

## **Laparotomy For Abdominal Injuries; Role Of Clinical Assessment In The Evaluation Of An Injured Abdomen**

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### **SUMMARY**

A series of 30 patients undergoing laparotomy for abdominal injuries at Bir Hospital is reported. Road traffic accident accounted for 50% of the injuries, and rare cases of goring by bullock still being seen. 70% of the cases were blunt abdominal injuries.

There were 2 deaths (6.6%), both being due to diagnostic delay and delayed surgical intervention. The diagnostic delay was due to multiple injuries and craniocerebral trauma obscuring the signs of abdominal injuries. Abdominal evaluation of the patient was limited to a thorough and repeated clinical examination. Radiological evidence of free intraperitoneal air, as a guide to intestinal perforation, was unreliable as it gave high rate of false negative results. Retroperitoneal haematoma was a baffling problem, where even the diagnostic peritoneal lavage would not have reduced negative explorations. With a negative laparotomy of 16.9% and mortality of 6.6% it is advocated that exploration is safer than delayed treatment. It is also stressed that clinical awareness is more important than any diagnostic aid.

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## INTRODUCTION

Management of abdominal injuries taxes the judgement and skill of a surgical team. While the indications for surgery in penetrating abdominal injuries, is most of the times, evident; it is the closed abdominal injuries that poses the greatest diagnostic problem. Delay in surgery progressively decreases the chance of recovery of a patient with an internal bleed or a hollow viscus perforation. The main problem for the clinician in the diagnosis of blunt abdominal injury is to make a decision as to laparotomy in the presence of minimal abdominal symptoms or signs. Ancillary investigations may be of little help. Aortography and selective coeliac arteriography, isotope scanning and ultrasonography are a few recent development in this field but in the acute cases these procedures are of less use and should not delay laparotomy which is therapeutic as well as diagnostic. The four quadrant tap or the diagnostic peritoneal lavage have their advocates. The recovery of heavily blood-tinged fluid or fluid containing bile or bowel contents is clearly a positive finding of value, but many are less happy about the interpretation of negative tap; does this exclude a serious upper abdominal injury? (Lord Smith 1978). Thus the value of a careful clinical assessment of the patient cannot be over emphasized. In doubtful cases it is worth performing a few negative explorations than to wait for the clear-cut indications for surgery by which time it may be too late to salvage the patient.

In this paper we report a series of 30 patients who underwent surgery for abdominal injuries. The fallacies of various diagnostic aids have been discussed and the role of clinical assessment in the evaluation of an injured abdomen is stressed.

## CLINICAL MATERIAL

### Patients

A total of 30 patients underwent laparotomy for abdominal injuries at Bir Hospital, Kathmandu, during a period of 2½ years from July 1979 to January 1982. Of these patients, 26 were males and 4 females, male: female sex ratio of 6.5:1. The mean age was 23 years  $\pm$  11.8 years. The age distribution is shown in Fig. 1.

