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COLORECTAL INJURIES

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INTRODUCTION

Colorectal injuries have always presented a challenge and some degree of confusion. The challenge is to control the high incidence of septic complications and mortality by the correct surgical decision. The confusion is because of the recent trend, which is directed away from colostomy, which was considered mandatory in the past.

Unlike the small intestine, colorectal anastomosis is fraught with the danger of anastomotic breakdown and leak. This is because of the following reasons:

1. Anatomical Factors

A. A large portion of the colon is bereft of peritoneal covering. Peritoneal mesothelium has a useful property of rapid growth, which seals of the anastomotic suture-line within few hours in intra-peritoneal viscera.

B. The longitudinal layer takes the form of taenia coli, allowing the colon to distend, but makes the wall thin and thus suture-line cannot withstand high pressure and is susceptible to leakage.

C. Small intestine which performs the majority of absorptive function, is naturally more vascular than the colon.

2. Physiological factors

Unlike the small bowel, where intraluminal pressure rise is gradual due to the gentle peristaltic wave; the intraluminal pressure rise is sudden in the large bowel due to mass movement.

3. Contents

As one goes from the right to the left colon, contents become more solid with increase in the chance of breakdown of suture-line.

4. Huge bacterial load

During the American Civil War, the mortality of colonic trauma was nearly 100%. At the time of the First World War, primary repair was practised for all the types of colonic injuries and it had a mortality of 60 %. With the popularisation of colostomy which was introduced by Ogilvie , the mortality came down to 37 % at the time of the Second World War. With rapid evacuation of victims and better supportive care, mortality dropped down further to 12% during Korean and Viet Nam conflicts.¹ Today in civilian practice it ranges from 3-5 %.^[1,2,3]

Although the practice of colostomy dramatically reduced the mortality in colonic injuries, attention has now been drawn to the morbidity associated with the colostomy. It delays return to work and colostomy closure has its own complications- wound infections, faecal fistulae, anastomotic breakdown and post-operative hernia.^[4,5,6] Thal et al have presented a morbidity rate of 17.3% with 8% infections, 2.7% anastomotic leaks including fistula and 0.2% mortality in 486 patients (cumulative data of 5 series).^[1]

There have been numerous reports of successful management of colonic injuries with primary

repair without the colostomy.[\[7-12\]](#) Thus has emerged the recent trend away from colostomy.

Incidence

In our hospital about 8% of patients with abdominal trauma have colorectal injury. Various series report the incidence between 5-10%. Age and sex incidence follows the usual pattern of trauma i.e. predominantly affects men (85%) in the third and the fourth decades of life.

Aetiology

In about 70 % of cases, colonic injury is the result of penetrating trauma. In civilian practice in India, it is mainly due to stab wounds with sharp-edged weapons (Table 1). But in the USA, as also in terrorism affected areas in India firearm injuries are common.

TABLE 1	
Aetiology	
Blunt	26 (28.9%)
Penetrating	64 (71.1%)
Stabs :	50
GSW :	07
Iatrogenic :	03
Miscellaneous	04
Source : L.T.M.G. Hospital Trauma Service (Data of 3 years- 1997-99)	

Blunt injuries result either due to sudden increase in intra-abdominal pressure which leads to a burst injury to the bowel or due to the torn mesentery causing devitalisation of the bowel. Rectal injuries are often associated with complex fractures of the pelvis. Most anorectal injuries are a result of blunt trauma, unlike colonic injuries where the majority are the result of penetrating trauma (Table 2).

TABLE 2			
Site of injury and mechanism			
Site	Blunt	Penetrating	Total
Colon	14	56	70
Rectum- Anal Canal	12	8	20
	26	64	90

Iatrogenic injuries are seen during endoscopic evaluation.[\[13\]](#) Inflamed bowel can easily get perforated with thermometers, enema catheters[\[14\],\[15\]](#) etc. Surgery on the organs in the nearby vicinity can cause injuries e.g. rectal injury during radical prostatectomy, colonic injury during percutaneous stone removal, nephrectomy, ureteral catheter placement etc.[\[16\]](#) Injury to the sigmoid colon during uterine curettage particularly for termination of pregnancy is one of the common iatrogenic causes.

