

## Wartime colon injuries: primary repair or colostomy?

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### Summary

A retrospective non-randomized study, comparing primary repair with colostomy, was made on a series of 102 patients with penetrating intraperitoneal colon injuries, in a war surgery programme in Cambodia. The overall case fatality rate (CFR) was 25.5%, whereas in the primary repair group CFR was 20%, compared to 30.8% in the colostomy group. The difference was not statistically significant ( $P=0.30$ ). Adjustment for possible confounding factors in the two groups did not alter the results. Considering the numerous advantages to the patient of a primary closure in the precarious situations where war surgery is often performed, this technique merits consideration.

### Introduction

The traditional management of colon wounds by exteriorization or proximal colostomy was influenced by the wartime experience that these injuries resulted in a high complication rate. Over the past 10 years, however, the idea of primary repair or resection in civilian colon injuries was introduced<sup>1,2</sup>. However, the question remains unanswered in the field of war surgery.

A primary repair has multiple advantages in the precarious conditions of many developing countries where this type of war surgery has to be performed. For social and cultural reasons, it is much better accepted by the patient than a colostomy. The problems of stoma care and stoma bags, which are always in short supply, disappear. There is no reintervention.

Under the very strenuous conditions of the Cambodian conflict, primary repair of colon injuries was practised in the surgical programmes of Médecins Sans Frontières (MSF). The aim of this work is to document the results of primary suture under war conditions.

### Materials and methods

This non-randomized retrospective study covers the admissions for colon injury during a period of 24 months, from January 1990 until December 1991, in four provincial hospitals in Cambodia (Kompong Thom, Kompong Cham, Pursat, Siem Reap). These hospitals were situated at the time of the study at about 50 km from the frontline. Transportation of the wounded was a major problem. Each hospital performed on average 70 to 100 operations a month;

60% being war casualties (blast injuries and gunshot wounds). The training level of the staff, medical equipment and general conditions were comparable. A permanent expatriate surgical team (MSF or International Committee of the Red Cross) was present throughout the study period in each hospital, with the exception of Kompong Cham Hospital, where since beginning 1991 no expatriate surgeon has been working.

The interventions described here were executed by a surgeon or a general practitioner with special training in surgery.

During the study period, 151 patients were admitted with colic injuries. One hundred and two case records were analysed for: patient and doctor's delay, general condition of the patient, aspect of the wound, associated lesions, surgical technique, post-operative treatment, complications, and outcome [expressed by case fatality rate (CFR)]. Forty-nine cases were not included in the study because of incomplete patient records. Clinically, there was no difference between the included and the excluded cases. Chi-square or Fisher's exact test was calculated for comparison of proportions in two by two tables and Mantel Haenszel Summary  $\chi$ -square was calculated in a stratified analysis for confounding factors. All data were analysed with the EPI-INFO program.

Four surgical techniques were used: primary repair ( $n=43$ ); segmental resection with anastomosis ( $n=7$ ); anastomosis with or without segmental resection protected with colostomy ( $n=44$ ); and exteriorization of the colon wound ( $n=8$ ).

The standard approach for primary repair was a transversal one-layer suture after débridement of wound edges. Segmental resection consisted either in a right or left hemicolectomy or in a segmental resection of transverse or sigmoid colon. The anastomosis was end-to-end, in a one-layer suture, except for the right hemicolectomy where the ileum was sutured in an end-to-side anastomosis to the transverse colon.

If colostomy was performed to protect sutures, it was a loop colostomy localized on the transverse colon. Exceptionally a caecostomy was done for lesions of the transverse colon. Colostomies were closed from week 6 onwards. Exteriorization of injured colon was done in a few cases, with the same technique as for colostomy. For the purpose of the study, the group of primary repair or resection with anastomosis ( $n=50$ ), series 1, was compared with the group of colostomy or exteriorization of the wound ( $n=52$ ), series 2.

Although retained in a lot of studies<sup>2</sup>, blood loss and degree of faecal contamination (high because of the significant delay) were not taken into account as absolute contraindications to primary repair or resection.

Table 1. Distribution of risk factors in the two series. All differences were statistically not significant ( $P > 0.05$ )

	Series 1	Series 2	Total
Age >45 years	4/50	4/52	8/102
Delay >6 h	31/50	41/52	72/102
Grade III-IV	16/50	25/52	41/102
Several foci	24/50	25/52	49/102
AL	38/50	45/52	83/102
>1 Localization	5/50	7/52	12/102

AL=Associated lesions

Table 2. Distribution of localization by treatment group.  $\chi^2$  Test of homogeneity  $P=0.020$

	Series 1	Series 2
Caecum	3	4
Ascending	10	3
Transverse	23	14
Descending	6	11
Sigmoid	3	13
2 Localizations	4	7
3 Localizations	1	0
Total	50	52

Peritoneal lavage with dilute povidone iodine in saline was systematically performed in all patients and peritoneal drainage. Unlike in some reports<sup>3</sup>, delayed closure of the laparotomy wound was not applied.

