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Intra-operative peritoneal lavage – who does it and why?

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ABSTRACT

INTRODUCTION Intra-operative peritoneal lavage (IOPL) is widely practised but its benefits are unclear. The frequency and pattern of its use amongst general surgeons is investigated.

METHODS A postal questionnaire was sent to 153 general surgical consultants and registrars enquiring about their use of IOPL. The surgeon was asked the volume and type of lavage fluid used, under various circumstances.

RESULTS 118 (77%) questionnaires were returned. 115 (97%) surgeons used IOPL. The majority of surgeons (61%) lavaged until the fluid was clear, 20% used more than 1 l and 17% used between 500–1000 ml. In the case of the dirty abdomen (i.e. gross pus or faecal peritonitis), 47% used saline as the lavage fluid, 38% aqueous betadine, 9% water and 3% antibiotic lavage. Similar results were found in the case of a contaminated abdomen (i.e. a breached hollow viscus). 34% of surgeons used IOPL during clean cases. 36% used water lavage during intra-abdominal cancer surgery; 21% lavaged with saline and 17% with betadine. More registrars (47%) than consultants (29%) lavaged with water during cancer surgery. Consultants, however, used more aqueous betadine.

CONCLUSIONS The frequency of use and choice of lavage fluid varies widely. The successful management of the septic abdomen rests on at least 3 tenants – systemic antibiotics, control of the source of infection and aspiration of gross contaminants. There is little good evidence in the literature to support IOPL in the management of the septic abdomen. The use of IOPL during cancer surgery is supported by in vitro evidence. The current use of IOPL, as shown by this study, appears not to be evidence based.

KEYWORDS
Intra-operative peritoneal lavage

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The initial management of peritoneal sepsis is clearly established and includes general resuscitation, aspiration of gross contaminants, instigating systemic treatment with antibiotics and ultimately controlling the source of contamination.[1] Though these measures are beyond dispute, intra-operative peritoneal lavage (IOPL) is also undertaken regularly with the aim of reducing peritoneal contamination. This treatment is controversial and may owe more to historical use than any real scientific evaluation.

IOPL appears to have been first performed in 1905 by a gynaecologist, Joseph Price, who advocated lavage with sterile water.[2] A few years later, in 1911, a surgeon named Torek, found that saline lavage reduced the mortality of patients from 100% to 33%.[3] The first successful closure of a perforated gastric ulcer was performed on a 20-year-old woman by Morse in Norwich in 1911 and he employed 17 pints of hot water to lavage the abdominal cavity.[4] At this time in the US, however, Deaver began to question the usefulness of IOPL, declaring that it was important not to spread infection across the peritoneal cavity through the use of lavage.[5] This philosophy was also adopted in the UK as evidenced by Lord Moynihan in 1926, and IOPL was all but abandoned.[6] A resurgence of IOPL occurred in the late 1950s as a result of Burnett who wrote a seminal paper on the treatment of peritonitis using peritoneal lavage.[3] This showed that patients with a contaminated peritoneum had an improved outcome having undergone lavage. Since then, numerous papers have examined the use of various irrigation fluids but debate continues as to whether lavage should be undertaken and, if so, which solution should be used.

IOPL may have four functions. All fluids, including sterile saline and water, may act as a physical cleaner, washing away bacteria debris and body fluids such as blood or bile. Lavage with such fluids will also have a dilutional effect when instilled and then aspirated from the abdomen. Another function is that of an antibacterial agent. Antiseptics, such as chlorhexidine and povidone iodine or antibiotics, such as tetracycline, cephradine and metronidazole, may be toxic to bacteria. Finally, IOPL may result in tumour and bacterial cell lysis, an effect that is dependent upon cell tonicity.

We have undertaken to look at the current practice within two regions and relate this to the literature.

Methods

A simple questionnaire was sent to general surgical consultants and registrars working in the Oxford and South West Thames regions. The questionnaire asked about the volume, type and under what circumstances IOPL would be used.

Results

A total of 153 general surgeons working in the Oxford and South West Thames regions at the time of the study were sent questionnaires. Of these, 118 (77%) responded and 115 (97%) surgeons used IOPL.

The majority of surgeons (61%) lavaged until the fluid was clear, 20% used more than 1 l and 17% used 500–1000 ml. In the case of the dirty abdomen (presence of gross pus or faecal peritonitis), 47% used saline as the lavage fluid, 38% aqueous betadine, 9% water and 3% antibiotic lavage (Fig. 1). Similar results were found in the case of a contaminated abdomen (presence of a breached hollow viscus).