Rectum is also a common site for weird foreign bodies.[\[17\]](#) Picket fence, jack handle, broken bottles and glasses, brooms, spoon, stick etc. Air insufflation¹⁸ and negative suction[\[19\]](#) are other unusual modes of rectal injury. Fist blow injuries have also been reported. [\[20\]](#)

Diagnosis

Diagnosis of colonic injuries is essentially reached on laparotomy.

In cases with penetrating injury, wound of entry is often suggestive. Wounds on back and gluteal region are deceptive and need proper evaluation. Digital rectal examination, proctoscopy and cystography have been recommended in all patients with penetrating wounds of the buttock. [\[21\]](#) Low velocity weapons injure the structure which come in the path of the weapon; whereas high

velocity weapons also damage the structures in the vicinity due to the pressure wave and the cavitation effect. Hence all patients with gun-shot wounds (high velocity wounds) need thorough exploration of abdomen. Those with stab wounds need immediate laparotomy if in shock, with evisceration or peritonitis. Otherwise stab wounds (low velocity injury) should be managed selectively. Local wound exploration for the evidence of peritoneal penetration and judicious use of other investigations like US, DPL, contrast enhanced CT scan and laparoscopy (through the tract) can help in decision making.

Clear evidence of abdominal injury may not always be present in all patients with blunt abdominal trauma.[22] Abdominal injury should be suspected in all patients with bruises and abrasions on the abdominal wall or tenderness, guarding or rigidity of the abdomen. Intra-abdominal injury should also be considered in all patients with unexplained hypotension, altered consciousness, fractures of lower ribs, pelvis or lumbar spine and those undergoing prolonged surgical management under anaesthesia for other injuries. Clinical examination, plain X ray for pneumoperitoneum, bedside ultrasound, paracentesis and diagnostic peritoneal lavage help in deciding about the immediate laparotomy.

Per rectal examination must be carried out in all patients with fracture pelvis or perineal injury. Blood staining of gloves is suggestive of rectal injury.

Factors affecting outcome

Sepsis is the main cause of morbidity and mortality following colorectal injury. Multiple factors have been found to be associated with and thought to be contributing to the post-operative complications.[23] They are :

1.*Shock* : Shock state leads to diversion of blood from the gastrointestinal tract, so obviously increases the incidence of anastomotic breakdown.

2.*Extent of faecal contamination* : One of the most important factors which influences the management decision, but is subjective. George has categorised it into three :

Mild : Localised

Moderate : Localised to one quadrant

Severe : Generalised

3.*Associated injuries* : Number and complexity of associated injury has effect on the outcome. More than two associated injuries are associated with higher septic complications and mortality.

4.*Delay in repair* : With delay, there is increase in faecal contamination and blood loss and hence complications. The risk significantly increases when the delay exceeds 6-8 hours.

5.*Age* : Patients over 40 have increased risk of mortality.

6. Patients requiring more than 4 transfusions tend to have more complications.

7.*Type of injury* : Blunt injuries have a much higher mortality as the incidence of associated organ injury is high, the injury is extensive with devitalisation and the diagnosis is delayed.

Thus blunt injuries are generally not suitable for primary repair. Most penetrating wounds in our practice are stabs, are clean cut and are diagnosed and treated early; hence are suitable for primary repair. But many recent papers report that mechanism of injury per say is not a risk factor.

8.*Colon injury severity* : Extent of colon injury is another factor which influences management decision.[3] Penetrating abdominal trauma index (P.A.T.I.) [24] has been found to be the most important indicator of the outcome in penetrating abdominal trauma.[11] Colon injury severity score (C.I.S.S.) categorises injury severity into five grades :

1. Serosal tear

2. Single wall injury
3. Injury involving < 25% of the circumference
4. Injury involving > 25% of the circumference
5. Injury involving blood supply.