Dextrose 5% and Ringer's Lactate or blood compounds were used during resuscitation if the patient's condition warranted. Eighty-seven patients received a blood transfusion. Several antibiotic treatment schedules were used, most frequent was penicillin+metronidazole+gentamycine. The nasogastric tube was removed as transit reappeared, ie around the fourth postoperative day.

## Results

Mean age of the patients was 25 years (range: 1 to 69 years). Of these 74.3% were male. Eighty-three patients presented with an associated wound. On the 75 patients with intraperitoneal associated wounds, 54 (72%) presented with small intestine injury. The most frequent extraperitoneal associated wound was injury of the limbs.

The mean delay between injury and treatment in our series was 12 h (range: 1-100 h). In 30 (29.4%) cases laparotomy was performed within 6 h, in 62 (60.8%) cases between 7 and 24 h and in 10 (9.8%) cases only after 24 h. Sixty-one (59.8%) colon injuries were described by the surgeon as grade I-II (only punctiform) and 41 (40.2%) were grade III-IV (more extensive). Fifty-three cases (52.0%) had only one focus, whereas 49 cases (48.0%) had multiple foci.

The distribution of age, delay, gravity and associated extra- or intra-abdominal lesions in both groups is illustrated in Table 1. Table 2 shows an association between localization of the wound and the type of intervention. Most of the ascending and transverse colon wounds were cured by anastomosis or resection whereas colostomy or exteriorization of the wound has been practised more often for wounds of the descending colon or the sigmoid.

The overall CFR was 25.5%, whereas in the primary repair group, CFR was 20%, compared to 30.8% in the colostomy group. The difference was not significant ( $P=0.30$ ). Having more than one localization was the only statistically significant risk factor for CFR ( $RR$  3.3,  $P=0.002$ ). A stratified analysis of the outcome by the risk factors in each group is presented in Table 3. No significant confounding factor could be detected.

Postoperative complications occurred in 47 cases [(46%), see Table 4]. The proportion of all complications was significantly higher in the colostomy group than in the primary repair group, 60% versus 32%,  $P=0.005$ . Peritonitis occurred in 8% of the primary repair against 13% in the colostomy group ( $P=0.37$ ).

Two patients in the primary repair group, with peritonitis, had a second look intervention, which

Table 3. Case fatality rate (CFR) in each treatment group stratified by potential risk factor. All differences were statistically not significant ( $P > 0.05$ )

	CFR Series 1	CFR Series 2	CFR Series 1+2	RR	Crude RR	MHWRR
Delay					0.53	0.50
≤6 h	3/17 (18%)	4/13 (31%)	7/30 (23%)	0.57		
7-24 h	5/30 (17%)	11/32 (34%)	16/62 (26%)	0.48		
>24 h	0/1 (0%)	2/9 (22%)	2/10 (20%)	—		
Associated lesions					0.65	0.66
None	2/12 (17%)	2/7 (29%)	4/19 (21%)	0.58		
Extra and/or intra	8/39 (21%)	14/45 (31%)	22/83 (27%)	0.68		
Gravity of wound					0.72	0.76
Grade I-II	7/33 (21%)	8/28 (29%)	15/61 (25%)	0.74		
Grade III-IV	5/16 (31%)	10/25 (40%)	15/41 (37%)	0.78		
Focality					0.61	0.61
1 Focus	4/26 (17%)	6/27 (24%)	10/53 (20%)	0.69		
Several foci	6/24 (25%)	11/25 (42%)	17/49 (35%)	0.57		
Localization of wound					0.65	0.70
Right colon	0/13 (0%)	2/7 (29%)	2/20 (10%)	—		
Transverse colon	6/23 (26%)	3/14 (21%)	9/37 (24%)	1.22		
Left colon	2/9 (22%)	5/24 (21%)	7/33 (21%)	1.07		
>1 localization	2/5 (40%)	6/7 (86%)	8/12 (67%)	0.47		

RR=Relative risk; Crude RR=Crude relative risk; MHWRR=Mantel Haenzsel weighted relative risk

Table 4. Complications by treatment group.  $\chi^2=7.91$   $P<0.05$ ; relative risk for any complication (Series 2): 1.86,  $P<0.01$

	Series 1	Series 2	Total
None	34	21	55
Peritonitis	4	7	11
Wound infection	4	9	13
Others	8	15	23
Total	50	52	102

resulted in a repeated suture for one case and a colostomy for the other: both patients died. Thirteen cases had an abdominal wound infection: four (8%) in the primary repair and nine (17%) in the colostomy group ( $P=0.27$ ).

