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Intraoperative rectal washout in rectal cancer surgery: A survey of current practice in the UK

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ABSTRACT

Objectives: Due to concerns about implantation of malignant cells during surgery for rectal cancer, traditionally, intraoperative rectal washout (IORW) has been performed to prevent local recurrence. But with the advent of laparoscopic surgery, many surgeons have abandoned this practice. The aim of this study was to assess current practice among colorectal surgeons in the UK.

Methods: A 10-item questionnaire was sent by email to 452 consultant surgeons, who were members of the Association of Coloproctology of Great Britain & Ireland, and had previously agreed to participate in research projects.

Results: The mean age of the 149 responders ($n = 149$, 33.0%) was 49.2 years. The mean number of years in independent practice was 12.1, and the mean number of rectal cancer cases performed per year was 20.3 and 20.6, in the years 2010 and 2011 respectively. 74.3% of the responders believed that there is an advantage in performing IORWs in rectal cancer resections. Of the 71.8% of all responders who performed laparoscopic rectal cancer resections, 54.8% routinely performed IORWs during laparoscopic resections. However, 87.2% of all responders performed IORWs in open resections for rectal cancer, and 79.2% had routinely performed IORWs before the advent of laparoscopic rectal cancer surgery.

Conclusions: Most colorectal surgeons believe that there is an advantage in performing IORWs. Although, most surgeons would routinely perform IORWs in open resections, they do not routinely perform these in laparoscopic resections.

1. Introduction

Recent decades have seen a remarkable improvement in the oncological outcome after rectal cancer surgery, mainly due to the principle of total mesorectal excision (TME) and the increasing use of adjuvant and neoadjuvant treatment. Nevertheless, local recurrence after rectal cancer surgery remains a problem, with serious consequences for the patients. Pelvic recurrences are associated with severely disabling symptoms and are extremely difficult to treat.[1–3]

Implantation of exfoliated cancer cells during surgery for rectal cancer has been identified as a potential cause of local recurrence.[2,4,5] There is evidence that colorectal tumours shed cells, which are viable and have the ability to implant, into the bowel lumen.[5–8] Implantation of these exfoliated cancer cells has been suggested as a possible mechanism of cancer recurrence in colorectal anastomoses.[2,4,5,9,10]

Local recurrence after rectal cancer surgery may be decreased if no viable malignant cells are left behind. With this in mind, intraoperative rectal washout (IORW) was introduced to eliminate the amount of viable tumour cells. *In vitro* and *in vivo* studies have suggested that IORW using cytotoxic agents can decrease the amount and viability of free intraluminal malignant cells shed during rectal cancer surgery.[5,6,11–13] IORW comprises cross-clamping of the rectum, distal to the tumour but proximal to the intended line of transection, followed by a cytocidal washout of the lumen from the anus to the clamp, before transection of the rectum.

Although the mechanical effect of irrigation, and the cytocidal effect of the solution, are effective in reducing the number of viable cancer cells,[6,12,14] the clinical relevance of IORW in terms of decreasing the incidence of local cancer recurrence, remains unclear.[15,16] Although, many surgeons[17,18] would recommend routine IORW, the practice of rectal washout is not universally adopted. Especially with the advent of laparoscopic surgery, many surgeons have abandoned this practice.

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With the above facts in mind, we decided to conduct a survey, with the aim of exploring the current views and practice in the UK regarding IORW, and to examine whether this practice has changed since the advent of laparoscopic surgery.

2. Methods

The survey was conducted during the period of October 2012 until January 2013. We designed a questionnaire with 10 questions on the surgeons' views and practice regarding IORW (Table 1). We used SurveyMonkey (http://www.surveymonkey.com) for survey distribution and data collection. The questionnaire was sent by email to 452 consultant surgeons, who were members of the Association of Coloproctology of Great Britain & Ireland, and had previously agreed to participate in research projects.

