REVIEW OF LITERATURE
Historically the mandate that colostomy is the only proper treatment for colonic injuries may be traced to a 1943 United States Army communication. This study was reinforced by studies generated near the end of World War II. Most important of these studies was by Colivic 1944, who reported from England in a review of the experiences of Surgeons in the Western desert during the North African campaign. Mandatory colostomy was considered to be the only treatment for the colonic injuries. This recommendation included bruises of the colon, possible injuries to the posterior portions of the colon i.e. the retroperitoneal areas.

The United States army also moved to solidify the place of colostomy as the only proper means to treat a colonic injury. Ma Son Jr in 1945 reviewed methods by which colonic injuries could be exteriorised. He dismissed the question of how to treat colon injuries by stating that "colon wounds among battle casualties.

... The statement is usually dismissed with the dictum: "Exteriorise all colon wounds."

This attitude remained through both the Korean & Vietnem conflicts. No dissenting voices were heard from these two arenas. The previous techniques were followed with no further studies emerging from the military experience. The introduction of antibiotics and development of rapid evacuation system
during the Vietnam conflict were not explored with respect to their impact on colonic injuries. Military surgeons continued to practice the methods established 25 years previously. Civilian trauma experience finally called into question the necessity of colostomy in the management of all colonic injuries. During World War I, primary closure of the colon resulted in a 60% mortality. During World War II the routine use of exteriorization drastically reduced the mortality of colonic wounds. The continued use of exteriorization and the improvements in methods of triage and transportation, surgical intervention and widespread use of antibiotics further reduced the mortality of colon wounds to 15% during Korean war and to 12% during Vietnam conflict.

Woodhall & Oschner in 1951 suggested primary repair or resection of perforating colon injuries. Thompson & Others reported that in the subsequent decade sufficient experience had been accumulated to suggest that certain colon injuries can be safely managed in such a manner thus avoiding colostomy. The high morbidity rate associated with colostomy closure as well as patient inconvenience, make avoidance of colostomy desirable. The problem then was to indentify those patients who might safely be managed by primary repair. Criteria of primary repair which were agreed upon were:

1- An interval of less than six hours since injury.
2- A small clean wound with little surrounding tissue damage,
3- minimal fecal contamination,
4- fewer than two associated injuries,
5- Absence of shock and
6- An otherwise stable patient.

It was suggested that primary repair and resection should be restricted to the right colon or at least be applied to the left colon only under more strict conditions.

It is not clear however that right colon injuries behave more favourably than those of the left colon. The argument that right colon injuries behave more favourably than left colon injuries has been based theoretically on the known anatomic and physiological difference between the right and left colon. The right colon functions physiologically to absorb and dehydrate the small intestinal effluent while the left colon is primarily for storage. Thus the right colon contents are liquid and the left colon contents are more solid. The wall of the right colon is thinner than that of left and lumen larger. There appears to be a higher concentration of bacteria in the left colon than in the right colon.

Hunt et al in 1970 postulated that healing of anastomosis is related to collagen content and
demonstrated increased collagenase activity in the left colon as compared to the right which may lead to a collagen deficit at the anastomotic site. The fate of exteriorized anastomoses however does not appear to be influenced by colonic location (Kirkpatric JR 1977). Such evidence may be misleading because a larger number of anastomotic dehiscences can be identified that do not become clinically detectable sequelae of anastomotic disruption. The morbidity and mortality rates of elective colon resection on prepared bowel are similar in the right and left colon.

Schrock et al 1972 found no significant difference in anastomotic leakage with ileocolic, colocolic and left colo-colic anastomoses under elective circumstances and this has been confirmed by others (Redburg SE, 1963). Irvin JJ & Geioghur (1973) also found that proximal decompression didn't diminish anastomotic complications. Thus under elective conditions there appears to be no significant advantage of proximal decompression.

During surgery for trauma on the unprepared colon, fecal contamination may be an important factor in anastomotic healing. The degree of fecal contamination and its significance are difficult to assess however, because intraperitoneal haemorrhage is often present and the use of systemic antibiotics and lavage of the peritoneal cavity are often employed.
Further more Notolo et al 1976 found in the experimental models that anastomotic leakage was not influenced by the presence of even massive fecal contamination.

Garrison et al 1979 found that ileostomy did not decrease the mortality rate of right colon injuries. Thus, the significance of fecal contamination is not clear. A higher rate of anastomotic complications has been found in emergency left colon resections (Schrock TR et al 1962) but other have found the morbidity and mortality rates of right and left colon emergency resections to be similar.

Hartzel et al 1974 found the morbidity and mortality rates of right and left colon resection for penetrating injuries to be similar with similar operative management.

Multherin & Sawyers (1975) reported that primary repair of left colon injury was associated with fewer anastomotic leaks than right colon injuries, although primary repair was used more liberally in the right colon.

