

Damage Control Surgery Strategy Versus Diverting Intestinal Stoma In Critically Ill Patients With Acute Mesenteric Ischemia. Retrospective Analysis

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ABSTRACT

Background: the septic presentation of the patients with acute mesenteric ischemia makes the possibility of doing bowel anastomosis very risky. So damage control surgery protocol was adopted by many surgeons because its great role in managing critical trauma patients. Other surgeons prefer to make a diverting stoma to avoid reopening of the abdomen again and hence reducing complications.

Patients and methods: retrospective analysis of the data of 73 patients underwent abdominal exploration for acute bowel ischemia. 42 of them had a diverting stoma (group A) other 31 patients underwent damage control protocol (group B). Both groups were compared as regard intra and post-operative outcomes.

Results: Over all 73 patients, 49 (67.12 %) female and 24 (32.90%) male patients, the mean age 54.21 ± 7.86 . However the mean operative time was significantly longer in group A, post-operative complications like abdominal dehiscence, and total length of hospital stay was significantly higher in group B patients.

Conclusion: Creation of a diverting stoma after resection of gangrenous bowel is a good alternative to damage control surgery and avoid the complications of re exploration of the abdomen.

Keywords: Mesenteric ischemia, Stoma, Damage control.

INTRODUCTION

Acute mesenteric ischemia leading to intestinal gangrene is considered one of the devastating critical abdominal emergencies that is associated with high morbidities and mortalities. ⁽¹⁾ Although the great advance in diagnostic modalities especially contrast enhanced CT, early diagnosis of acute mesenteric ischemia is still difficult because of a typical and variable presenting symptoms. So, most of the patients usually present with irreversible bowel infarction and septic shock. ⁽²⁾

In critically ill patients presented with signs of peritonitis and suspicion of acute bowel ischemia or gangrene, urgent exploratory laparotomy is highly indicated to resect the gangrenous bowel segment and then either to re anastomose the residual bowel or making a temporary diverting intestinal stoma according to the general and local abdominal conditions. ^(3,4)

In 1993, Rotondo had introduced the concept of damage control surgery strategy based on three

levels : an effective quick first procedure ended with temporary Closure of the abdomen then resuscitation and improvement of the general conditions and definitive surgical management at last. ^(5,6)

The protocol of "Second-Look" Laparotomy in acute bowel ischemia was firstly described by Shaw in 1965 which consists of a planned re exploration 48 h after the initial surgery, aimed at assessing the residual intestinal viability. ⁽⁷⁾

Now it is assumptive that bowel re anastomosis shouldn't performed in patient who presented in septic shock or in those with extensive bowel ischemia and multiple questionable suspicious segments , So some surgeons adopt damage control strategy and planned second look after 48 hours as the critical condition of the patient doesn't allow performing any surgical maneuver in addition to the risk of development of definite gangrene in the suspicious bowel segments . ⁽⁸⁾

Other surgeons prefer to do a temporary diverting stoma after resection of the evident gangrenous

bowel as a simple and fast procedure and evade the necessity of reopening of the abdomen again. ^(9,10)

PATIENTS AND METHODS

This retrospective study was conducted in Mansoura university hospitals. Mansoura. Egypt and in Al Jahra Hospital, Al Jahra, Kuwait. From medical records we retrieved data of the Patients who were operated by abdominal exploration for acute mesenteric ischemia in the period between January 2017 to December 2019.

Patients who underwent resection of gangrenous bowel and primary anastomosis in the same setting were excluded. Also patients with total or extensive bowel ischemia were excluded.

We included in the study only those who presented in sepsis and underwent diverting intestinal stoma after ischemic bowel resection (Group A or Stoma group) and those who were planned for second look exploration after damage control surgery strategy (Group B or second look group).

Damage control strategy was described as (resection of evident ischemic bowel while leaving questionable segments, stapling of the ends of remaining segments, temporary abdominal closure and re exploration again after 48h for second look and re anastomosis of the bowel).

All perioperative data including patient's demographics, associated comorbidities, preoperative risk factors signs of peritonitis and septic shock upon presentation, ASA (American Society of Anesthesia) score evaluation, intraoperative findings, complications, and operative time were reported.

Re-exploration positive findings in the second group were documented Patients hospital stay and Post operative mortalities, morbidities or complications including (intestinal fistula, abdominal wall dehiscence, incisional hernia) were reported.

