RATIONALE FOR RECTAL WASHOUT

Intraoperative rectal washout is performed to prevent postoperative infection and to prevent local cancer recurrence.

Rectal washout to prevent postoperative infection

Suctioning and irrigation of the rectum are frequently performed immediately prior to surgery on the left colon and rectum to remove feces that might contaminate sterile tissues or interfere with the formation of a colorectal anastomosis. The prospect of passing a circular stapler through a rectum filled with liquid or formed stool is unappealing to many surgeons. Most surgeons prefer some sort of bowel prep before anterior resection. Preoperative mechanical bowel preps remain popular. Fleet enemas are often administered a short time before surgery. Many surgeons use a proctoscope and suction cannula to inspect and cleanse the rectum immediately before surgery. Irrigation with an antiseptic is common. The irrigation is performed through the proctoscope, or with a syringe and catheter, or with a device specially designed for rectal irrigation. However, during surgery bowel content flows downward to re-contaminate this area.

By clamping below a rectal tumor or diseased sigmoid colon during surgery, the rectum can be isolated and cleansed to a degree that cannot be achieved by preoperative methods. Studies have shown that no preoperative method can reliably eliminate all feces, or reduce the bacteria concentration below 10^5 per ml of colonic content. Even clear bowel effluent can contain as many as 10^6 bacteria per ml. However, after irrigation with an antiseptic (0.4 % Clorpactin WCS-90, a stabilized organic derivative of sodium hypochlorite), no organisms could be cultured from bowel aspirates in experimental animals.

In a randomized study of 43 patients undergoing a restorative colorectal resection, 0.3% sodium hypochlorite was superior to 2.5% povidone-iodine or 0.9% saline as a rectal washout solution to reduce bacterial counts. In 14 patients who received rectal washout with 0.3% sodium hypochlorite mean E. coli counts were reduced from log 6.1 to log 1.1 bacteria per ml and mean B. fragilis counts were reduced from log 8.1 to log 0 per ml.

Intraoperative rectal and colonic irrigation with 10% povidone-iodine has been shown to be an effective method of wound sepsis prevention.

Rectal washout to prevent local cancer recurrence

The rationale for performing rectal washout to prevent local recurrence is to prevent cancer cell dispersion, implantation and metastasis by eliminating viable free cancer cells from the lumen of the bowel before the bowel wall is violated. Rectal washout for this purpose is usually accomplished by occluding the bowel below a tumor with a clamp or stapler, washing the rectum via the anus, and dividing the bowel below the point of occlusion. Belief in the value of this procedure is based on the following experimental and clinical findings:

1. There are a significant number of viable exfoliated tumor cells in the bowel lumen at the time of surgery.
2. Exfoliated colorectal cancer cells are capable of implanting and proliferating in wounds.
3. Irrigation with saline can eliminate exfoliated cancer cells from the rectum.
4. Certain solutions can destroy exfoliated cancer cells with little or no harm to bowel.
5. Rates of local cancer recurrence can be reduced by bowel irrigation with a tumoricidal solution.
What evidence is there to support these findings?

1. There are a significant number of viable exfoliated tumor cells in the bowel lumen at the time of surgery.

Malignant cells and cell clusters constituting actual tissue fragments are present in the bowel lumen, and may be recovered by taking smears or washings of colonic mucosa at a distance from a tumor. Viable exfoliated tumor cells were demonstrated in 52 of 74 lavage specimens (70%) from 49 patients with carcinoma of the large bowel. Lavage can retrieve millions of viable cells, which are present in diminishing numbers as the distance from a tumor increases, and which may be present in large numbers at the site of anastomoses. In 9 of 10 cases, malignant cells were recovered from circular staplers after low anterior resection for cancer, even when all donuts were tumor free.

