The Alternative to Colostomy for the Injured Colon

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SUMMARY
In 34 patients with penetrating colon wounds which were considered to be liable to dehiscence, the sutured wounds were exteriorized. There were several 'high-risk' factors, i.e. operative delay of more than 6 hours after injury, faecal contamination of the peritoneal cavity, marked confusion of the bowel wall, and severe associated visceral haematoma which is deemed liable to infection. Additional considerations were thoraco-abdominal penetration and combined colonic and renal injuries.

The operative technique is described in detail, and the morbidity of the procedure, which is low, is analysed.

Comparison is made with a similar group of patients in whom colostomy was performed with subsequent closure. Exteriorization and closure of the penetrating colon wound appear significantly superior to colostomy in terms of mortality, septic complications and period of hospitalization.


Primary suture with intraperitoneal drainage has been advocated for patients with perforating colonic injuries. However, some patients with colonic injuries are particularly at risk regarding the development of intraperitoneal septic complications and possible disruption of the colonic suture line. At King Edward VIII Hospital in Durban, we consider a delay of 6 hours or more before laparotomy or frank faecal contamination of the peritoneal cavity as defining criteria for these 'high-risk' patients. For patients falling into these categories colostomy was strongly recommended, either by exteriorization of the wound or by primary closure and proximal decompression of the repair. Colostomy was also considered advisable when surrounding areas of devitalized bowel with subserosal haematoma or severe associated visceral injuries with extensive haematoma formation were present, as seen in patients with gunshot wounds. Thoraco-abdominal penetration or combined colonic and renal injuries should also be treated by exteriorization, in view of the severe complications that may follow colonic dehiscence under these circumstances.

However, colostomy is associated with significant morbidity and increased periods of hospitalization. This is particularly important when dealing with relatively unsophisticated unskilled labourers, such as constitutes the bulk of our patients.

Beall et al. and Middleton and Wayne have described the technique of sutured exteriorization of the colonic wound. We decided to try this form of management, as an alternative to colostomy, in a group of patients who fell into the 'high-risk' category.

PATIENTS AND METHODS
Thirty-four patients (32 men and 2 women) had colonic injuries which were considered liable to breakdown if primary closure was attempted. They constituted 40% of all patients treated for colonic injuries during the period of study. The average time between injury and operation was 11.3 hours, and all patients had faecal contamination of the peritoneal cavity. An additional consideration in 3 patients was surrounding haematoma and tissue damage of the bowel wall.

All the patients were Zulus and their ages averaged 29 years. Twenty-seven sustained stab wounds, and 7 injuries resulted from gunshot wounds.

The transverse colon, including flexures, was injured in 22 cases (64.5%), 7 of which involved the right side. Five patients (14.7%) had perforations in the descending large bowel, while the sigmoid colon was involved in the remaining 7 (20.5%).

Eighteen patients had associated visceral injury, involving small bowel in 10, kidney in 4, liver in 3, duodenum in 2 and diaphragm in 2. The spleen, stomach, spinal cord, superior mesenteric and brachial arteries were injured on one occasion each. Four patients sustained a haemopneumothorax.

Operative Technique
The abdomen was explored through a midline incision and attention given to any coexisting abdominal injuries. The involved segment of colon was then mobilized so that it could easily be exteriorized without tension. The colon perforation was debrided. Perforations in close apposition were extended to form a single larger wound, but widely spaced wounds were closed separately. An inner (all coats) continuous 3/0 chromic catgut and outer (seromuscular) 3/0 silk interrupted suture were used in all cases. The segment of colon involved was exteriorized through a generous, separate colostomy incision over a thin, soft rubber tube sutured to the skin. In this manner some retraction was allowed to occur, which prevented obstruction. A standard, transparent self-adhesive colostomy bag was immediately applied. This had the advantages of providing a warm, moist environment for the bowel, of allowing ready inspection without disturbing dressings and, in the event of dehiscence, of providing a ready receptacle for faeces.

The bowel was returned to the peritoneal cavity approximately 7 days later (time interval ranged from 5 to 21 days) under general anaesthesia, provided there was no sign of intraperitoneal sepsis or suture line dehiscence. At this stage, only finger dissection was necessary to free...
the bowel from the abdominal wall. Sharp dissection became necessary after about 10 days, but no problems were experienced with replacement under these circumstances. Routine intraperitoneal drainage was practised. Colonic breakdown was regarded as a colostomy, and formal closure was performed 6-10 weeks later.

RESULTS

Complications after Exteriorization (Table I)

A patient who had sustained multiple gunshot wounds died within 24 hours of operation of causes unrelated to the colon injury or exteriorization, and has therefore been excluded from the morbidity analysis. Of the remaining 33 patients, 1 patient, who had also sustained multiple gunshot wounds, died of Gram-negative septicemia 11 days after colon exteriorization. This followed drainage of an empyema and a subphrenic abscess. The colon was intact at the time of death.

<table>
<thead>
<tr>
<th>Complication</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
<td>1</td>
<td>3.0</td>
</tr>
<tr>
<td>Wound sepsis</td>
<td>9</td>
<td>27.2</td>
</tr>
<tr>
<td>Intra-abdominal abscess</td>
<td>4</td>
<td>12.1</td>
</tr>
<tr>
<td>Colon wound dehiscence</td>
<td>7</td>
<td>21.2</td>
</tr>
<tr>
<td>Pulmonary complications</td>
<td>7</td>
<td>21.2</td>
</tr>
<tr>
<td>Empyema</td>
<td>1</td>
<td>3.0</td>
</tr>
<tr>
<td>Deep vein thrombosis</td>
<td>1</td>
<td>3.0</td>
</tr>
<tr>
<td>Delirium tremens</td>
<td>1</td>
<td>3.0</td>
</tr>
</tbody>
</table>

* Excludes 1 unrelated death which occurred within 24 hours.

