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Operative Management of Civilian Rectal Gunshot Wounds: Simpler Is Better

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Abstract. Extraperitoneal rectal gunshot wounds have been managed with a variety of methods from simple diverting colostomy to combinations of rectal repair, proximal diversion, transperitoneal or presacral drainage, and distal bowel irrigation techniques. Treatment methodology is chosen based on anecdotal experience, and there is no clear evidence that any technique is superior to the others. The objective of this study was to compare 3 methods of managing civilian extraperitoneal gunshot wounds. Retrospective analysis of 30 consecutive patients with extraperitoneal rectal gunshot wounds was undertaken. Patients were treated with 1 of these 3 techniques: (1) simple diverting colostomy without rectal repair (group A, 12 patients); (2) diverting colostomy and rectal repair (group B, 12 patients); and (3) diverting colostomy and presacral drainage without repair (group C, 6 patients). Injury, hospital course, and outcome data were compared. The 3 groups were similar in age, injury severity, admission hemodynamics, preoperative and intraoperative time, blood loss, fecal contamination, and associated injuries. The overall incidence of complications was 27% (8/27): 25% (3/12) in group A, 33% (4/12) in group B, and 17% (1/6) in group C (p = NS). Complications directly associated with the rectal injury were found in 2 cases (7%): 1 group A patient developed a vesicorectal fistula and 1 group B patient developed a rectocutaneous fistula. For 10 patients with both rectal and bladder injuries, the complication rates for groups A, B, and C were 50%, 20%, and 0%, respectively (p = NS). No patient died. In conclusion, diverting colostomy without rectal repair or drainage appears to be safe for the management of most civilian retroperitoneal rectal gunshot wounds. Additional surgical maneuvers may be required for combined rectal and urinary trauma or other complex rectal injuries. Sound surgical principles, tailored to the individual case, should overrule any unproven dogmas.

Extraperitoneal rectal injuries are associated with significant morbidity and mortality. Delays in diagnosis, difficulties in adequate exposure, and inconsistencies in suggested methods of treatment influence outcome negatively. The variety of proposed surgical techniques adds to the confusion. Proximal colostomy, rectal repair (transabdominal or transanal), distal bowel washout, presacral drainage, and combinations thereof are the most frequently reported methods [1–5]. However, most of the studies have dealt with diverse injuries that are caused by various mechanisms and have been collected over long periods of time [2, 4, 6]. Therefore, conclusions are not easily drawn.

Given the difficulties in conducting a randomized trial for an uncommon injury, we believe that a relatively large case series from a busy trauma center on patients managed over a short period of time may allow reliable comparisons and lead to valuable conclusions. As gunshot wounds account for >80% of all rectal injuries, we decided to focus on this mechanism of injury to limit the variables that influence outcome.

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Patients and Methods

The Los Angeles County and University of Southern California (LAC+USC) Medical Center is a large, academic, level I urban trauma center with approximately 7000 trauma admissions annually. All patients with truncal gunshot wounds are managed according to a protocol by a dedicated trauma team which is composed of 24-hr in-house surgical attendants and residents. Patients with peritonitis and frank hemodynamic instability are taken to the operating room immediately without any diagnostic tests. Hemodynamically stable patients with peritonitis are taken urgently for exploration after only minimal diagnostic tests (hematocrit, urinalysis, chest radiograph). The remaining patients are closely monitored in a dedicated observation area and undergo all necessary investigations. Patients with gluteal gunshot wounds and patients with rectal bleeding are routinely sigmoidoscoped, unless emergent abdominal exploration is required.

All patients who were treated for extraperitoneal rectal gunshot wounds during the period of January 1992 to October 1995 were identified through the trauma registry. The charts were reviewed and data referring to patient demographics, preoperative evaluation, surgical management, postoperative course, and final outcome were collected.

Preoperative time was defined as the summation of the prehospital time (from the paramedics' alarm to hospital admission) and the in-hospital preoperative time (from admission to beginning of the operation). Injury severity score (ISS) was recorded. The degree of fecal contamination was graded as minimal if confined around the injury, moderate if confined to 1 quadrant, and severe if found in >1 quadrant. The patients were managed according to 1 of 3 surgical methods: diverting colostomy alone, colostomy and repair of the rectal injury, or colostomy and presacral drainage without repair. Transanal repair, transabdominal primary repair without prophylactic colostomy, or distal bowel washout were not practiced in any of the cases, based on surgeon's preference.

Table 1. General demographics and admission data from 30 patients with gunshot wounds to the extraperitoneal rectum.