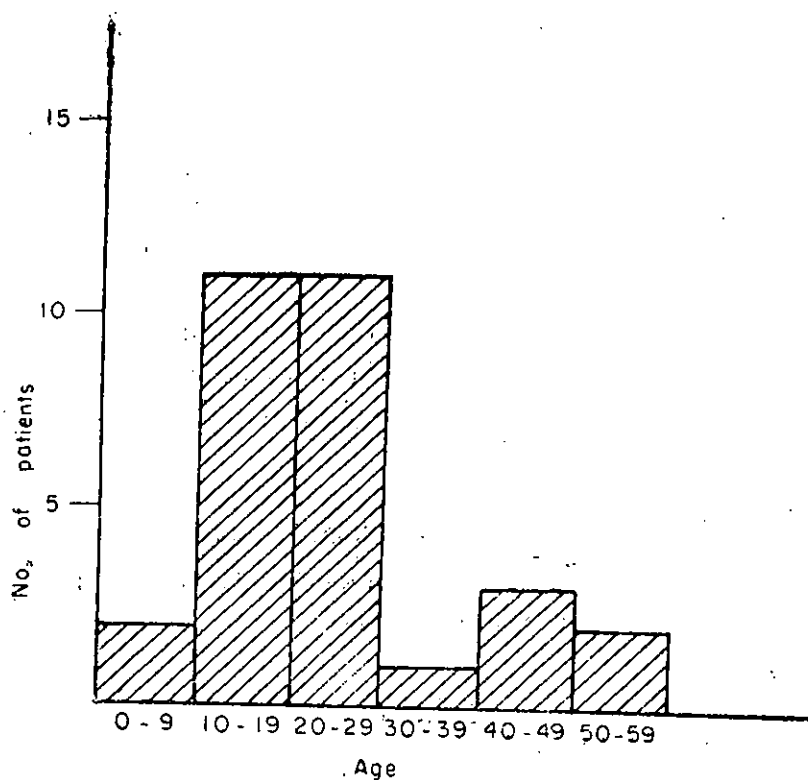


Fig 1 - Age incidence of the present series

#### Diggnosis

A detailed history about the nature of the injury and a thorough clinical examination was done in all the patients. A careful search was made to find out any associated injury of the head, chest and the limbs, and the priority of treatment determined in their presence. Three patients with pneumothorax had tube thoracostomy and under water-seal drain put before surgery for abdominal injury was considered.

Routine haematological investigation (Total and Differential W. B. C. Count, Haematocrit) and plain Skiagram of the abdomen in erect position was done in all the patients with blunt injuries and in most of the patients with penetrating injuries. Skiagram of other parts of the body was also done in patients with multiple injuries. A four quadrant tap with false negative result was found in tow patients, hence the procedure was abandoned. The diagnostic peritoneal lavage was not done in any case. Gastrograin meal X-Ray was done in

one case to confirm the presence of diaphragmatic tear and intrathoracic herniation of the bowel.

All cases of bullet injuries were explored. Surgical exploration was considered in other penetrating abdominal injuries when there was evisceration of the bowel, evidence of peritoneal tear or internal injury. In closed injuries laparotomy was embarked upon when there was evidence of internal haemorrhage or peritoneal irritation.

Resuscitation was attempted in all the cases before undertaking surgery. Except in a case of splenic rupture where the patient did not show signs of improvement in spite of a massive transfusion, haemodynamic stabilization of the patient was clearly a priority.

## RESULTS

The causes of injury is shown in Table I. Traffic accident accounts for 50% of the cases. Most of the cases of fall were brought from rural areas of the country. Of the missile injuries, one was suicidal and one accidental in a child.

TABLE I  
CAUSES OF INJURY

	No. of cases.
Traffic Accident	15
Fall	6
Missile	4
Stab	3
Gored by a bullock	1
Injury by a falling object	1
Total	30

The type of injury is listed in Table II. 70% of the cases were closed abdominal injuries. Table III shows the frequency of viscera involved. Small intestinal perforation or laceration is the commonest (18.7%) followed by splenic rupture (15.6%) and liver injury (12.5%).

**TABLE II**  
**TYPES OF INJURIES**

I. Closed	-	21
II. Penetrating	-	9
a) Stab	-	3
b) Gun shot	-	4
c) Goring	-	1
d) Pierced by sharp wooden piece	-	1

**TABLE III**  
**VISCERA INVOLVED**

	No. of cases	Percentage
Small intestine	6	18.7
Spleen	5	15.9
Liver	4	12.5
Large intestine	2	6.2
Evisceration of ileum	2	6.2
Stomach	1	3.1
Diaphragm	1	3.1
Mesentery	1	3.1
Kidney	1	3.1
Pancreas	1	3.1
Intraperitoneal bleeding	4	12.5
i. Source not found	1	
ii. Superlor epigastric artery bleeding (Stab wound)	1	
iii. Leak from retroperitoneal haematoma (with fracture pelvis)	2	
Retroperitoneal haematoma alone	4	12.5
<b>Total</b>	<b>32</b>	

Note : One patient had a splenic rupture, lacerated pancreatic tail and injured left kidney.

Table IV shows the associated injuries that complicated the picture. 8 patients (26.7%) had associated injuries. Significant cranio-cerebral trauma was encountered in 4 patients (13.3%). Severe chest injury with pneumothorax requiring tube thoracostomy and water-seal drain was seen in 3 patients. Except one patient, who had pneumothorax, fracture pelvis with central dislocation of the hip and extensive retroperitoneal haematoma with significant intraperitoneal leak, rest of the patients with chest injury had associated upper abdominal injury.