9. *Anatomic location* : Right colon has been considered more suitable for primary closure due to liquid contents and less bacterial load. But recent papers show no significant difference in the outcome.

Flint has summarised these factors in three grades of the Flint score.[\[25\]](#)

1. Isolated injury, minimal contamination, no shock, minimal delay
2. Through and through perforation, lacerations with moderate contamination
3. Severe tissue loss, devascularisation with gross contamination

Score 1 has the least morbidity and is most suitable for primary repair without diversion.

Tables 3 and 4 depict our data about the risk factors and mortality and morbidity in our series. There was no death due to colon injury itself. Two thirds of the deaths were due to associated injury, while others were due to sepsis. Wound infection occurred in 25% of patients. Delayed repair was associated with infective complications in 80% of cases. 69% of patients in our series had only mild contamination and were thus suitable for primary repair.

TABLE 3		
Factors affecting outcome		
Risk Factor		Mortality
Mode of injury	Blunt	15%
	Penetrating	3%
Shock	BP < 90 mmHg	30%
	BP > 90 mmHg	nil
Associated injuries	>2	22%
	<2	2.78%
Delay in repair	< 6 hours	Nil (Infective complications 80%)

Management of colonic injuries

It has been recognised that colostomy is not required for all patients. The safety and practicality of primary repair of colon perforations in good risk patients are well established. Controversy continues in management of patients with more extensive injuries. In general three treatment options have been described for the management of colorectal injuries:

TABLE 4		
Mortality and Morbidity of colorectal injury		
Mortality :	6 of 90 (6.67%)	
Causes of death :	Associated injuries :	4
	Chest infection:	2
Morbidity :	Wound infection	22 (24.4%)
	Leak	5
	Chest infection	5

	Obstruction	3
	Ileus	2

1. Primary intraperitoneal repair (without diversion)
2. Exteriorisation repair
3. Colostomy

Primary intraperitoneal repair

Stone and Fabian after a well controlled prospective, randomized study have summarized the following factors as contraindications to the primary closure.[\[26\]](#)

Contra-indications to primary repair:

- 1.Shock
- 2.Delay > 6 hours
- 3.Gross faecal contamination
- 4.Haemoperitoneum > 1000 ml
- 5.Associated intra-abdominal organ injury > 2
- 6.Colonic injury requiring resection
- 7.Loss of abdominal wall

Primary closure should be done when these risk factors are absent. Most stab injuries of the colon are suitable for primary repair as they are clean-cut and such patients often undergo surgery without delay. Blunt injuries of the colon not only have contused edges, but are often operated late as the diagnosis is delayed. Right colonic injuries can be safely treated by suturing or resection (right hemicolectomy).[\[2\]](#)

Primary repair should not be done in an unstable patient or in the presence of inflammation, oedema due to peritonitis or when the bowel viability is doubtful. It is also contraindicated in the presence of urinary tract injury; as primary repair in such cases without proximal diversion often leads to fistula formation.

The technique includes simple suturing of the perforation or the resection of the involved bowel and anastomosis.

Primary intraperitoneal repair of colon has been reported to be effective both in blunt as well as penetrating trauma.[\[27\]](#),[\[28\]](#) Many recent reports describe aggressive primary repair without diversion using intra-operative colonic washouts[\[29\]](#) and the use of intracolonic bypass tube.[\[30\]](#),[\[31\]](#)

Out of 90 cases in past three years, 51(56.7%) were primarily closed. Leak was noted in 5 cases - treated conservatively in 2 and by diversion in 3. Twenty of 22 (91%) of right colonic injuries were treated by primary repair, whereas 58% of transverse and left colon and only 15% of anorectal injuries were treated by primary repair(Table 5).