The questionnaire was composed of demographic questions concerning age, sex, number of years in independent practice as consultant, and number of rectal cancer cases performed per year. The questionnaire also included the participants' views regarding IORW, whether the surgeon performed IORW during laparoscopic or open surgery, and whether the surgeon's practice has changed since the advent of laparoscopic surgery.

The survey was anonymized and the participants were informed that the results would be used for a scientific study. In the email sent to the participants, there was a link to the survey questionnaire, which was uniquely tied to the survey and the responder's email address. After a three-week reply period, the questionnaire was resent to the non-responding surgeons. Subsequent to an additional three-week reply period, the questionnaire was resent to the non-responding surgeons. After another 3-week reply period, the responses were analysed.

Participants were not required to answer all questions; therefore, some answers may have missing values. We used standard descriptive analysis: categorical variables by number of respondents in the categories and their percentages, and continuous variables by mean, minimum and maximum.

3. Results

From October 2012 to January 2013, 149 (33.0%) questionnaires were returned and used for the analysis. The results of the survey for each individual question in the questionnaire are shown in Table 1.

The mean age of the responders was 49.2 years, and 134 (91.8%) responders were male. The mean number of years in independent practice as consultant was 12.1, and the mean number of rectal cancer cases performed per year was 20.3 and 20.6, in the years 2010 and 2011 respectively. One responder reported he no longer performed rectal cancer surgery. 71.8% of the responders currently performed laparoscopic rectal cancer resections.

Although 74.3% of the responders believed that there is an advantage in performing IORWs (Fig. 1), only 54.8% of those performing laparoscopic surgery routinely performed IORWs during laparoscopic resections (Fig. 2). On the other hand, 87.2% of responders performed IORWs in open resections for rectal cancer (Fig. 3). Furthermore, 79.2% of the responders had routinely performed IORWs before the advent of laparoscopic rectal cancer surgery.

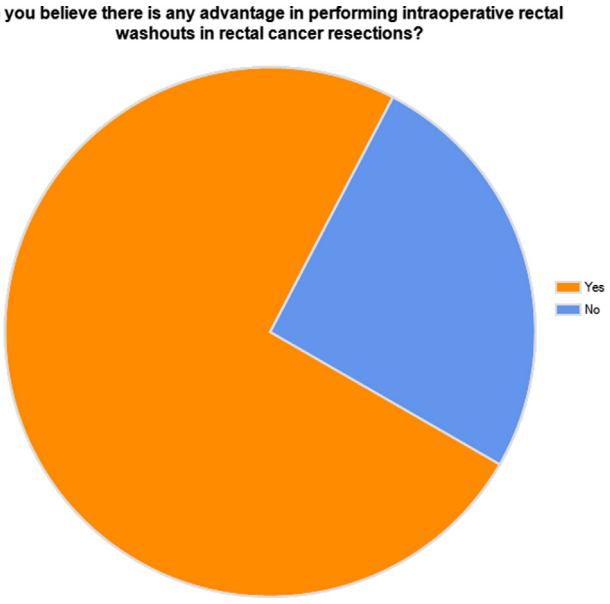

Fig. 1. Pie chart showing the number or responders who believed there is any advantage in performing intraoperative rectal washouts in rectal cancer resections.

3.1. Subgroup analysis

Subgroup analysis of 107 responders who performed laparoscopic rectal cancer resections showed that 70.8% believed that there is an advantage in performing IORW in rectal cancer resections. As mentioned above, only 54.8% routinely performed IORW in laparoscopic resections. 84.0% performed IORW in open resections for rectal cancer, and 77.6% routinely performed IORW before the advent of laparoscopic rectal cancer surgery.

Subgroup analysis of 37 responders aged 45 and below, showed that 75.7% believed that there is an advantage in performing IORW in rectal cancer resections. 83.8% performed laparoscopic rectal cancer resections, and 60.0% routinely performed IORW in

Table 1
The questions of the survey questionnaire and the results of the survey for each individual question.