TABLE IV  
ASSOCIATED INJURIES

1. Head injuries	-	4
2. Chest injury with pneumothorax	-	3
3. Multiple long bone fractures	-	1
4. Fracture Pelvis	-	2

Table V shows the type of surgical procedure carried out. Six cases of small intestinal laceration or perforation were repaired. Primary closure without a proximal colostomy was done in a case of bullet injury of the transverse colon. Right hemicolectomy was done for a case of perforating injury of the hepatic flexure. A case of mesenteric tear of over 5 cm length necessitated resection and anastomosis of the ileum. Haemostasis could be achieved in all liver injuries either by simple suturing or by suturing over gel foam. The tear of the left dome of the diaphragm was repaired with nonabsorbable suture material through a thoracic approach.

TABLE V  
OPERATION PERFORMED

1. Splenectomy	-	5
2. Repair of intestinal perforation	-	7
Small intestine	-	6
Large intestine	-	1
3. Resection and anastomosis of ileum	-	1
4. Right hemicolectomy	-	1
5. Suturing of the injured liver	-	
Stab	-	
Bullet	-	

Laceration (RTA)		2	
6. Repair of diaphragmatic tear	-		1
7. Repair of lacerated stomach	-		1
8. Cleaning of the eviscerated bowel and repair of the abdominal wall	-		2
9. Suturing of kidney laceration over gel foam	-		1
10. Cleaning of the intraperitoneal haematoma	-		4
(Bleeding Superior epigastric artery ligation	-	1)	
11. Retroperitoneal haematoma	-		4
Negative exploration	-	5 cases	(16.6 %)

#### Negative Laparotomy

An operation was considered to be a 'Negative Laparotomy' where no visceral lesion required repair, or if the peritoneal cavity contained less than 250 ml. of blood without evidence of continuing haemorrhage. A retroperitoneal haematoma that was neither expanding, nor pulsating was also considered a negative laparotomy. The 4 retroperitoneal haematomas and a small intraperitoneal haematoma with unidentified source were considered negative explorations. Thus 5 cases (16.6 %) of negative laparotomy was performed in this series.

#### Mortality

There were 2 deaths in the present series, a mortality of 6.6%. Both of these patients were transferred to this hospital 48 hours after the injury. One of the patients was a lady with multiple long bone fractures, head injury and splenic rupture. The splenic rupture had been missed by those attending the patient earlier until the patient arrived to this hospital in a state of profound shock. Splenectomy was done after attempting enthusiastic resuscitative measures. The patient died of acute renal shut-down on the third post-operative day, as a result of prolonged shock. The other was a diabetic patient with bullet injury of the chest and liver, attempt at removal of the bullet through a thoracoabdominal approach failed. The patient succumbed to acute renal failure.

#### DISCUSSION

Khatry and Gongal (1975) have reported 27 cases of laparotomies for abdominal injuries in Bir Hospital over a period of 15 years. The present series of 30 cases in 2½ years period clearly shows the rising incidence of abdominal trauma

in this country. This may be part of an overall rise in the incidence of trauma contributed largely by road traffic accident (50%). The sex ratio and age incidence in this series are similar to those of Bolton et al, two-thirds of the patients being in their second or third decade.

Mandatory laparotomy has been the accepted practice for penetrating abdominal wounds for many years. With careful observation and selective surgery. Thavendran et al (1978) have been able to report a negative laparotomy of only 10.0% in their series. Though we had a smaller sample, negative exploration was not encountered in any penetrating injuries.