Exteriorisation repair [\[32\]](#),[\[33\]](#)

It should be employed when factors other than local tissue injury itself prohibit primary repair. [\[34\]](#) Systemic risk factor may be present, but local factors are favourable i.e. clean cut wound, no oedema, good vascularity, minimal contamination. In such cases, primary repair is done and the

colonic loop is brought out for observation. It is returned to the abdomen if the suture-line heals. Otherwise it is converted to a colostomy. Thompson and Moore found that 75% of anastomotic breakdown occurred before the seventh post-operative day and virtually all occurred within nine days.^[34] Hence delaying the return to the abdomen until the tenth post-operative day has been recommended. Anastomotic breakdown is more likely in tangential wounds and gun shot wounds where the local tissue injury is likely to be more extensive than what is apparent.^[34]

The recommended technique involves suture repair of the colon, wide mobilisation of the colon to avoid retraction, obstruction or tension on sutureline, creation of an adequate opening in the abdominal wall to prevent obstruction and exteriorisation of the loop. The loop is kept moist and is observed. Petroleum jelly gauze and saline soaks have been found satisfactory. If it heals well, it is returned to the abdomen; otherwise it is converted to a colostomy. Overall it is successful in about 50% of patients. Conversion to colostomy is required in remaining 50% (in 40% due to giving way of sutures and in 10% due to intestinal obstruction).^[2]

Out of 6 exteriorisation repairs done by us in the past 3 years, four were safely returned to the abdomen; while ^[2] broke down and were converted to colostomy.

Colostomy

Colostomy is the most important factor responsible for reducing mortality in patients with colorectal injuries. It is the life saving measure and is a safe decision if in doubt. Morbidity of colostomy closure can be minimised with proper precautions. Some recent figures of morbidity and mortality associated with colostomy appear exaggerated and should not deter the surgeon from avoiding colostomy when needed.^{[35], [36]} Out of 90 cases treated in last 3 years, in 33(36.6%) of cases colostomy was done initially, whereas in three more cases with primary repair, it had to be done later for the anastomotic leak (Table 5).

Colostomy is definitely indicated in presence of extensive injury, significant contamination, or multiple distal injuries involving the left colon or the rectum.

When one decides to do a colostomy, a defunctioning colostomy must be performed. When the wound is on the transverse or the sigmoid colon, the loop can be brought out and the wound itself can be converted into a colostomy. In other high risk patients, the wound is closed primarily with a proximal colostomy. A loop colostomy performed properly i.e. with adequate mobilisation of the colon and fixation to the abdominal musculature, is the diversion of choice; because it is easy and safe to close later. Other options are a double barrel colostomy, end colostomy with a mucus fistula or a Hartmann type of procedure. But the aim is to completely divert the faecal stream from the distal sutureline. This is never achieved by a hesitant attempt at faecal diversion by performing a tube colostomy or a caecostomy and these should not be done.

Technique : The loop to be brought out must be adequately mobilised. Omentum must be separated carefully. While looping the colon, injury to the marginal artery must be avoided as it may be the only source of supply to the distal colon in some cases. Site of colostomy must be chosen according to the injury site. Right transverse colon and sigmoid colon are the commonest colostomies.

Adequate incision must be taken so that the loop does not get obstructed or strangulated. The colon must be properly fixed to the muscle layer to avoid retraction later. The stoma must be matured (opened) right on table to achieve the objective of faecal diversion.

TABLE 5				
Site of injury and management				
Site	No of Cases	Primary repair	Exteriorisation	Colostomy
Right colon	22	20	0	2 (ileostomy)
Transverse colon	24	14	4	6
Left colon	24	14	2	8

Rectum-Anal canal	20	3	0	17
	90	51	6	33

Management of rectal injury

Rectum is well protected in the pelvis. Yet it can be injured in penetrating abdominal injuries, iatrogenic injuries or injuries due to foreign bodies.