	Mean	Range
Age (years)	28.9	15–74
Injury severity score	12.9	1–32
Admission blood pressure (mmHg)	126	90–190
Admission hematocrit (%)	31.6	32–51
Prehospital time (min)	30	9–57
Preoperative time (hr)	3.8	0.5–17

Table 2. Four patients with preoperative delays.

Case no.	Preoperative time (hr)	Gunshot wound site	Injured organs	Complications
1	9	Buttock/left groin/ right arm	Rectum/ prostate	None
2	10	Back	Rectum	None
3	11	Abdomen/buttock	Rectum	Wound hematoma
4	17	Multiple gunshot wounds	Rectum	None

Colostomies were always brought out as loops, except for 3 patients who had end colostomies with Hartman's pouches for associated severe intraperitoneal colonic injuries. Antibiotics (a second-generation cephalosporin) were started before surgery in all cases, but varied thereafter in type and duration. The wound was closed or left open at the discretion of the surgeon.

Statistical comparisons were done with the chi-square goodness-of-fit test with Yates correction and the 2-tailed Fisher's exact test. A significance level of $p = 0.05$ was used.

Results

Thirty consecutive patients with extraperitoneal rectal gunshot wounds were included in this series (Table 1). All of them were males. Twelve patients (40%) suffered a gunshot wound to the anterior abdomen, 11 (37%) to the back, and 7 (23%) to the buttocks. Emergent surgery was performed in 26 cases (87%). Four patients (13%) were initially observed but were eventually taken to the operating room due to development of abdominal tenderness 9, 10, 11, and 17 hr after admission (Table 2). Sigmoidoscopy was performed in 21 patients (70%) and revealed blood in all of them. However, identification of the exact location and size of the rectal injury was possible in only 4 cases. Bleeding and feces prevented proper intraluminal visualization. The presence of rectal hemorrhage was sufficient evidence to suggest the need for operative intervention.

Associated injuries were found in 23 cases (77%) (Table 3). The intraoperative time varied from 2 to 9 hr (average 4.9), and mean intraoperative blood loss was estimated as 762 ml (range 50–5000). Prolonged operations were necessary in the presence of multiple associated injuries and particularly major vascular trauma. The degree of intraperitoneal contamination was considered minimal in 20 cases (67%), moderate in 7 (23%), and severe in 3 (10%).

Complications were found in 8 patients (27%) (Table 4). Four patients developed wound sepsis, requiring opening of the wound. One patient suffered a wound dehiscence that was managed non-

Table 3. Associated injuries in order of frequency in 30 patients with extraperitoneal rectal gunshot wounds.

Organs	Number of cases
Small bowel	11
Bladder	10
Colon	5
Skeletal	4
Urethra	2
Femoral artery	1
Inferior vena cava	1
Prostate	1

operatively. Three of 4 wound infections and the wound dehiscence occurred in 3 of 21 patients who had had their wounds closed (incidence of wound infection 14%). One of 9 patients who was left with the wound open developed wound infection (incidence 11%). One patient with colonic resection and Hartman's closure developed a left lower quadrant intraabdominal abscess that was successfully drained percutaneously. Two other patients had complications directly associated with the rectal injury: 1 patient developed a vesicorectal fistula after a combined bladder and rectal injury which was treated by bladder repair and diverting colostomy, and 1 patient underwent bladder and rectal repair with diverting colostomy but developed a rectocutaneous fistula. Both fistulas healed spontaneously, and the patients were discharged on postoperative days 9 and 13, respectively, with no further sequelae.

Nine patients required admission to the Surgical Intensive Care Unit due to other associated injuries. The mean hospital stay for the whole group, for patients with complications, and for patients without complications was 12, 16, and 9.5 days, respectively.

Twenty patients (67%) returned to follow-up and none developed late complications. All of these patients underwent restoration of bowel continuity on average 6.5 months after the initial procedure (range 8 days–21 months).

Influence of Operative Management of Rectal Injury on Outcome

The patients were divided into 3 groups according to the operative strategy used for the rectal injury. Group A consisted of 12 patients (40%) who underwent diverting colostomy only. Group B consisted of 12 patients (40%) with rectal injury repair and proximal colostomy. Group C consisted of 6 patients (20%) with proximal colostomy, presacral drainage, and no rectal repair. All but 3 patients (2 in group A and 1 in group B) who underwent Hartman's procedures had loop colostomies. The 3 groups were found to be similar in age, ISS, admission systolic blood pressure, admission hematocrit, preoperative time, intraoperative time, estimated blood loss, degree of fecal contamination, and number of associated injuries (Table 5). The complication rate was 25% (3/12) for group A, 33% (4/12) for group B, and 17% (1/6) for group C (p = NS). There were only 2 patients (7%) with local complications (vesicorectal and rectocutaneous fistulas): 1 belonged to group A and 1 to group B.