Also Local Stoma related complications were reported like stoma gangrene, retraction, infection and parastomal hernia.

Statistical analysis:

All collected data were analyzed using SPSS, version 26.0 (IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp.). Qualitative data were expressed using number and percent. Quantitative data were termed using median, mean and SD for parametric data after

testing normality. Significance of the collected results was considered if probability value less than 0.05.

RESULTS

Out of 97 patients were operated by midline exploration for acute mesenteric ischemia 73 patients were included in our study after exclusion of 22 (22.70%) patients who had underwent bowel resection and re anastomosis in the same setting and 2 (2.10%) patients with almost total bowel ischemia. 42 (57.53%) patients underwent diverting stoma after bowel resection were allocated in group (A), while 31 (42.47%) patients underwent damage control surgery and second look were enrolled in group (B).

As regard demographic data of the included cases as shown in table 1 (67.12 %) 49 patients were females whereas 24 patients (32.90%) were males, the mean age 54.21 ± 7.86 with no significant difference in both groups.

Almost the whole included patients had associated comorbidities, cardiovascular disorders (AF, MI, Valvular disease), portal hypertension chronic liver disease, DM and hypertension were the most common associated comorbidities.

Concerning preoperative evaluation 28 (38.36%) patients were categorized as ASA III, while 27(36.98%) patients ASA II and 18 (24.65%) patients ASA IV grade, there was no significant difference between both groups.

Intraoperative variables (table 2): The diverting stoma group patients had more prolonged operative time when compared with patients in damage control group (94 ± 11.71 vs 52.41 ± 8.16) that was statistically significant.

Neither the length of the resected intestinal segment nor its distance from the duodenojejunal junction have any significant difference in both groups. Also no intraoperative surgical complications were detected in both groups.

Arterial ischemia represented the main pathological findings in majority of the cases (72.60%) in both groups while arterial ischemia was suspected in (27.40 %)

Only one patient (3.22%) in (group B) showed positive findings of extended bowel gangrene and required re resection during the second look surgery after 48 hours.

Table (1): Patients preoperative and demographic data.

Variables	Group A n / % (42) patients	Group B n / % (31) patients	Test of significance P value
Age mean \pm SD	54.92 \pm 5.85	57.16 \pm 8.85	t = 1.01 P = 0.30
Sex			
Female	27 (64.28%)	22(70.96%)	P = 0.61
Male	15 (35.71%)	9 (29.03%)	$\chi^2 = 0.19$
Associated comorbidities:			
Cardiac disorders (AF, IHD, Valvular)	18 (42.85%)	14 (45.16%)	P = 1.0
Portal hypertension	15 (35.71%)	9 (29.03%)	P = 0.6
DM	11(26.19%)	8 (25.81%)	P = 1.0
Hypertension	8 (19.04%)	5 (16.13%)	P= 1.0
ASA scoring :			
ASA (II)	17 (40.47%)	10 (32.25%)	P= 0.36
ASA (III)	15 (35.71%)	13 (41.94%)	P= 0.51
ASA (IV)	10 (23.90%)	8 (25.80%)	P= 0.86

Table (2): Intraoperative variables.

Variables	Stoma Group n / % (42) patients	Damage control Group n / % (31) patients	Test of significance P value
Operative time / mins mean \pm SD	94 \pm 11.71	52.41 \pm 8.16	t = 11.07 P < 0.001*
Pathological Findings :			
Arterial Ischemia	30(71.43%)	23(74.19%)	$\chi^2=0.40$
Venous Ischemia	12 (28.57%)	8 (25.81 %)	p=0.5
Resected bowel length/ cms mean \pm SD	64.24 \pm 8.24	67.36	t = 0.3 p = 0.8
Distance from DJ / cms mean \pm SD	224.78 \pm 8.04	231.45 \pm 12.33	t = 0.8 p = 0.40
Second look progression of ischemia	(-)	1(3.23%)	

Post-operative outcome:

Evaluation of the post operative course and outcomes as shown in table 3 revealed that the over all mortality incidence in all patients was 17(23.29 %). 10 (23.81%) patients in group A and it was because of multiorgan failure versus 7 (22.58%) patients in group B because of irreversible septic shock and respiratory failure with statistically non significant difference.