Question	Number of responders	Result
1. What is your age?	147	Mean: 49.2
2. What is your gender? Female/Male	146	Female: 12 (8.2%) Male: 134 (91.8%)
3. Number of years in independent practice (as consultant):	148	Mean: 12.1
4. Number of rectal cancer cases performed per year: 2010/2011	141	2010 mean: 20.3 2011 mean: 20.6
5. Do you believe there is any advantage in performing intraoperative rectal washouts in rectal cancer resections? Yes/No	148	Yes: 110 (74.3%) No: 38 (25.7%)
6. Do you undertake laparoscopic rectal cancer resections? Yes/No	149	Yes: 107 (71.8%) No: 42 (28.2%)
7. Do you routinely perform intraoperative rectal washouts in laparoscopic resections? Yes/No	104 (out of 107)	Yes: 57 (54.8%) No: 47 (45.2%)
8. Have/do you performed intraoperative rectal washouts in open resections for rectal cancer? Yes/No	148	Yes: 129 (87.2%) No: 19 (12.8%)
9. Did you routinely perform intraoperative rectal washouts before the advent of laparoscopic rectal cancer surgery? Yes/No	144	Yes: 114 (79.2%) No: 30 (20.8%)
10. If you perform intraoperative rectal washouts in laparoscopic rectal resections, please use free text below to explain the technique:	74	Free text. Summary of responses given in the results section

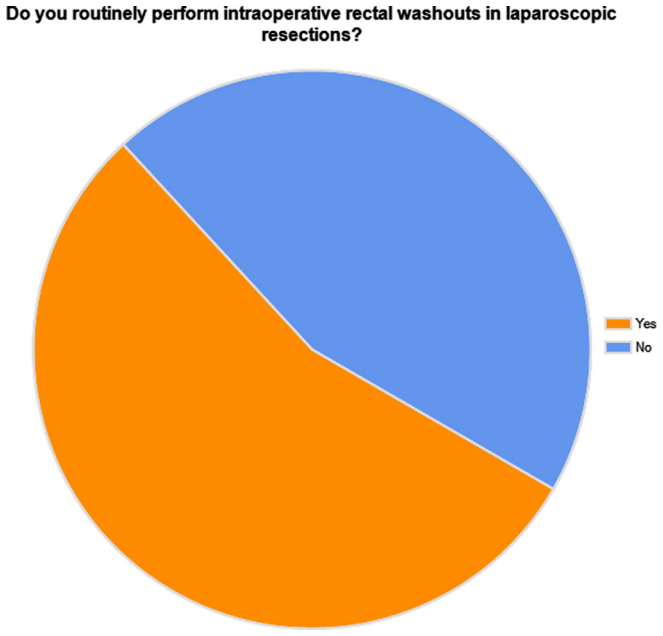

Fig. 2. Pie chart showing the number or responders who routinely perform intraoperative rectal washouts in laparoscopic resections.

laparoscopic resections. 86.1% performed IORW in open resections for rectal cancer, and 77.1% routinely performed IORW before the advent of laparoscopic rectal cancer surgery.

Subgroup analysis of 110 responders above the age of 45, showed that 75.2% believed that there is an advantage in performing IORW in rectal cancer resections. 68.2% performed laparoscopic rectal cancer resections, and 53.4% routinely performed IORW in laparoscopic resections. 87.3% performed IORW in open resections for rectal cancer, and 79.4% routinely performed IORW before the advent of laparoscopic rectal cancer surgery.

Finally, subgroup analysis of 12 female responders, showed that 83.3% believed that there is an advantage in performing IORW in rectal cancer resections. 66.7% performed laparoscopic rectal cancer resections, and 50.0% routinely performed IORW in laparoscopic resections. 91.7% performed IORW in open resections for rectal cancer, and 90.0% routinely performed IORW before the advent of laparoscopic rectal cancer surgery.