There were 13 patients (43%) with combined rectal and genitourinary trauma. Three of them suffered prostate (1) or urethra (2) lacerations and had uneventful recoveries. The remaining 10 patients had bladder injuries: 2 of these belonged to group A and

Table 4. Complications among 30 patients with extraperitoneal rectal gunshot wounds.

Case no.	ISS	Estimated mean BP (mmHg)	Admission hematocrit (%)	Preop time (hr)	Intraop time (hr)	Intraop blood loss (ml)	Fecal contamination	Associated injury (organs)	Type of surgery	Complication
1	9	113	43	2	4	1000	Minimum	Ileum	Repair and colostomy	Wound dehiscence
2	17	100	51	3	4	400	Moderate	Bladder	Repair and colostomy	Rectocutaneous fistula
3	18	100	37	2	2	100	Severe	Small bowel, femur	Repair and colostomy	Wound sepsis
4	19	103	40	2	3	200	Moderate	Small bowel	Repair and colostomy	Wound sepsis
5	17	110	40	3	4	50	Minimum	Bladder	Colostomy	Vesicorectal fistula
6	16	25	34	0.5	4	5000	Severe	Small bowel, colon	Colostomy	Intraabdominal abscess
7	17	65	38	2	6.5	2800	Moderate	None	Colostomy	Wound sepsis
8	5	100	46	11	4	1500	Moderate	None	Presacral drainage and colostomy	Wound sepsis

ISS: injury severity score; BP: blood pressure; Preop: preoperative; Intraop: intraoperative.

Table 5. Comparisons among the 3 groups.

	Simple colostomy (group A, $n = 12$)	Primary repair and colostomy (group B, $n = 12$)	Presacral drainage and colostomy (group C, $n = 6$)
Age (years)	32	26	23
Injury severity score	12.7	13	13
Admission blood pressure (mmHg)	120	135	119
Admission hematocrit (%)	39	41	41
Preoperative time (hr)	5.1	2.7	3.6
Intraoperative time (hr)	3.5	4.6	4.3
Estimated blood loss (cc)	970	583	638
Fecal contamination	Minimal 7, moderate 3, severe 2	Minimal 6, moderate 3, severe 3	Minimal 6, moderate 0, severe 0
Associated injuries	Small bowel 3, colon 3, bladder 2, femoral artery 1, prostate 1	Small bowel 7, bladder 4, colon 2, inferior vena cava 1	Bladder 3, small bowel 1, colon 1, urethra 1
Complications	3 (25%)	4 (33%)	1 (17%)

1 (50%) developed a complication (vesicorectal fistula); 5 belonged to group B and 1 (20%) developed a complication (rectocutaneous fistula); and 3 belonged to group C with no complications.

Discussion

Various management options have been described for extraperitoneal gunshot wounds. The 4 most commonly used are (1) diverting colostomy; (2) primary repair; (3) presacral drainage; and (4) distal bowel washout. Different combinations of the above techniques are being suggested as the ideal methods of treatment. However, the data that drive these conclusions usually have significant limitations. In many studies, different mechanisms of rectal injuries (gunshot wounds, stab wounds, iatrogenic injuries, foreign bodies, blunt trauma) [2, 4] or different treatment combinations [1, 3] result in many small subgroups, which are difficult to compare meaningfully. None of the studies has been prospective and cases have been collected over long periods of time (6–10 years) [4, 5], reflecting possibly diverse treatment philosophies from different surgeons. Lack of control for antibiotics and wound management adds to the difficulty of interpreting these data.

Although our study is retrospective and has significant limitations, we tried to control some of the above-mentioned factors. Only cases with gunshot wounds to the extraperitoneal rectum were reviewed. All patients were managed during a relatively short time period by a dedicated group of trauma surgeons with similar treatment philosophies. Although postoperative antibiotics were tailored to the individual patient's infectious course, the type (second-generation cephalosporin) and the dose (2 g) of preoperative antibiotics were uniform for all patients. Finally and most importantly, only 3 methods of rectal wound management were compared.