Roche has classified rectal wounds into 4 types according to the site of damage and presence of sphincter damage.[\[37\]](#)

1. Intraperitoneal perforation without sphincter damage
2. Intraperitoneal perforation with sphincter damage
3. Extraperitoneal perforation without sphincter damage
4. Extraperitoneal perforation with sphincter damage

Blunt injuries are associated with pelvic fracture. In blunt rectal injuries, genitourinary injury is often associated and haemorrhage control is of primary concern. Due to solid contents, bacterial load and high intraluminal pressures, primary closure is not recommended. Diversion, debridement and drainage of the presacral space are advised. Bilateral internal iliac arterial ligation can be done for haemorrhage control.[\[38\]](#)

Although diversion is the mainstay of management of rectal injuries, primary repair can be done successfully in selected cases.[\[39\]](#) Out of 20 cases with anorectal injury in last 3 years, three were closed primarily (Table 5). Two were clean cut rectal wounds (one iatrogenic injury, one stab wound) and one anal injury was repaired like the primary closure of an anal fistula.

Management of Sphincter injury

When sphincter injury is associated, meticulous approximation and avoidance of infection by diversion are recommended. Delayed repair has poor results.[\[40\]](#) Sphincter injuries from blunt trauma are a result of crush injury of the pelvis and have a very high mortality.

Management of Colonoscopic Perforations[\[41\]](#)

Colonoscopic perforations have been reported in upto 1% of diagnostic colonoscopies and about 3% of therapeutic colonoscopies. They result either due to mechanical trauma from the endoscope, or barotrauma of insufflation or injury during a therapeutic procedure (cautery, biopsy etc.). It might be recognised on table or diagnosis may be delayed when patient develops pain in the post-operative period.

Some cases remain silent and are asymptomatic. Others develop signs of peritonitis. As bowel is always prepared well for colonoscopy, spillage is minimal if perforation is small. Surgical intervention is necessary only for large perforations recognised during procedure or those who develop signs of generalised peritonitis or septicaemia.

Colostomy closure

Optimal timing for the repair of the colostomy is from six weeks to three months of the initial operation.[\[42\]](#) If done earlier than 4 weeks, the risk of anastomotic breakdown is high due to oedema and inflammation and collagenase activity at the site and after three months the stoma gets firmly adherent to the site due to fibrosis.

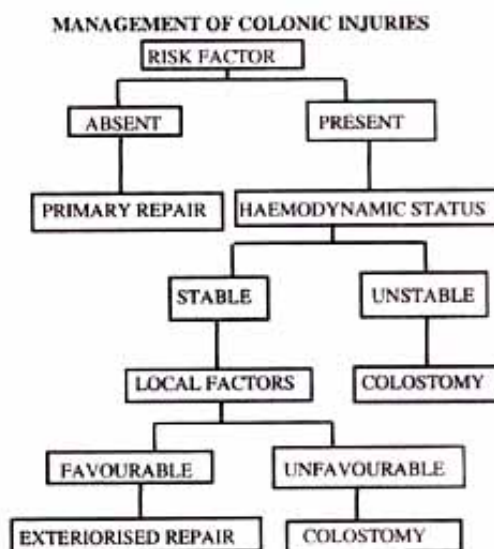
It is usual practice to perform Barium enema prior to colostomy closure - to confirm the healing of sutureline. But its routine use has been questioned. It is said to just add to the delay and expense of surgery.[\[43\]](#) It is useful in patients with fistulae to define anatomy and in those with rectal injury, as

for most rectal injuries proximal diversion is done without primary suturing of the rectal wound. [44]

Extraperitoneal closure of colostomy used to be practised in the past, with the hope to contain the leak outside the peritoneal cavity, should there be anastomotic break-down. Intraperitoneal closure allows proper identification of tissues and proper two layered closure under vision. Closure of loop colostomy is not only technically simple, but also has been found to have less morbidity than resection and anastomosis. Reversal of Hartmann procedure is technically difficult due to extensive local adhesions and hence Hartmann type of procedure should be avoided as far as possible.

CONCLUSION

A large number of colorectal injuries can be managed without proximal diversion. Primary repair is safe in selected patients - those without high risk factors. A quick colostomy is life saving in unstable patients. In stable patients, when colonic wound is clean and edges are not inflamed, but when the presence of risk factors precludes primary closure, exteriorisation repair can be tried as a safe middle path, in an attempt to avoid colostomy. (Fig.1)



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