Blunt abdominal trauma is a difficult problem to diagnose. Apart from the clinical criteria of internal haemorrhage and evidence of peritoneal irritation we could not put much reliance on other diagnostic aids. Though the accuracy of needle aspiration by the method of four quadrant tap has been reported as 80% (Matsuemoto et al 1978) we had false negative results in both the cases we tried. The overall accuracy of a diagnostic peritoneal lavage is reported as 97% (William Gill et al 1975) and the advocates of this procedure have gone to the extent of relying almost entirely on it. William Gill et al (1975) in their series of 299 patients with positive lavage result that underwent exploratory laparotomy have found 89% to have significant intra-abdominal trauma requiring a surgical procedure, 8% with trauma requiring no surgical procedure and 3% without any abnormality. These authors believe that retroperitoneal haematomas almost always stain the lavage fluid even though covered by intact peritoneum. Olsen and Hildreth (1971) also share the same idea that trauma to the retroperitoneal space can never be excluded with certainty by abdominal lavage. As it has already been mentioned, retroperitoneal haematoma has been a baffling problem in our experience, constituting 4 out of 5 negative laparotomies in the present series. Retroperitoneal haematoma can present with features of either hypovolaemia or of hollow viscus injury such as progressively increasing distension and diminishing bowel sound. Thus we believe that none of these diagnostic aids could have helped us reduce the incidence of negative exploration in our series. We are not discouraged by a negative laparotomy rate of 16.6% which is comparable to results published from abroad (Table VI).



**TABLE VI**  
**NEGATIVE LAPAROTOMY RATE COMPARED**

Authors	Percentage
Michael et al (1974)	17
William Gill et al (1975) (Guided by peritoneal lavage)	11
Johnston et al (1976)	14
Present Series (1982)	16.6

Plain skiagram of the abdomen in erect posture to see gas under the right dome of the diaphragm in hollow viscus perforation, is a common practice. In the present series, such skiagram failed to show free intraperitoneal air in both the cases of small intestinal rupture due to blunt trauma. Michael et al (1974) have reported 100% false negative and Evans (1973), 66% false negative X-ray results in their cases of traumatic small intestinal rupture. Hence, routine X-ray film is of no value even in the diagnosis of hollow viscus perforation.

#### MORTALITY RATE COMPARED

Authors	Mortality
Bolton et al (1973)	14%
Michael et al (1974)	6%
Present series (1982)	6.6%

The overall mortality of 6.6% is comparable to 6% of Michael et al and 14% of Bolton et al. As pointed out earlier, one of the fatal cases in our series had the diagnosis made very late and in both cases the surgical intervention was considerably delayed. Williams and Zollinger (1959) had long recognised diagnostic delay as a major factor responsible for increased mortality in blunt abdominal trauma. Sometimes extra abdominal injury, specially craniocerebral trauma, may obscure the signs of peritoneal irritation and causes considerable delay in diagnosis if the clinician is not aware of it. If a patient with head injury has signs of hypovolemia one should always look for evidence of chest and abdominal injury, because head injury alone can never cause shock (Walt, 1969). Mortality rate rises with combined injuries of the abdomen, head and chest. 2

#### Liver Injury

##### Case report:

M. Y. a 19 year old male was seen in the casualty on 16/2/81, ten hours after a traffic accident outside the city. He was in a state of severe shock with an unrecordable blood pressure, rapid thready pulse and extreme pallor. The abdomen was distended with generalised tenderness and guarding, maximal over the right hypochondrium.

drium. Immediate transfusion with 3 units of blood, plasma volume expanders and crystalloids was initiated. Laparotomy 2 hours later revealed 2 1/2 litres of blood in the peritoneal cavity with active bleeding from an extensive deep stellate laceration on the superolateral surface of the right lobe of the liver. The laparotomy incision was extended into the right chest through the eighth intercostal space. Division of the right dome of the diaphragm gave direct access to the injury. There was catastrophic fall of blood pressure after laparotomy. It was managed by rapid transfusion of additional two units of blood and temporary packing of the wound. Loose pieces of the liver tissue was removed and haemostasis was achieved by suturing over gel foam. The wound was drained with a corrugated drain. The diaphragm was repaired with nonabsorbable suture material and the chest was closed after putting an under water-seal drain. At the end of the operation the patient had a stable blood pressure of 120/80mm of Hg. and pulse rate of 100/min. The patient made a steady postoperative progress. Fluoroscopy on the 10th post-operative day showed evidence of subphrenic collection. Needle aspiration revealed it to be bile stained fluid with liver cell debris. Repeated needle aspiration was done on five occasions and a total of 1500 c.c. of the fluid was aspirated. The collection eventually stopped and the patient was back to his work one month after the accident.