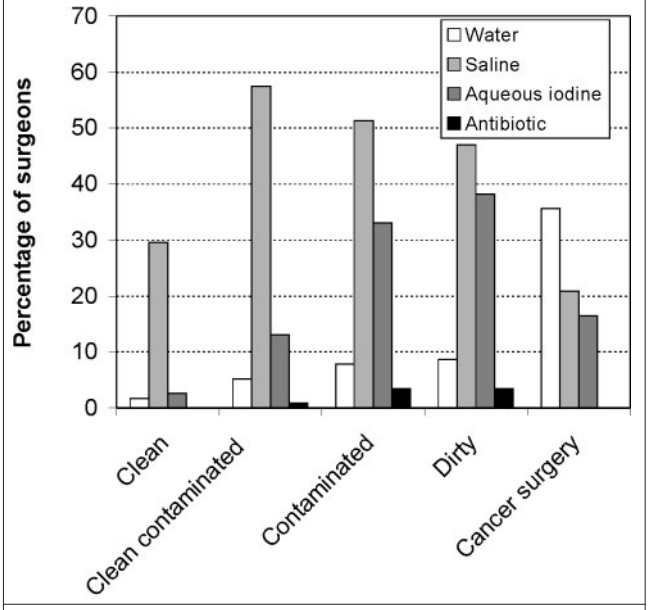

Figure 1 The use of different types of lavage fluid.

Of surgeons, 34% used IOPL during clean cases. In addition, 36% used water lavage during intra-abdominal cancer surgery; 21% lavaged with saline and 17% with betadine.

More registrars (47%) than consultants (29%; $P < 0.05$) lavaged with water during cancer surgery. Consultants used more aqueous betadine. Two consultants noted that they would have used tetracycline lavage but were prevented from doing so by the hospital pharmacy. There were no regional differences in the use of IOPL.

Discussion

IOPL is a procedure employed frequently, yet there is little evidence to show its benefits. This survey of a group of general surgeons shows the diverse opinions and practices. The vast majority of surgeons used IOPL, the main premise for this being the dilution and removal of contamination from within the abdomen. At first, this seems logical but does have one main disadvantage; the conversion of a localised area of contamination to a generalised one has been shown to occur experimentally using radiolabelled markers.[7] There are two clinical studies that are relevant. The first was an uncontrolled, non-randomised study of 21 patients undergoing elective colorectal surgery who had IOPL with 5 l of normal saline and received no peri-operative intravenous antibiotics.[8] This showed that, despite a large decrease in bacterial counts shown on swabs taken from all areas of the abdomen, the lavage group had high rates of postoperative wound infection (47%), intra-abdominal abscess (26%) and septicaemia (13%) when compared to the control group (rates of 37%, 8% and 3%, respectively). The authors attribute this to the dissemination of organisms by the fluid. Lack of use of intravenous antibiotics is also likely to have played a role. The practice of IOPL following a standard appendicectomy is now discouraged as it spreads contamination around the peritoneal cavity.

The second was a prospective randomised trial using Ringer's lactate as the IOPL fluid and compared this with simple removal of contamination with suction. This revealed no difference in mortality and septic complication rates. Peri-operative intravenous antibiotics were used.[9]

The history of lavage with antiseptics can be traced back to 1923 when alcohol was used to reduce mortality in peritonitis from 100% to 4%.[10] Since then, the lack of toxicity of saline to micro-organisms gave added interest to antiseptics. However, although they have a wide spectrum of activity and a rapid action, there is a problem with toxicity to the native tissues. Platt *et al.*[10] performed an animal study comparing

povidone iodine, taurolin, noxythidin and chlorhexidine as intraperitoneal antiseptics, though without actually lavaging, and found chlorhexidine significantly reduced early mortality though this was not maintained beyond 5 days postoperatively. Povidone iodine has undergone two prospective randomised studies. The first in 1979 evaluated IOPL with 1% povidone iodine and showed an incidence of 1.3% intra-abdominal abscess compared to 10.2% in those who had saline lavage.[11] All patients had peri-operative intravenous antibiotics. Weaknesses in this study include the lack of mortality data and the possibility of increased intra-abdominal abscess in those who survived a more severe peritonitis. Vallance and Waldron[12] found no difference between povidone iodine and saline IOPL in these circumstances. Again, this paper has a small number of patients (53) and had an uneven randomisation allocation with more patients with appendicitis in the saline group and relatively more bowel perforations in the povidone iodine group. Interestingly, they also found that chlorhexidine lavage made no difference. The use of taurolidine has also been investigated but only by a retrospective, non-controlled study which showed a reduction in mortality and morbidity when used during appendicectomy.[13] This was not confirmed, however, during a randomised trial.[14] Hydrogen peroxide lavage was investigated by Lawson and Lavery[15] using an animal model and demonstrated that normal saline lavage was superior to no lavage or lavage with hydrogen peroxide solution which appeared to have greater toxicity than benefit. There is no controlled *in vivo* data available.