### Discussion

Compared to series from civil practice, overall mortality in our study is high<sup>1,2,4,5</sup>. This can be explained by the long patient delay (mean 12 h) and the precarious working conditions. Patients with more than one colon segment affected, had a statistically significant higher CFR.

Comparison of the two techniques revealed a lower death rate in the primary suture group than in the colostomy group (20% versus 30.8%), but this was not statistically significant. Complications were more frequent in the colostomy group. The immediate question arises whether this higher morbidity and mortality cannot be explained by the choice of this treatment in the more severe cases, with bad prognosis.

We considered the following risk factors: delay, associated intra- or extra-abdominal lesions, severity

of wound, focality, localization and the number of these localizations. Colostomy was more often performed in patients with a delay longer than 6 h, in grade III-IV lesions and with associated lesions ( $P>0.05$ ). A stratified analysis for each risk factor could not detect any significant confounding factor.

Another explanation might be that the more skilled and experienced surgeons chose primary repair.

### Conclusion

Our data show no significant difference between the CFR in primary repair and in colostomy of war colon injuries. Risk of bias in this retrospective survey is, however, too important to build any therapeutic recommendation on this series. Regarding the potential benefits to the patients of a primary repair, we will continue to study the technique in cases of colon trauma under the following conditions: delay < 24 h, only one colon segment affected, not more than two associated lesions, no severe shock and not in cases of rectum trauma or for reinterventions.

### References

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## Forthcoming events

### Opportunities, Problems, and Solutions of Working in Developing Countries

26 May 1994, London, UK

Further details from: Mrs M Adair, The Royal Society of Medicine, 1 Wimpole Street, London W1M 8AE, UK (Tel: 071-408 2119; Fax: 071-495 2814)

### MRCP Part II Course

6-10 June 1994, London, UK

Further details from: Dr D Geraint James, Royal Free Hospital, Pond Street, Hampstead, London NW3 2QG, UK (Tel: 071-794 0500 ext 391)

### British Association of Urological Surgeons (BAUS) Annual Meeting

28 June-1 July 1994, Birmingham, UK

Further details from: BAUS, 35-43 Lincoln's Inn Fields, London WC2A 3PN, UK (Tel: 071-405 1390; Fax: 071-404 5048)

### 5th Annual Training Course for Clinicians in Practical Nutritional Support

4-8 July 1994, Southampton, UK

Further details from: The Short Courses Administrator, The Department of Human Nutrition, University of Southampton, Bassett Crescent East, Southampton SO9 3TU, UK (Tel: 0703 594302; Fax: 0703 594013)

### Techniques & Applications of Molecular Biology: A Course for Medical Practitioners

18-21 July 1994, Coventry, UK

Further details from: Dr Veronica McGowan, Department of Biological Sciences, University of Warwick, Coventry CV4 7AL, UK (Tel: 0203 523540; Fax: 0203 523701)

### Scandinavian Perspectives in Regional Anaesthesia and Pain Control

25-27 August 1994, Stockholm, Sweden

Further details from: Mrs M Roe, Options Eurocongress SA, Rue du Cornet 36, 1040 Brussels, Belgium (Tel: 010 32 2230 5592; Fax: 010 32 2230 7406)

### 34th International Congress on the History of Medicine

4-8 September 1994, Glasgow, Scotland, UK

Further details from: International Society for the History of Medicine, c/o Meeting Makers, 50 George Street, Glasgow G1 1QE, Scotland, UK (Tel: 041-553 1930)

### The Use of Lasers in the Treatment of Cancer

28-30 September 1994, Dublin, Ireland

Further details from: Dr J Donegan, Local Organizer British Medical Laser Association, c/o Department of Pure & Applied Physics, Trinity College, University of Dublin, Dublin 2, Ireland (Fax: 010 353 1671 1759)

### Practical Cardiovascular Pathology

17-18 October 1994, London, UK

Further details from: Education & Conference Centre, National Heart & Lung Institute, Dovehouse Street, London SW3 6LY, UK (Tel: 071-351 8172; Fax: 071-376 3442)

### MRCP Part II Course

17-21 October 1994, London, UK

Further details from: (see entry for 6-10 June 1994)