Concerning Wound related complications wound infection was high in both groups with no significant difference (80.95% in Group A vs 87.09% in group B) while the incidence of Complete abdominal wall dehiscence was higher in the second look group (22.58%) while in stoma group (4.76%).

The mean length of hospital stay (days) in surgical ICU in group B was 3.67 \pm 0.92 that was higher than patients in A group 1.43 \pm 0.94.

Also the mean of hospital stay/Days in group A patients was significantly shorter than those in group B (9.71±2.27 versus 15.65±5.31).

Anastomotic leakage and peritonitis had occurred in 4 (12.90%) patients in the second look group that required re exploration again and diverting stoma was created.

Table (3): Post-operative evaluation variables.

Post operative variables	Stoma Group n / % (42) patients	Damage control Group n / % (31) patients	P value
	17 (23.29%)		
Post operative mortality	10(23.81%)	7(22.58%)	0.9
Wound related complications:			
Wound infection	34 (80.95%)	27(87.09%)	0.64
Wound dehiscence	2 (4.76%)	7 (22.58%)	0.02*
Need for Revisional surgery	1(2.38%)	4 (12.90%)	0.20
Stay in Surgical ICU	1.43±0.94	3.67±0.92	0.001*
Total length of hospital stay	9.71±2.27	15.65±5.31	0.001*

As shown in table 4, Stoma related complications in Group A were detected in 8 (19.04%) patients. Peristomal skin irritation was the commonest and detected in 5(11.90%), para stomal infection was found in 3(7.14%) cases, superficial mucocutaneous separation occurred in 2 (4.76%) patients and only 1(2.38%) patient developed gangrene through the entire wall of the stoma and required revisional surgery. No stoma retraction, bleeding from the stoma or parastomal herniation were detected in any patients.

Table (4): Local stoma complications in the stoma group.

Stoma complication in (group A)	n (%)
Over all complications	8 (19.04%)
Peristomal skin irritation	5 (11.90%)
Parastomal infection	3 (7.14%)
Superficial mucocutaneous separation	2 (7.76%)
Gangrene	1 (2.38%)

DISCUSSION

Because of its high mortality rate with acute mesenteric ischemia is one of the most critical abdominal emergencies that may require urgent planned intervention. Many factors contribute to these high mortalities that may reach up to 80%, time interval between the onset of the symptoms and surgical intervention, extent of the resected bowel segments and associated comorbidities. ^(11,12)

Surgical exploration either by laparotomy or laparoscopy is the treatment of choice once acute ischemia is suspected and subsequent resection of evident gangrenous bowel to eliminate the source of sepsis with subsequent start of anticoagulant drugs to limit the extension of ischemia. ⁽¹³⁾

Usually the intraoperative decision for different treatment options in acute bowel ischemia is

challenging and put surgeons in a great dilemma because of the delayed presentation with signs of sepsis and the associated comorbidities that raise the risk of complications. ⁽¹⁴⁾

To resect the gangrenous bowel and then proceed for intestinal anastomosis however the risk of new ischemic attack and anastomotic failure or to bring the residual healthy bowel out of the skin as a stoma to skip the patient critical condition and reduce the necessity of emergent re exploration. ⁽¹⁵⁾

Although patients under went bowel anastomosis in the same setting have a better quality of life than those with diverting stoma, but still carries a very high risk of anastomotic failure and peritonitis especially in septic conditions that increase the incidence of mortality. ⁽¹⁴⁾

Rotondo et al. in 1993 had introduced the concept of damage control surgery in penetrating abdominal

trauma and it gains wide popularity in management of critically ill patients because of severe traumatic injuries. Then this concept had extended to involve non-traumatic abdominal emergencies like acute mesenteric ischemia, perforated viscus peritonitis, and acute pancreatitis, and many studies showed promising results.^(16,17)

In the current study, we retrospectively analyzed the data of 73 patients operated for acute bowel ischemia aiming to compare the early outcomes of diverting stoma technique (group A / 42 patients) and Damage control surgery strategy in (group B / 31 patients).

No significant difference between both groups concerning patients' demographic characteristics, the predominant sex was female and the mean age of the patients was nearly 55 years.