Wound sepsis occurred in 9 patients (27.2%) and intra-abdominal abscesses in 4 (12.1%). Pulmonary complications occurred in 7 patients (21.2%) and 1 patient developed an empyema. Upper-segment deep venous thrombosis developed on one occasion.

Colon wound dehiscence occurred in 7 patients (21.2%). The time interval between exteriorization and breakdown ranged from 3 to 21 days (average 7 days). One patient had a gunshot wound, but the remainder had stab wounds. One of the latter patients manually disrupted his exteriorized bowel during a bout of delirium tremens. The remaining 6 patients had additional septic complications related to the wound or the peritoneal cavity, and all had severe faecal contamination at the time of operation. Only 3 patients (11.5%) of the remaining 26 whose colon wounds remained intact developed septic complications. This difference is highly significant ($P<0.001$).

Comparison of Postoperative Morbidity between Replacement of Closed Exteriorized Colon and Colostomy Closure (Table II)

Of the 26 patients who had the sutured colon replaced, 8 (30.8%) developed wound sepsis, and a faecal fistula, which closed within 5 days, occurred in 1 patient. There were no intra-abdominal abscesses. The average period of hospitalization was 17.6 days.

In 11 additional patients colostomies were performed for the indications defined for exteriorized closure. Their average age was 25 years and all were male patients. Sixty per cent of these injuries involved the transverse colon, 9% the descending colon and 31% the sigmoid colon. There is thus no significant difference between the groups with regard to age, sex or distribution of injury.

One patient (9.1%) died of overwhelming intra-peritoneal sepsis and septicemia after anastomotic disruption. Wound sepsis occurred in 5 patients (45.5%), and 1 patient (9.1%) developed a subphrenic abscess. Septic complications therefore occurred in 7 patients (63.6%), which is a significantly higher incidence than that occurring after replacement of the exteriorized sutured colon ($P<0.001$).

Anastomotic disruption with faecal fistula formation occurred in 2 patients (18.2%). The average total period of hospitalization in this group was 51.9 days.

DISCUSSION

The technique of exteriorization described is similar to that used by others. However, meticulous attention must be paid to detail if the sutured colon wound is to heal. The wound edges must be adequately debrided before two-layer closure, and a generous incision must be made in the abdominal wall so that there is no obstruction to the exteriorized loop. It is also important to avoid pressure trauma to the bowel by suspending the loop on a soft rubber tube. We feel that this is more secure than the Penrose tubing advocated by Middleton and Wayne. An added refinement is the meticulous appli-
cation of a self-adhesive colostomy bag immediately after the operation. This provides the exteriorized loop with a warm, moist environment, provides a receptacle for exudate or faeces and prevents frequent disturbance of the area to change dressings.

The single death and septic complications, such as intra-abdominal abscess formation and wound infection, were caused by faecal contamination and not by the exteriorization procedure.

The colon wound dehisced in 7 patients (21.2%), but in 1 case it was caused by the patient who tore the exteriorized bowel during a bout of delirium tremens. The other 6 patients all had extensive faecal contamination of the peritoneal cavity at the time of operation, and had either intraperitoneal or wound sepsis at the time of colonic breakdown. This would appear to be a significant causative factor, although the precise mechanism remains obscure, as the sepsis was not always related to the colostomy wound. This observation also adds weight to the argument for exteriorization in the presence of intraperitoneal faecal contamination.

Disruption of the sutured perforation occurred at an average period of 7 days after operation (range 3-21 days). Septic complications due to contamination of the wound or peritoneal cavity have usually manifested by this stage, and it is safe to return the bowel to the peritoneal cavity at this time provided there are no complications. Our policy is to delay colonic replacement until all complications have resolved. Once the wound has broken down and formed a colostomy it is regarded as such and no attempt at closure is made for a period of at least 6 weeks.

Return of the exteriorized bowel is a simple procedure at 7 days after operation and can be achieved by blunt finger dissection. However, in contrast to other authors,\textsuperscript{5,6} we feel that short general anaesthesia is preferable to local anaesthesia for reduction and wound closure. Although sharp dissection becomes necessary to replace the bowel after 10 (or more) days after the operation, this does not cause much technical difficulty or increased morbidity.

One-third of the patients in whom the exteriorized segment of colon was returned developed wound infection; there were no other septic complications and there was no mortality. Partial dehiscence of the colon wound with a small faecal fistula, which closed within 5 days, was noted on one occasion. These results are far more favourable than those seen after colostomy closure. Among the patients who had colostomy closure there was 1 death, directly attributable to anastomotic disruption, and 2 patients developed faecal fistulae. In addition, there was a significantly higher incidence of septic complications. Finally, the average period of hospitalization among the patients in whom the exteriorized wound had been sutured was 17.6 days, which is significantly shorter than the 51.9 days among the colostomy patients.

CONCLUSIONS

In patients with perforating colon wounds, who are considered to be at risk with regard to dehiscence of the sutured perforation, two-layer closure of the exteriorized bowel, with the technique described, provides a favourable alternative to colostomy. These conclusions are based on the significantly higher incidence of morbidity that occurs after colostomy closure, as well as on the significantly longer period of hospitalization necessary for colostomy patients in our practice.

REFERENCES


Books Received: Boeke Ontvang