2. Exfoliated colorectal cancer cells are capable of implanting and proliferating in wounds.

Malignant cells retrieved from washings of the lumen of the rectum can be cultured and can proliferate in artificial media and in immune suppressed animal models. Free intraluminal cancer cells can migrate through a sealed anastomosis and implant on the serosal surface of the intestine. Reports of carcinomatous deposits in hemorrhoidectomy wounds, fissures and fistulas, in a colonoscopic biopsy site, and on otherwise damaged mucosa, support experimental findings that any colorectal wound is fertile ground for the implantation and proliferation of cancer cells.

3. Irrigation with saline can eliminate exfoliated cancer cells from the rectum.

Jenner compared 10 patients who were given a rectal washout with 200 to 500 ml of normal saline to 10 patients who were not. The anastomoses were performed with circular staplers in both groups. The staplers and donuts were then rinsed in saline and sent for cytological examination. Of the ten patients who had rectal washout performed, none had malignant cells seen. Of the ten patient who did not have rectal washout performed, eight had malignant cells seen. Sayfan found that mechanical lavage with 500 ml of saline can eradicate free malignant cells shed into the rectal stump during anterior resection in some but not all patients, and that completeness of cleansing is volume related. Maeda showed that using saline alone for irrigation, 1.5 liters are required to clear cancer cells in patients with tumors below the peritoneal reflection, whereas at least 2 liters is required when the tumor is above the peritoneal reflection. Although irrigation fluid became clear in the majority of cases after 500 ml of irrigation, exfoliated cancer cells were still present in two-thirds of the samples. Maeda performed rectal washouts with a special irrigation device that simplified the procedure and reduced contamination of the surgical area. “Rectal washouts were completed within a median of three minutes and three seconds without difficulties, inconveniences, or problems.”

4. Certain solutions can destroy exfoliated cancer cells with little or no harm to bowel.

Buffered sodium hypochlorite (Dakin’s solution) kills free floating intestinal epithelial cells on contact, but does not delay anastomotic healing in dogs and is non-toxic. Clorpactin was shown to be effective in 0.4% and 0.5% concentrations in destroying tumor cells in vitro, and in preventing tumor growth in inoculated rats and mice. 0.25% buffered sodium hypochlorite solution and Clorpactin have been used clinically
for colonic irrigation\textsuperscript{5} and rectal washout.\textsuperscript{38-43} When used in recommended concentrations Clorpactin WCS-90 has no adverse affect on normal epithelium, systemic toxicity or allergenicity.\textsuperscript{44} 5\% povidone-iodine is lethal to colorectal cancer cells when exposed for 5 minutes.\textsuperscript{45-47} 5\% and 10\% povidone-iodine solutions,\textsuperscript{7, 48-52} and more dilute povidone iodine solutions, have been widely used clinically for bowel cleansing both preoperatively and intraoperatively. However, when used for intraoperative whole-colon washout, 5\% povidone-iodine produced epithelial desquamation, markedly increased urinary iodine excretion, and significantly decreased levels of thyroid hormones.\textsuperscript{53} Used for rectal washout, 300 ml of 5\% povidone-iodine produced high serum levels of iodine.\textsuperscript{54} Chlorhexidine-cetrimide and 0.2\% mercury bichloride are also effective intestinal tumoricidal agents, but noxythiolin and water alone are less effective.\textsuperscript{45} 0.5\% silver nitrate\textsuperscript{45} and 1 and 3\% formalin\textsuperscript{55} have also been used clinically.

5. Rates of local cancer recurrence can be reduced by bowel irrigation with a tumoricidal solution.

Animal experiments

Local irrigations of the colon lumen with sodium hypochlorite 0.2\% prior to anastomosis produced a significant decrease in cancer cell implantation rate in a rat model.\textsuperscript{56} 5\% povidone-iodine significantly reduced tumor growth in suture wounds when injected into the colon after colon cancer cells were introduced in a rat model.\textsuperscript{46} 10\% povidone-iodine significantly reduced the incidence of anastomotic tumor growth in a similar model.\textsuperscript{57} Another experimental study in rats found that irrigation with water and povidone-iodine reduced the rate of anastomotic tumor growth when compared to irrigation with water alone.\textsuperscript{58}