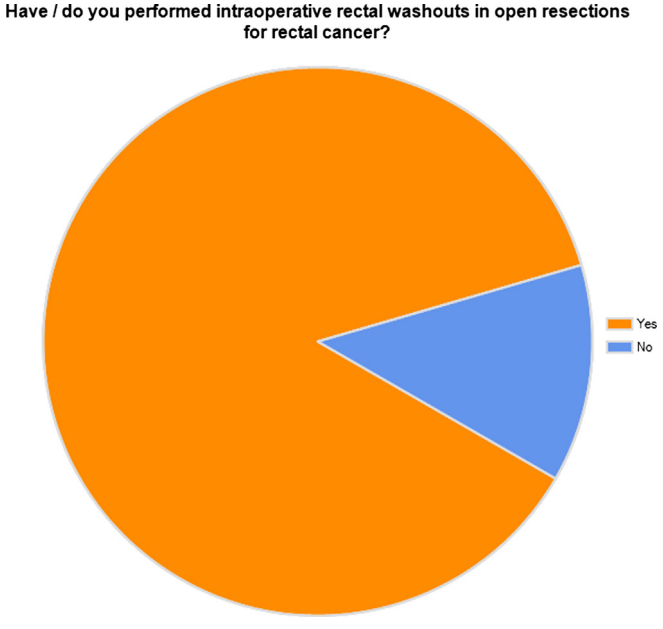

Fig. 3. Pie chart showing the number or responders who routinely perform intraoperative rectal washouts in open resections for rectal cancer.

3.2. Technique for intraoperative rectal washout (IORW)

As a part of the questionnaire, the responders who routinely performed IORW in laparoscopic rectal resections were asked to explain their technique. Their answers were reviewed and the most common techniques are described here.

During laparoscopic IORW, the rectum is clamped distal to the tumour but proximal to the intended line of transection. The rectum can be clamped laparoscopically either using a Johanns grasper across the rectum distal to the tumour after dissection, or a Hayes clamp distal to the tumour, or by placing a ligature around the rectum proximal to the site of division and using a sliding knot to occlude, or alternatively using a tightened Nylon tape around the rectum. The Nylon tape can be wrapped twice around the rectum, below the cancer and pulled tight, and this would also aid manipulation of the rectum during cross-stapling. Also, the rectum can be clamped either by using an endostapler or an open linear stapler through a Pfannenstiel incision. In the open technique, a medium self-retaining wound retractor may be used, and the rectum is completely mobilized to the pelvic floor. For any of the above techniques, the clamp or stapler should be applied below the tumour, but above the proposed anastomosis line or transection line, before performing an IORW.

A cytocidal washout is performed of the lumen from the anus to the clamp. For the IORW, some surgeons use Povidone Iodine diluted with water or saline, or Chlorhexidine, or Cetrimide, or only water. For the irrigation, a 50 ml bladder ended syringe, a Foley catheter, a rectal tube, a Ross irrigating proctoscope, or a Proctowash has been used. The syringe can also be used to empty the rectum, with the plunger of the syringe fully removed before inserting into the rectum (plunger not removed whilst still in rectum).

Once IORW is completed, a stapler is placed distal to the clamp, for transection of the rectum. If a stapler was used as the clamp, the same stapler can be moved distally to the correct level for the anastomosis. Alternatively, a second stapler to be used for the dissection can be placed distal to the one used for clamping. The transection of the rectum can be achieved using either a stapler gun laparoscopically, or an open linear stapler through a Pfannenstiel incision. Then, the colorectal anastomosis can be performed with the double cross-stapled technique for restoration of continuity with a circular stapler.

4. Discussion

This is the first study to assess colorectal surgeons' practice in the UK regarding IORW during rectal cancer surgery. Several notable findings are revealed by this survey, and these findings may guide future research and education. The most important observation is that there is no consensus amongst colorectal surgeons about IORW in rectal cancer resections. This survey has shown that most colorectal surgeons in the UK believe that there is an advantage in performing IORWs in rectal cancer resections. Furthermore, this survey has shown that although most colorectal surgeons would routinely perform IORWs in open resections, they would not routinely perform these in laparoscopic resections. Moreover, the survey has shown that more surgeons had routinely performed IORWs before the advent of laparoscopic rectal cancer surgery.

