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## Indications for different agents in peritoneal lavage

### Normal saline

Normal saline is a widely used peritoneal lavage fluid in the management of intra-abdominal infections such as appendicitis, peritonitis, perforated peptic ulcer, intra-abdominal abscess, intra-abdominal sepsis, and colorectal cancer intra-operatively. However, its benefit is still controversial since it was first used in 1905<sup>[2]</sup>.

IOPL with normal saline was found to be not associated with a significantly decreased risk of mortality, intra-abdominal abscess, incision surgical site infection, postoperative complications, reoperations, readmission, and number of positive cultures postoperatively compared to non-IOPL<sup>[1,7,8]</sup>.

However, the experimental study done on a rat model suggested that normothermic saline lavage reduces adhesions by improving peritoneal fibrinolysis<sup>[9]</sup>. Another comparative evaluation of IOPL with super-oxidized solution and normal saline showed that super-oxidized solution with normal saline is associated with reduced wound pain and infection as compared to normal saline alone<sup>[8]</sup>.

### Super-oxidized solution

Super-oxidized solutions have shown significant benefits in peritonitis as they reduce postoperative complications like wound infection, pain, surgical site infection, burst abdomen, episodes of postoperative fever, and hence early recovery<sup>[10]</sup>. Furthermore, super-oxidized solutions with saline have been shown to decrease the infection rate and bacterial growth as compared to normal saline alone<sup>[8]</sup>. Moreover, peritoneal lavage with super-oxidized solution has shown decreased surgical site infection and mortality incidence in emergency laparotomies<sup>[8]</sup>. However, one study showed that there was no clinical outcome difference between using super-oxidized solution or normal saline alone as a peritoneal lavage fluid<sup>[11]</sup>.

### Antibiotics

IOPL with antibiotics proved to have a significant effect on controlling infection due to the expulsion of microorganisms from the bowel lumen, hence increasing the disease-free and global survival of colorectal tumors among patients<sup>[12]</sup>.

Antibiotic lavage has also been shown to be useful clinically in an intra-abdominal abscess. One study found that intraperitoneal lavage with metronidazole provides confidence in the treatment of intra-abdominal abscesses, and it enhances quick recovery<sup>[13]</sup>. Moreover, antibiotic lavage of the peritoneum is associated with

a lower incidence of intra-abdominal abscesses and wound infections as compared to lavage with normal saline alone<sup>[12]</sup>.

Furthermore, antibiotic lavage is indicated in peritonitis. One study showed that IOPL with metronidazole in patients with peritonitis is more beneficial compared to normal saline alone in terms of reduction of complication rate related to infection<sup>[14]</sup>. Another study showed that metronidazole lavage is better than saline lavage in terms of sepsis and hospital stay<sup>[15]</sup>.

### Chemotherapy

Intraperitoneal chemotherapy involves administering certain anticancer agents directly into the intraperitoneal cavity<sup>[16]</sup>. This has proved to be of clinical use in managing most gastrointestinal and female reproductive systems-related malignancies because, in systemic chemotherapy, the intraperitoneal effect is hindered by the plasma peritoneal barrier. This, in turn, reduces systemic toxicity and enhances the maximum availability of chemotherapy to the local affected area due to minimal systemic exposure than observed with intravenous administration and higher intraperitoneal concentration, respectively<sup>[16]</sup>.

Intraperitoneal chemotherapy has shown significant clinical benefits in managing ovarian cancer, gastric cancers, peritoneal mesothelioma, and pancreatic cancers<sup>[16,17]</sup>. However, IOPL with intraperitoneal chemotherapy with cisplatin and paclitaxel has shown to be the recommended treatment of choice for almost all stages of advanced ovarian cancer<sup>[17]</sup>. Additionally, intraperitoneal chemotherapy helps prevent disseminated tumor cells from implanting on the peritoneal surfaces<sup>[18]</sup>. As well, the gastrointestinal malignancy history change when intraperitoneal chemotherapy is instilled immediately after surgery<sup>[19,20]</sup>.

### Hyperthermic intraperitoneal chemotherapy

This cancer treatment involves filling the abdominal cavity with chemotherapy drugs that have been heated. Hyperthermic intraperitoneal chemotherapy is conducted immediately after debulking surgery<sup>[21]</sup>. This approach is indicated in gastric adenocarcinoma, peritoneal carcinomatosis, colorectal cancer, peritoneal pseudomyxoma, mucinous tumors, and mesothelioma as it is associated with a low rate of adverse effects, and with overall increase survival rate and slow oncological progression<sup>[15,16,22,23]</sup>.

### Conclusion and recommendation

IOPL with saline alone was not associated with significant reduction of infection, decreased risk of mortality, intra-abdominal abscess, incision surgical site infection, postoperative complications, reoperations, and readmission as compared to non-IOPL, but IOPL with antibiotics, super-oxidized solutions, intraperitoneal chemotherapy, and hyperthermic chemotherapy have shown significant reduction of the intra-abdominal infections, including cancer cells if used according to the indication.

IOPL should not be done as a normal routine but should be done according to the indication of the patient so as to maximize the benefit of the practice and minimize the possible complications associated with it. Evidence-based clinical guidelines for surgeons should be developed with supported professional consensus on when to use what type of peritoneal lavage agent so as

to reduce the morbidity and mortality among patients undergoing peritoneal surgeries.

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