Clinical studies

Morgan reported a reduction in local recurrences from 21.4 to 2.1\% using mercury bichloride irrigation distally.\textsuperscript{59} Keynes showed that while local recurrence rates without using mercuric chloride rectal washouts varied between 10 and 16 per cent, the recurrence rate using mercury bichloride rectal washout was reduced to 2.6 per cent in 229 patients.\textsuperscript{60} Southwick found no suture line recurrences in 101 patients after a five year follow-up when employing prophylactic measures consisting of preliminary ligation of the lumen of the bowel proximal and distal to the tumor, excision of the tissue crushed by the clamps, and irrigation of the bowel before performance of the anastomosis with tumoricidal solutions. In a consecutive series of 55 patients in whom such prophylactic measures were not taken, the suture line recurrence rate was 10.9\%.\textsuperscript{43} Using Clorpactin for proximal and distal irrigation Bacon achieved a 4.3\% recurrence rate.\textsuperscript{41} Long used dilute formalin to wash the bowel ends proximal and distal to transected colon and rectum and reported a significant difference in local recurrence rates, 14.3\% in 133 control patients versus 2.6\% in 38 formalin-treated patients.\textsuperscript{55} Long, citing a colostomy recurrence, remarked “That tumor sterilization of both proximal and distal sites of transection is critical,” a point emphasized by Basha,\textsuperscript{53} who notes that viable tumor cells can be present as far as 35 cm upstream of a tumor.\textsuperscript{11}

Analysis of published surgical series

In a review of 51 papers published between January 1982 and December 1992, McCall found a median local recurrence rate of 18.5\% in 10,465 patients with rectal cancer.
treated surgically for cure, without adjuvant therapy. The pooled local recurrence rate for 3,577 patients who underwent anterior resection was 16.2%. Rectal washout with a tumoricidal agent (water, povidone-iodine, cetrimide or mercuric perchloride) was performed routinely in 10 series, involving 1,364, with a pooled local recurrence rate of 12.2%. However, a substantially higher proportion of these patients also underwent total mesorectal excision and extended pelvic lymphadenectomy. When separated according to surgical technique, local recurrence rates were marginally less with routine rectal washout.61

Discussion

One hundred years ago it was hypothesized that “liberated cancers cells” may cause “cancerous infection of wounds during operation” and recurrence after surgery for rectal cancer.62 Lloyd-Davis may have been the first to perform rectal washout to prevent cancer recurrence. In 1948 he reported “Especially care must be taken to avoid implanting cancer cells. We at St. Mark’s have been aware of this danger for some time and have adopted the following plan when performing restorative resections. A clamp is applied to the bowel at least 2 in. below the growth and the distal portion is irrigated through the anus with 1 : 1,000 per chlorid of mercury. The bowel is then divided, the distal portion being held with tissue forceps or stay sutures. To complete the toilet perchlorid swabs followed by dry swabs are pushed down to the anus where they are removed by an assistant. Since the patients are always in the lithotomy-Trendelenburg position this manoeuvre is a simple matter.”63 Goligher adopted and helped popularize this technique.64, 65 In 1996, a questionnaire on the management of rectal cancer was sent to all colorectal surgeons involved in the 31 U.S. colorectal residency programs. 53 of 110 respondents (48 percent) irrigated the rectum before dividing it. The most common agents used were povidone-iodine (28) and water (10).66 Heald employed rectal washout along with total mesorectal excision to achieve 5 and 10 year local recurrence rates of 2% in the 380 patients selected for anterior resection, in which the operation was judged to be curative. Describing his surgical technique he states, “Great importance is attached to preventing implantation by the use of sterile water to wash out the rectal stump below a clamp before the anorectum is divided and the pelvis itself, both before and after the division.”67 Rectal washout with and without tumoricidal agents is still commonly practiced. Heald and colleagues recently reported on their triple stapling technique which reliably occludes the rectum for distal rectal washout.68