There is evidence that colorectal tumours shed cells into the bowel lumen,[5–8] and implantation of exfoliated cancer cells during rectal cancer surgery has been suggested as a possible mechanism of cancer recurrence.[2,4,5,7,9,10] IORW was introduced, to reduce the amount of free tumour cells during surgery for rectal cancer, and therefore, decrease the risk of cancer recurrence. Rectal washout can decrease the amount and viability of exfoliated malignant cells, by mechanical cleansing, or through the cytocidal effect of the washout solution.[12,17,19] Nevertheless, the clinical relevance of IORW in terms of decreasing the incidence of local cancer recurrence remains unclear,[15,16] and there is no consensus amongst colorectal surgeons regarding IORW during rectal cancer surgery.

A possible mechanism, by which viable exfoliated tumour cells are implanted at the site of the anastomosis, is the use of circular stapling devices, introduced transanally to perform a low colorectal anastomosis during anterior resection.[5,19,20] Although some studies[19–21] have suggested that the use of staplers may result in a higher rate of local recurrence, it has not been supported by studies comparing stapled versus hand-sewn anastomoses.[22] Local extraluminal recurrence may also be caused by inoculation of malignant cells during the cross staple technique, when the trocar punctures the sealed rectal stump.[23] Local mechanical injury may also be a cause of implantation.[24,25] Risk of implantation of exfoliated cancer cells also exists when performing transanal local excision.[23] Moreover, viable intraluminal tumour cells can leak through a watertight (clinically intact) anastomosis and potentially lead to locoregional (extraluminal) tumour recurrence.[9,23,26]

There have been two meta-analyses on the effect of IORW on rectal cancer recurrence. The first meta-analysis, published by Constantinides et al., in 2008, included five studies and 432 patients who underwent oncologic resection for rectal cancer.[16] The meta-analysis showed that the recurrence rate for rectal washout patients was less compared to patients who did not undergo rectal washout, but the difference was not statistically significant.[16] Subgroup analysis of the only two studies that used exclusively TME, demonstrated no difference in local recurrence rates between the two groups. The studies included in the meta-analysis were non-randomized with small sample size, not all studies included patients who had resections for curative intent only, and there was limited information in the studies regarding long-term survival rates.[16]

A further meta-analysis performed by Rondelli et al., in 2012, included five studies and a total of 5012 patients.[27] This meta-analysis showed that rectal washout is associated with reduced local recurrence, and suggested that rectal washout should be routine during anterior resection for rectal cancer.[27] Furthermore, the meta-analysis showed that the recurrence rate was significantly lower after washout in patients having radical resection only, patients treated by a curative resection, and those undergoing preoperative radiotherapy.[27] Nevertheless, all the included studies were non-randomized, four[13,15,23,28] out of the five studies, were also included in the meta-analysis performed by Constantinides et al.,[16] and there was significant heterogeneity among the studies. The main additional study in this meta-analysis,[27] was the study by Kodeda et al., which was the most recent study (2010) and included the most patients (4600 in total).[29]

The study by Kodeda et al.[29] was based upon a retrospective evaluation of a population-based national database of patients in Sweden undergoing anterior resection from 1995 to 2002 and were followed for 5 years. There was a more favourable outcome in patients after rectal washout than without. Local recurrence rates were 6.0% for the washout group, and 10.2% for the no-washout group, which was statistically significant ($P < 0.001$). The lack of randomization and the retrospective nature of the study, made it liable to the risk of bias, especially selection bias and confounding.[29] By being based on a national database, inevitably the study included surgeons with different technical abilities, including colorectal and general surgeons, and there was inconsistency in the method of IORW used between surgeons.[27,29] Furthermore, rectal washout was performed at the discretion of the surgeon, and there was lack of data on the method of irrigation and washout solution used.[29]