Primary closure was not advocated on large scale until 1970 when Beall & associates reported a series of primary repairs of the colon with results comparable to colostomy. This technique had the advantages of obviating secondary and tertiary procedures.
In contrast Schrock & Christensen in 1972 reviewed their experiences with primary closure with exteriorization of sutured perforation at San Francisco General Hospital. Only 4 of 19 exteriorized suture lines healed and 15 (79%) required conversion to loop colostomy. Eleven required colostomy because of leakage and 4 required colostomy because the exteriorized loop obstructed the colon. These untoward consequences of trauma can be reduced by careful assessment and individualized therapy for each patient.

Several clinical features were found to be correlated with poor results after treatment of trauma to the colon. These included the age of patient, the type of wounding agent, haematoma adjacent to perforation and undue delay from the time of injury to that of operation. Also associated injuries, shock and fecal contamination reflected over-all trauma as well as local conditions in the colon and had a correlation with morbidity and mortality.

Garfinkel SE et al in 1974 studied a series of 94 civilian colonic injuries, modes of treatment were variable ranging from double-barreled colostomy to primary repair with or without exteriorization. The data from the series do not support the dogmatic approach of "colostomy only" as the only acceptable method of management of colonic injuries. Primary repair with or without exteriorization in selected cases reduces morbidity, length of hospitalization and the necessity of secondary operations. In these ninety-four patients studied during
studied during seven-years period the ages ranged from 6 to 78 years. Complications related to primary procedures occurred in 29% cases. The incidence in primary closure group was 25.5% as compared to 32% in patients treated with colostomies. In addition for those patients having colostomies there was a further complication rate of 22% associated with closure of colostomy including colocutaneous fistula, bowel obstruction, wound infection and colonic bleeding. Mortality associated with the management was 13% out of these 4% occurred in primary closure group and 21% in the colostomy group.

John R. Kirk Patrick in 1977 studied injuries of the colon and indicated that the surgeon should remember that primary closure is a safe and reliable method of management when careful patients selection is employed and the closure with exteriorization of the injured colon is a valuable adjunct that will significantly decrease the colostomy rate. However injuries of the sigmoid colon continues to require proximal colostomy, closure of the intestinal injury and wide pelvic drainage. Meticulous attention to the associated organ injuries is essential and the surgeon must be aware that the management of these associated injuries largely determines the survival.

Flint et al in 1978 reviewed missile tract infections and indicated that these septic complications may be a major contributor to the intra abdominal
infections seen in relation to penetrating trauma. If the infections are cause of some of the complications seen then colostomy formations could not be expected to prevent them.

_Stone & Fabian in 1979_ carried out a prospective randomised non-blind study with 268 patients. Considerations of primary closure demanded that pre-operative shock was never profound, blood loss was less than 20\% of the estimated normal volume, no more than two intra-abdominal organ systems were injured, fecal contamination was minimal, surgery was begun within 8 hours of injury and the wounds of the colon were technically amenable to closure. Comparison of these patients meeting these criteria and having a primary closure and those treated by more traditional means showed no statistical difference.

_Sister Mary Ann Lou et al in 1991_ reported on exteriorised repair in the management of colon injuries also known as primary repair and exteriorization of the injured colonic segment. In 66\% patients the colonic wounds successfully healed and the exteriorized loop returned into the peritoneal cavity within 14 days. In 34\% cases faecal leakage developed at the repair site and the exteriorised loop were converted into colostomies without sepsis. There was no mortality and a low complication rate (18\%). They concluded that exteriorized
repair is extremely safe, as it obviates the morbidity of mandatory colostomy yet avoids the risks of primary repair alone.


GRADE I. Isolated injury, minimal contamination, no shock, minimal delay, Occurrence 16%.

GRADE II. Through and through perforation, laceration, moderate contamination, Occurrence 74%.

GRADE III. Secure tissue loss, devascularization, heavy contamination, Occurrence 10%. They advocated management as:

Grade I - Single layer primary closure.

Grade II and III by colostomy or exteriorization.

Chen V Beng et al in 1991 reported about management of trauma of colon. 82 colonic injury cases were reviewed to determine the indications for primary repair or colostomy and to assess the feasibility of early drop-back of exteriorized repaired colon.

They graded injuries into three stages:

Stage 1: Good risk
Stage 2: Moderate risk
Stage 3: Bad risk

They indicated that primary repair is good for stage I injuries.
the injury involved left colon and in remaining 42 the right colon. Death due to the colonic injury occurred in 1.5% and the incidence of abdominal complications was 17.9%. Patients treated by primary repair of the colon had less colon related complications and a shorter hospital stay than the patients treated with colostomy. Left and right colon injuries treated by primary repair had similar complications rate and hospital stay.

Rodgeway CA et al in 1999 found in their studies that colostomy was not mandated by anatomic location or number of colonic injuries, circumference of colonic wall involved, presence of fecal contamination, or involvement of blood supply. This study indicated that primary repair does not carry increased risk of septic complications and saves the patient risk and increased stay of colostomy closure.