This case represents an exsanguinating intra abdominal haemorrhage due to liver injury. It is well known in such injuries that relief of abdominal tamponade first by anaesthetic agents and then by the actual laparotomy can be followed by a torrential haemorrhage 11. Hence adequate precaution should be taken to manage this catastrophe. Various methods have been practised to control bleeding from an injured liver. The packing of the wound except for temporary control of bleeding intraoperatively or during transport to a major centre has been largely abandoned 3. If suturing of the wound fails to achieve haemostasis, lobar dearterialization 5 or hepatic lobectomy 21 have to be considered. The overall mortality for closed liver injury is about 30% (Faris I. B. et al 1973). Little and Williams (1969) with a strict regimen of resuscitation, early laparotomy, definitive haemostasis, resection of devitalized tissue, and bile duct decompression were able to reduce the mortality rate in closed liver injuries from 48% to 19%.

The accepted method of treatment for traumatic rupture of the spleen is Splenectomy. To avoid the problem of overwhelming sepsis after splenectomy in children, conservative treatment such as repair of the ruptured spleen have been tried by some. In the present series splenectomy was done in all the cases.

Out of the two colonic injury, right hemicolectomy was done for a case of hepatic flexure injury, and primary closure without a proximal colostomy was done for a case of bullet injury of the transverse colon. Kirkpatrick et al (1975) have suggested such primary closure of a solitary injury of the proximal colon if gross peritoneal contamination is absent.

In all cases of kidney injury intravenous pyelography should be done at the earliest opportunity to establish the presence and general state of the contralateral kidney. In addition it gives some indication of the extent of the renal injury and the size of the renal haematoma. If the information from the intravenous pyelogram is unsatisfactory a retrograde pyelogram or better a renal angiogram may be performed. In one case of multiple abdominal organ injury we have encountered a case of renal hilum laceration without involvement of the major vessels. The vast majority of closed renal trauma can be treated successfully conservatively. The role of surgery in the management of closed renal trauma is debatable and while there is no argument about the necessity for intervention in the patient whose condition is deteriorating from internal bleeding, the argument for immediate surgical intervention on the basis of the angiographic studies with the idea of preventing long term complications such as abscess formation, renal atrophy, hydronephrosis, hypertension, calculi and cyst formation is not well supported by many authors (Smith J. M. et al 1977). Cass and Ireland (1974) reported a nephrectomy rate three times greater in those kidneys which were explored than in those treated conservatively. Hence, the consensus in the surgical management of renal trauma is to try to conserve the kidney or part of it, if possible.

In our series we have encountered only one case of laceration of the pancreatic tail, associated with splenic rupture and kidney injury. The damaged tail of pancreas was removed with the spleen and drainage provided, with good results. This is all what is required in such an injury: but a major injury of the pancreas with extensive parenchymal disruption and injury to the pancreatic duct requires either distal pancreatectomy or a complicated T-tube drainage through the lumen of the stomach (Smith Rodney 1978). If a patient with shattered head of the pancreas with rupture of the duodenum is to survive, a formidable procedure like pancreatoduodenectomy has to be undertaken (George H H Eysel-Moore, 1976).

We had a single case of rupture of the left dome of the diaphragm due to blunt trauma. The diagnosis being suggested clinically by absence of respiratory sounds and presence of gurgling sound in the affected hemithorax and confirmed by chest X-ray and Gastrographin meal X-ray. Traumatic rupture of the diaphragm is 12 times commoner in the left side because of diminished buffering effect on the undersurface (Orville F. Grimes, 1974). All diaphragmatic ruptures require early surgical repair as they are unlikely to heal spontaneously. Moreover, the herniated viscera may be strangulated after a latent period. Though, thoracic approach gives excellent access to the injury an abdominal approach is advisable if intra-abdominal injury can not be definitely excluded (Bayer JV et al. 1978).

## CONCLUSION

The incidence of traffic accident is rising and the complicated nature of multiple injuries that it causes does not often spare the abdomen too. Management of blunt abdominal injury is always a serious responsibility, requiring sound judgement and detailed and frequently repeated assessments. Complete reliance on the diagnostic aids may at times cause serious error in their diagnosis and management. Reduction in the mortality rate of blunt abdominal trauma is possible through prompt resuscitation, early diagnosis, using repeated and thorough clinical assessment of the abdominal signs coupled with a willingness to resort to laparotomy. An occasional negative laparotomy is preferable to the dangers of an unrecognised visceral injury.