Although primary repair is undoubtedly established as the treatment of choice for the majority of civilian gunshot wounds of the intraperitoneal colon [7–9], there is no good support for its use in extraperitoneal rectal injuries. The anatomic (lack of serosa) and technical (difficult exposure) problems associated with the rectum do not allow primary repair without fecal diversion to emerge as a safe method. Despite sporadic cases of transanal or

transabdominal primary repair [5], this technique has to be tested more extensively before safety is proved. Proximal colostomy is therefore believed to be a necessary adjunct in the management of the vast majority of rectal gunshot wounds. The question then arises as to the need for additional maneuvers to improve outcome.

Distal bowel irrigation has attracted serious controversy. After the initial work supporting the value of this technique for war casualties [10], 2 more groups reported decreasing morbidity rates in patients who underwent bowel irrigation [11, 12]. No benefit was shown in other series [1, 5, 13]. In fact, bowel irrigation was considered to be associated with a high risk of infection because of spilling intraluminal contents out of unrepaired rectal perforations [14]. These arguments, in combination with the difficulties in performing this technique, have shifted most surgeons' preference away from distal bowel washout. In our series, no patient underwent this procedure.

Presacral drainage is thought to decrease pelvic sepsis rates [5, 15]. However, scrutiny of the literature reveals extrapolation of combat data to the civilian arena. There is no proof that presacral drainage improves outcome, and some of the conclusions in favor of it are based on 1 patient [5]. On the other hand, this procedure requires an additional incision with dissection of uninvaded space, special positioning of the patient on the operating table, and dealing with suboptimally sterilized body regions. The drain may be malpositioned, malfunction, or cause significant patient discomfort. In our series, only 6 patients underwent presacral drain placement. Their trauma profile was similar to the rest of the group, and the procedure was done for no other reason than the surgeon's preference. The presence of the drain did not decrease complication rates or hospital stay.

Rectal repair in association with diverting colostomy is infrequently performed [4, 5]. Unless the rectal wound is close to the peritoneal reflection, attempts at repair are associated with extensive dissection, which is done usually in a narrow male pelvis. Although the morbidity after pelvic dissection for benign disease is small, the complications (bladder dysfunction, impotence) are particularly bothersome for young patients [16, 17]. Furthermore, opening of the peritoneal reflection may cause unnecessary contamination of the peritoneal cavity in cases of isolated extraperitoneal rectal injuries. The friability of the repair, in view of serosal absence and technical difficulties, and the prolongation of operative time for injury localization and precise suturing, make the value of primary rectal repair even more questionable.

Colostomy without rectal injury repair or presacral drainage seems to be safe [3, 18]. It avoids iatrogenic pelvic nerve injury, cross-contamination of clean spaces, additional operative time, and unnecessary patient discomfort. In our study, similar outcomes were observed among patients treated with diverting colostomy, primary repair with colostomy, or colostomy with presacral drainage. For patients with combined rectal and bladder injuries, additional maneuvers may be required [19]. Our findings showed a trend toward decreased complication rates when rectal repair or drainage was used under such circumstances, but the small numbers prevent sound conclusions. In view of the proximity between the rectum and the bladder, the mandatory opening of the retroperitoneal space to assess the bladder, and the potential for persistence of relative complications, simple diversion may not suffice for such injuries. Repair of both organs, placement of omentum between them, and drainage of the area may be advisable.

Our results need to be interpreted with caution. Our study is retrospective and reflects individual preferences, even if under a uniform philosophy of patient management. The conclusions are based on results from moderate rectal injuries. Extensive or devascularizing injuries may require various surgical procedures in addition to diverting colostomy. Sound surgical principles, tailored to the individual case, should overrule any unproven dogmas. A multicenter trial is the only way to accumulate the necessary numbers for definitive conclusions.

In conclusion, diverting colostomy appears to be safe as the sole method of treatment of most civilian extraperitoneal rectal gunshot wounds. However, in the absence of undisputed evidence of the superiority of any method, every patient should be managed on an individual basis.