The discovery of penicillin, in 1928, and then the development of further antibiotics led to the inevitable use of antibiotics as lavage fluids. The first use is attributable to Dees[16] and subsequently nearly every available antibiotic has been used. Important considerations include the reaching of therapeutic serum levels from peritoneal installation in order that bactericidal effects can be obtained within 1 min following exposure of bacteria to topical antibiotics.[17] Krukowski *et al*.[18] advocated the use of tetracycline solution as a lavage fluid, reporting excellent results.

Many earlier studies into IOPL did not routinely employ intravenous antibiotics and were not randomised or controlled; therefore, it is difficult to relate them to this day and age. In 1967, Noon *et al*.[19] took 430 patients with peritoneal contamination, performing saline lavage on half and comparing them with a study group in which kanamycin and bacitracin were used for lavage and irrigation of the subcutaneous tissues. The majority of patients had intravenous antibiotics in the postoperative period. Septic complications, the majority of which were wound infections, were found to be twice as common in the control group, but the mortality and the incidence of intra-abdominal abscess were the same in both groups. This suggests that wound infection is reduced with the use of topical antibiotics.

In 1986, Silverman *et al*.[20] ran a prospective randomised study of 159 patients who had undergone either elective or emergency intestinal surgery. The authors compared normal saline lavage with lavage using 2 l of normal saline containing 2 g of tetracycline. Again, there was a reduction in wound infection but no difference in intra-abdominal abscess formation or septicaemia. All patients received intravenous antibiotics including metronidazole and one other antibiotic.

Schein *et al*.[21] performed a prospective randomised trial of 87 patients undergoing emergency laparotomies for peritonitis. Patients were randomised to receive no IOPL, IOPL with saline or IOPL with chloramphenicol solution. The authors concluded that neither IOPL with saline or antibiotics influenced the outcome for these patients in terms of mortality or wound infection rates.[21]

Wound infection could be reduced by IOPL but this may also be achieved with instillation of topical antibiotics into the wound. There is no good evidence to show that IOPL with antibiotics is any better than conventional peri-operative intravenous antibiotics.

Continuous peritoneal lavage is a recognised treatment for acute pancreatitis, though controversial. A meta-analysis evaluating continuous peritoneal lavage in acute pancreatitis over eight randomised prospective clinical trials including a total of 333 patients did not reveal a significant improvement in the mortality or morbidity with the use of this technique.[22]

The role of IOPL and cancer surgery has a number of important considerations, which have been investigated in the case of colorectal cancer. Umpleby *et al*.[23] showed that viable exfoliated cancer cells were frequently present in large numbers at the site of intestinal anastomoses, supporting their potential role for suture-line recurrence. Yu and Cohn[24] showed that tumour spillage at the time of the operation is a major cause of cancer recurrence. Cancer cells have also been found on the doughnuts of bowel following the use of the circular stapler.[25] Rectal washout with saline has been shown to reduce the number of cancer cells within the lumen and at the site of the anastomosis.[26,27] The best results, however, come from performing the rectal washout with a hypotonic solution such as water and/or antiseptic.[28,29] To take this evidence further, if the presence of exfoliated cancer cells lying within the peritoneum were a cause of local recurrence, then theoretically, IOPL would be useful to reduce the number of cancer cells and, hence, the future local recurrence rate.

Conclusions

The successful management of the septic abdomen rests on at least three tenants – use of systemic peri-operative antibiotics, control of the source of infection and aspiration

of gross contaminants.[1] IOPL is routinely undertaken if pus is found in the abdomen. Its use, however, for the clean or clean/contaminated abdomen appears to be based on habit and is hard to justify when the evidence is so conflicting.

The same is also true for IOPL for cancer. The evidence for tumour lysis, well proved in the *in vitro* model, has not been subjected to a rigorous randomised trial. This study highlights the variation in practice and hence the correct indications for IOPL remain unresolved.

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