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## REFERENCE

1. Bayer J. V., Begarty M. M., Howe C. Rubin D. and Angron I. B, (1979); Traumatic Diaphragmatic Hernia Br. J. Surg. Vol. 65, 69-73.
2. Boltan P. M., Wood C. B., Quartery-Papafio J. B., and Blumgart L. H. (1973); Blunt abdominal injury: A review of 59 consecutive cases undergoing surgery. Br. J. Surg. Vol. 60, 657-662.
3. Calne R. Y, Mc Master P. and Pentlow B. D, (1979): The treatment of major liver trauma by primary packing with transfer of the patient for definitive treatment. Br. J. Surg. Vol. 66, 338-339.
4. Cass A. S., and Ireland G. W. (1973); Cited by Smaith J. M. and Dermoto Flynn J.
5. Changit Tanphiphat (1976); Lobar dearterialization in liver trauma, Br. J. Surg. Vol. 63, 213-215.
6. Dudley H. A. F. (1972); Syndroms of Abdominal Trauma, Hamilton Bailey's Emergency Surgery 9th Ed., Bristol, John Wright and Sons Ltd.
7. Evans J. P. (1973); Traumatic Rupture of Ileum, Br. J. Surg. Vol. 60, 119-121.
8. Faris I. B. and Dudley H. A. F. (1973); Closed Liver Injury: An assessment of prognostic factors, Br. J. Surg. Vol. 60, 227-229.

9. George H. Heyse-Moore (1976), Blunt Pancreatic and Pancreaticoduodenal trauma, Br. J. Surg, Vol. 63, 226-228.
10. Hussein B. M. S. (1973); Diaphragmatic rupture due to blunt trauma, Br. J. Surg. 429-433.
11. Johnston G. W. and Kennedy T. L. (1976), Limb and abdominal injuries: Principles of treatment, Br. J. Surg, Vol. 63, 738-741.
12. John R. Kirkpatrick and Swarn G. Rajpal (1975); The injured colon: Therapeutic considerations, Am. J. Surg, 129, 187-191.
13. Khatry T. B., and Gongal D. N. (1975); Incidence of acute abdominal diseases in the cases operated as 'Emergency' in Bir Hospital. J. N. M. A.
14. Lihle J. M. and Williams C. W. (1969); Improved mortality in the management of liver injuries, Br. J. Surg, Vol. 56, 603-609.
15. Matsumoto T. and Suflan S. (1978), Diagnosis and Management of Abdominal Trauma, Intentional Surgery, vol. 63. No. 6
16. Michael C. Sinclair, Thomas C. Moore, Morris J. Asch, and Stanley A. Brosman (1974); Injuries to hollow abdominal viscera from blunt trauma in children and adolescents, Am. J. Surg, 128, 693-98
17. Olsen W. R. and Hildreth D. H. (1971); Cited by William Gill et al.
18. Orville F. Grimes (1974); Traumatic injuries of the diaphragm, Am. J. Surg, 175-181.
19. Roger I. Dent and George P. Iena (1980); Missile injuries of the abdomen in Zimbabwe-Rhodesia, Br. J. Surg, Vol. 67, 305-310.
20. Sandrasagra F. A. (1977); Penetrating Thoracoabdominal Injuries, Br. J. Surg, Vol. 64, 630-640.
21. Smith I. B. (1969), Right Hemihepatectomy for severe blunt injury, Br. J. Surg, Vol. 56, 226-229.
22. Smith J. M. and Dermot C. Flynn J. (1977), Closed renal trauma, Br. J. Surg, Vol. 64, 753-755.
23. Smith Lord (1978); Injuries of the liver biliary tree and pancreas, Br. J. Surg, Vol. 65, 673-677.

24. Thavendra A, Vijayaraghavan A, and Rudra Rasaretnam (1975), Selective surgery for abdominal stab wounds, Br. J. Surg, Vol. 62, 750-752
25. Walt A. J (1969) The surgical management of hepatic trauma and its complications. Ann. R. coll. Surg. Engl. 45, 319-339.
26. William Gill, Howard R. Champion, William B. Long, Joseph Jamais and R. Adams Cowley (1975), Abdominal lavage in blunt trauma. Br. J. Surg, 62, 121-124.
27. William R. D. and Zollinger, R. M. (1959), Cited by Bolton P. M. et al.