Résumé

Fond du problème: Les plaies par balle du rectum extrapéritonéal peuvent être traitées de plusieurs façons, allant de la colostomie simple de dérivation, à la combinaison de plusieurs procédés différents comme la colostomie d'amont, le drainage transpéritonéal ou présacré, et les techniques d'irrigation du côlon distal. La méthodologie du traitement est basée sur l'expérience anédotale et il n'existe pas de preuves claires qu'une technique particulière est supérieure à une autre. Objectif: Comparer trois méthodes pour traiter les plaies par balles extrapéritonéales en pratique civile. Lieu: Trauma center de niveau l dans un grand centre académique. Patients et Méthodes: Analyse rétrospective de 30 patients consécutifs ayant une plaie par balles du rectum extrapéritonéal. Les patients ont été traités par une des trois méthodes suivantes: a) colostomie de dérivation simple sans réparation rectale (Groupe A, 12 patients); b) colostomie de dérivation et réparation rectale (Groupe B, 12 patients); et c) colostomie de dérivation et drainage présacré sans réparation rectale (Groupe C, 6 patients). Les lésions, l'évolution à l'hôpital, et l'évolution finale ont été comparées. Résultats: Les trois groupes étaient similaires en ce qui concernait l'âge, la sévérité des lésions, l'état hémodynamique à l'admission, la durée préopératoire et peropératoire, les pertes sanguines, la contamination fécale et les lésions associées. L'incidence globale des complications était de 27% (8/27): 25% (3/12) dans le groupe A, 33% (4/12) dans le groupe B et 16% (1/6) dans le groupe C (p = NS). On a trouvé des complications directement en rapport avec la lésion rectale chez deux patients (7%): un patient dans le groupe A a développé une fistule vésicorectale et un dans les groupe B, une fistule rectocutanée. Pour dix patients ayant à la fois des lésions rectales et vésicales, les taux de complications des groupes A, B et C ont été, respectivement, de 50%, 20% et 0% (p = NS). Aucun patient n'est décédé. Conclusion: La colostomie de dérivation sans réparation rectale ou drainage apparaît comme une méthode sûre pour la prise en charge de la plupart des lésions rectales sous-péritonéales par balles en pratique civile. Des gestes chirurgicaux complémentaires sont parfois nécessaires pour des lésions rectales et urinaires combinées ou d'autres lésions rectales complexes. Des principales solides, adaptés à chaque cas individuel, devrait primer sur les dogmes non prouvés.

Resumen

Las heridas extraperitoneales del recto, producidas por arma de fuego, se han tratado con las más diversas técnicas: desde la simple colostomía de descarga, a la sutura de la herida rectal asociada a colostomía de descarga, drenajes transperitoneales o presacros, técnicas de irrigación del intestino distal, etc. Estos diversos tratamientos se efectuaron basados en casuísticas escasas, anecdóticas y no han demostrado, con claridad, que un método sea mejor que otro de los propuestos. Objetivo: Estudiar comparativamente los resultados del tratamiento de las heridas extraperitoneales del recto por arma de fuego, con tres técnicas quirúrgicas diferentes. Realización: Un gran centro académico de traumatología de nivel l. Pacientes y Métodos: Se efectúa un análisis retrospectivo de 30 pacientes, con herida extraperitoneal de recto producida por arma de fuego. Los traumatizados fueron tratados con tres técnicas diferentes: a) Colostomía de descarga sin reparación de la lesión rectal (grupo A, n = 12); b) Colostomía de descarga y sutura de la herida del recto (grupo B, n = 12) y c) Colostomía de descarga con drenaje presacro, sin reparación de la herida rectal (grupo C, n = 6). Se compararon entre los tres grupos, la lesión, evolución hospitalaria y resultados. Resultados: Los pacientes de los tres grupos eran semejantes por lo que a la edad, gravedad del traumatismo, estado hemodinámico al ingreso, tiempos pre e intraoperatorios, hemorragia, contaminación fecal y lesiones asociadas se refiere. La frecuencia global de complicaciones fue del 27% (8/27). En el grupo A, se observaron un 25% (3/12); en el grupo B 33% (4/12) y en el C 16% (1/6) (p = N.S.). Complicaciones directamente atribuibles al traumatismo rectal se constataron en 2 (7%) casos: Un paciente del grupo A, desarrolló una fístula vesico-rectal y otro del grupo B, una fístula estercorácea. En 10 pacientes con traumatismo rectal y vesical, la tasa de complicaciones fue: 50% para el grupo A, 20% para el B y 0% para el C (p = N.S.). Ningún paciente falleció. Conclusión: La colostomía de descarga, sin reparación de la herida rectal y sin colocar drenaje alguno, parece ser la técnica más segura para el tratamiento de la mayoría de las lesiones rectales retroperitoneales por arma de fuego en tiempo de paz. Otras estrategias quirúrgicas habrán de utilizarse cuando se trate de heridas combinadas recto-vesicales o traumatismos más complejos del recto. Sólidos principios quirúrgicos, individualizando caso a caso, han de prevalecer sobre dogmas no confirmados.

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