Every study published in the literature, and included in the two meta-analyses, comparing cancer recurrence rates between the use and no use of IORW, used different rectal washout solutions e.g. cetrimide 500 ml,[15] Povidone Iodine 500 ml,[23] formalin 10–20 ml,[13] sodium chloride 600 ml[28] The different types and quantities of rectal washout solutions used, and the different techniques of IORW between surgeons, are significant sources of heterogeneity among studies.[27] The effect of rectal washout solutions on cancer cells could be variable, and it would be difficult to distinguish which rectal washout solution is most appropriate in reducing the volume of viable cancer cells within the rectum.[2,5,10,11,30] Differences between rectal washout solutions in cytocidal effect, volume of solution used, and method of irrigation, may influence cancer recurrence rate.[27] In our survey, surgeons reportedly used the following rectal washout solutions: Povidone Iodine diluted with water or saline, Chlorhexidine, Cetrimide, or water.

Although the clinical importance of cytocidal rectal washout remains unclear, many studies would argue in favour of performing IORW because it is thought to be quick, simple, inexpensive, relatively risk-free, and adds little to the operative time.[16,29] This may be true for open surgery, but IORW during laparoscopic surgery can be difficult, complex, expensive (if for example additional staple guns are used), add significant time to the operating time, and possibly even increase the risk of morbidity. For these reasons, and importantly because there is no clear evidence in the literature to show significant clinical benefit of IORW, many surgeons have abandoned this practice, especially with the advent of laparoscopic surgery. As this survey has shown, more surgeons had routinely performed IORWs before the advent of laparoscopic rectal cancer surgery. Furthermore, this study has demonstrated similar results irrespective of age or sex, if one were to argue that the younger responders perform more laparoscopic surgery and lesser IORWs.

Although the main surgical principles to reduce local recurrence in rectal cancer should be the same between open and laparoscopic surgery, as this survey has shown, only over half of those colorectal surgeons performing laparoscopic rectal resections perform IORWs in laparoscopic resections. Many studies have shown that there is no difference in the oncological outcome in rectal cancer, resected by open or laparoscopic techniques.[31–33] However, none of these studies mention the use or lack of IORW. It would be interesting to know in how many of these resections, IORW was used.

To resolve these issues, a properly designed multicentric, randomized, controlled trial, with an appropriate sample size and follow-up, is required to compare operating time, costs, postoperative morbidity, survival rates, and importantly recurrence rates of patients undergoing intraoperative rectal washout versus no rectal washout. Furthermore, randomized, controlled trials should be performed comparing different methods of IORW, and looking at the different types and amounts of rectal washout solutions, in order to determine the optimal washout solution and technique for performing IORW.[16,23,29]

5. Conclusion

The results of our study highlight that there is no consensus amongst colorectal surgeons about IORWs in rectal cancer resections. This survey has also shown that nearly three quarters of the colorectal surgeons that responded believe that there is an

advantage in performing IORWs in rectal cancer resections. Furthermore, it has demonstrated that although most colorectal surgeons would routinely perform IORWs in open resections, they do not routinely perform these in laparoscopic resections. Finally, the survey has shown that most surgeons had routinely performed IORWs before the advent of laparoscopic rectal cancer surgery. Further research is required to determine the clinical benefits of IORW, and to identify the optimal solution and technique for performing IORW.

Ethical approval

Not applicable.

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Author contribution

Constantinos Simillis: designed and performed survey, acquisition of data, analysis and interpretation of data, writing manuscript.

Kiki Mistry: assisted in performing survey, acquisition of data, reviewed manuscript.

Ash Prabhudesai: study conception and design, supervised survey, reviewed manuscript.

Conflict of interest

The authors declare that they have no conflict of interest.

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