Over the years there have been both forceful proponents and opponents of rectal washout. While some share the conviction that it is “…imperative that the irrigation technique be applied whenever colonic resection is undertaken for malignancy,”69 others dissent, “I don’t believe in it, I don’t use it!”70 Despite the strong experimental evidence and logic behind rectal washout, some surgeons argue against its use because its value has not been proven by randomized controlled clinical trials. Although some authoritative guidelines recommend rectal washout,71-73 others do not.74

Reviewing the scientific evidence available in 1961, Keynes stated that “It is clear that implantation of malignant cells can occur in carcinoma of the large intestine, both from the lumen and from the peritoneal surface.”66 Most surgeons today continue to avoid touching or manipulating a tumor excessively, so as not to spread malignant cells inside or outside the bowel. Some continue the practice of isolating colonic tumors between ligatures before dissection in order to prevent intraluminal spread. These prophylactic measures are supported by clinical and experimental evidence,8, 75-77 but are also not proven by controlled prospective trials.78 Both peritoneal lavage and irrigation of port sites with tumoricidal solutions during laparoscopic colorectal cancer surgery in order to reduce port site metastases are widely advocated,67, 79 but the
scientific evidence for these practices is limited, largely experimental, \(^{80-84}\) contradictory, \(^{85-88}\) and also not proven by prospective randomized trials.

As Keighley wrote in 1987, “Until the results of a randomized clinical trial comparing peroperative cytotoxic washout with a placebo washout are available, clinicians will never be sure whether this time honoured practice is justified.”\(^{89}\) Recent attempts to determine the value of rectal washout have been underpowered, and conclude “We believe that the time has come for a large-scale multicenter trial to address this important question,”\(^{90}\) and “There is a need for a randomized, controlled, large-scale, multicenter trial to establish the clinical relevance of intraoperative rectal washout.”\(^{91}\) Assuming a local recurrence rate of 10 percent, recurrences caused by anastomotic implantation are responsible for 10 percent of local recurrences, and rectal washout prevents one-half of anastomotic recurrences, Byrne calculates that a prospective randomized controlled trial would require at least 3766 patients enrolled and followed for 5 years, with no dropouts, to detect the effect of rectal washout with a power of 80 percent and a \(P\) of \(< 0.05\).\(^{92}\)

Loyd-Davies wrote in 1948 “It is still too early to give any statistics which will prove whether this method is effective in reducing local recurrence due to implantation.”\(^{63}\) Sixty years later the value of rectal washout is still debated. Until prospective randomized controlled studies of sufficient power are performed, it is reasonable to adopt the position articulated by Byrne, “The cost and time to perform a washout is so low that we will continue to perform this technique until strong evidence suggests otherwise”\(^{92}\) and by Radice and Dozois “The potential value of the washout, its ease of execution and its very low cost would favor its routine use.”\(^{93}\)

Conclusions

Intestinal antiseptics can prevent postoperative infection. Maximal benefit can be achieved by eliminating fecal matter and applying an antiseptic that does not injure mucosa to the entire exposed luminal surface.

When operating for cancer, intraoperative rectal washout should employ a tumoricidal agent. The tumoricidal solution should not injure intestinal mucosa, and either a sufficient volume should be used, or the concentration and exposure time should be optimized. If rectal washout is performed with saline alone, a sufficient volume should be used.

There is compelling evidence that rectal washout with or without tumoricidal agents can reduce the rate of rectal cancer recurrence. Since the evidence supporting rectal washout is as strong as the evidence for other common measures to avoid tumor implantation, rectal washout should be employed when feasible, and no less frequently than these other measures in operations for distal sigmoid and rectal cancers, where manipulation of the tumor is unavoidable and the transection line is near the tumor.

REFERENCES

5. Gliedman ML, Grant RN, Vestal BL, Rogers CE, Karlson KE. Clorpactin, a surgical adjunct; antimicrobial and tumoricidal action. Surgical Forum 1957;8:104-8
75. Cole WH. Measures to combat the menace of cancer. Am Surgeon 1951;17:660
89. Keighley MRB, Hall C. Anastomotic recurrence of colorectal cancer – a biological phenomenon or an avoidable calamity? Gut 1987;28:786-791

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