Cardiological disorders represent the commonest associated comorbidities. **Hansraj et al.**⁽¹⁸⁾ and **Koungias et al.**⁽¹⁹⁾ also reported mean age of 63 and 65.

Many studies also reported predominant female sex and cardiological disorders as a common associated comorbidity.^(20,21)

Arterial ischemia was found more prevalent (72.60%) than venous ischemia (27.40%) in our study in both groups which goes with the global incidence in the whole world. **Debus et al.**⁽²²⁾ reported mesenteric ischemia of arterial origin about 90% and of venous origin 10% or less also **Babodilla**⁽²³⁾ also found that mesenteric ischemia in 50% because of arterial embolism, in 20% arterial thrombosis, in 20% nonocclusive arterial ischemia and 10% of venous origin.

Increased incidence of venous ischemia in our current study may be attributed to increased incidence of portal hypertension among our patients.

Patients underwent diverting stoma had experienced an increased mean operative time (94 mins) when compared with those in damage control group (52 mins) and it was statistically significant ($P < 0.001$) and this difference can be explained by times consumed for stoma creation and definitive closure of abdominal fascia while in damage control group temporary abdominal (skin) closure was done. **Girard et al.**⁽²⁴⁾ revealed median operative time for damage control patients about 55 mins. This statistical difference will not be of great importance

because the damage control patients were reoperated again for a second look after 48 hours.

The overall incidence of post-operative mortality in both groups was not statistically significant (23.29%), and when compared with other studies it was relatively low, it was (22.58%) in stoma patients versus (23.80%) in damage control group. **Hansraj et al.**⁽¹⁸⁾ reported 39% mortalities in those exposed to second look surgery without re-resection **Kaminsky et al.**⁽²⁰⁾ showed 35% mortalities in those not requiring second look.

Our decreased mortality rate because we excluded the patients who underwent bowel anastomosis at the first surgery and hence decreasing the rate of anastomosis failure that induces fatal peritonitis also patients with extensive gangrene affecting most of the bowel were excluded.

Post-operative morbidities evaluation revealed high incidence in wound-related complications in both groups, wound infection was detected in (83.56%) with no significant difference in both groups. While burst abdomen or dehiscence took a higher incidence in damage control group with statistically significant difference between both groups (22.58% vs 4.76%) and this may be because leaving the bowel closed for 48 hours and abdominal sheath retraction that makes definitive closure after the second look difficult, also the incidence of peritonitis due to anastomotic dehiscence in 4 (12.90%) patients and reopening the abdomen twice increase the risk of abdominal wall dehiscence.

Goussous et al.⁽²⁵⁾ reported that successful fascial closure usually achieved in the first exploration and the possibility of delayed fascial closure is closely related to the preceding indications for open abdomen or temporary abdominal closure.

Girard et al.⁽²⁴⁾ also showed that however the great role of damage control surgery in reducing mortalities in traumatized patients, the application of damage control strategy in non-traumatic abdominal emergencies especially in patients with peritonitis is associated with high mortality and morbidities rate.

In current study, patients underwent diverting stoma in group A had mean length of hospital stay (9.7 days) and ICU stay (1.43) shorter than those in damage control group (15.65) and (3.67) with statistically significant difference ($p < 0.001$).

Girard et al. ⁽²⁴⁾ in a study evaluating usefulness of damage control strategy in acute mesenteric ischemia showed median duration of ICU stay 4 days and 15 days for total length of hospital stay.

Local stoma related complications in group A managed by conservative measures except one case (2.38%) of stoma gangrene required surgical intervention for refashioning while 4 (12.90 %) patients in group B required re exploration because of anastomotic dehiscence.

CONCLUSION

The usual critical presentation of the patients with acute mesenteric ischemia makes intraoperative decision crucial and affecting the early and late surgical outcomes.

Bowel re anastomosis in critically ill patients with acute mesenteric ischemia usually carries high risk of leakage and peritonitis.

Although damage control surgery strategy had made a dramatic improvement in surgical outcomes of traumatized patients, its application in non-trauma abdominal emergencies is still questionable.

Creation of diverting stoma after resection of gangrenous bowel seems to be a safe and feasible alternative for damage control protocol without increasing morbidities and mortalities.

RECOMMENDATIONS

We recommend more prospective randomized studies comparing the both techniques in critically ill patient with acute mesenteric ischemia.

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