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3. HISTORICAL REVIEW

Injury to the Abdomen and pelvis has always been considered as one of the most critical injuries inflicted upon the body. The historical documentation of abdomino-pelvic trauma is probably as old as history itself.

Physicians were referred to by the Ionian Greeks as "In Ipos" meaning an "Extractors of arrows" (Loria, 1948). Xenophon in his Anabasis speaks of a Greek army captain who returned to his camp literally holding his bowels in his hands after an eviscerating wound of the abdomen. From the Homeric epics, we learn of the death of Polydorus at the hands of Achilles whose weapon on entering the back of the victim protruded out in front thereby leaving the boy "bending with his bowels clasped in his hands". Eurymachus succumbed to the effects of a liver wound which was inflicted by an arrow from powerful bow of Odysseus.Hippocrates (460-355 BC) recognized the high incidence of mortality ensuing from intra-abdominal and intra-pelvic injuries, and postulated that `A severe wound of the bladder, small intestine, stomach, and the liver is deadly' (Adams 1886). Several of the twenty three stab wounds inflicted on the person of Julius Caesar were situated in the abdomen (Buchan, 1932). In the famous old Indian books of Medicine, Charaka and Susruta described the management of holes in the intestine. Bishop (1960) quotes Susruta about the management of perforating injuries of the abdomen wherein he says that in a case of protrusion of the intestines, they should be carefully examined and washed with milk; lubricated with clarified butter (ghee), and gently reintroduced back into the abdomen. Any perforations or tears, when identified, should be closed by applying black ants. Suicidal injuries covered another aspect of penetrating abdomino-pelvic injuries. The self disembowelment of the Japanese known as 'Hara-kiri', is a vestige of old feudal Japan which has gone down in records as the `Natural Form of Suicide'. After the preliminaries in the ritual, the suicide plunges a dragger into the left side of the abdomen, below the costal margin, draws it slowly across the right, and finally turns it up giving a sharp upward bend.

Although murder by stabbing was chiefly superseded by poisoning during the Dark Ages, sharp weapons like dragger, arrow, spear, lance, and sword continued to be responsible for causing many fatal wounds of the abdomen. In those ancient days, with almost a total lack of mechanized industries and modes of transport, cases of non-penetrating trauma to the abdomen and pelvis were rare. The dragger continued to serve as the principal weapon of assassination especially in the European Countries till Schwartz in 1354 heralded the era of gunpowder firearms. With further modifications of these weapons, came the pistol in 1500 and was improved upon into the revolver in the 17th century. With these came on record cases of gunshot injuries of the abdomen and pelvis.

With increased mechanization of life, abdomino-pelvic injuries have more taken a different turn. Penetrating injuries can now be caused by accidental impaction of pointed objects attached to machines or other structures. Blunt injuries following fall from heights such as scaffoldings of buildings under construction or following run over under wheels of heavy vehicles have become commoner. Firearm injuries take the biggest toll in warfare. The advent of rockets, and guided missiles have brought further risks in their wake. Davis et al have mentioned a case of through and through penetration of the abdominal cavity by a rocket which back fired and hit its designer in his belly.

It is thus seen that the mode of sustaining abdominal and pelvic injuries have undergone a change over the course of history.

REVIEW OF LITERATURE

STUDIES

A number of studies have been done on various aspects of abdominal and pelvic trauma. Few of these studies have been reviewed in present series.

J.S. Wilson (1946) reported findings of delayed rupture of subcapsular haematoma and stated that delayed rupture of spleen occurs days or weeks after injury to the abdomen.

C.R. Crawshaw (1952) reported herniation of the stomach, transverse colon and portion of jejunum into the pericardium following intrapericardial rupture of diaphragm.

A.R. Moritz (1954) described spontaneous rupture of normal spleen occurring in cases where extreme passive congestion is due to sudden torsion of the pedicle of an abnormally mobile spleen.

Allen and Curry (1957) reported that majority of the non-penetrating injuries (70%) were due to automobile accidents. For other categories of blunt trauma, their statistics are as follows; falls (8.3%), brawls (5.7%), industrial accidents (7.9%), footballers (1.3%) and children at play (3.9%). They found that liver was the most commonly injured organ following penetrating injuries of the abdomen.

R.S. Sparkman (1958) stated that pregnancy predisposed to splenic rupture, and its frequency in pregnancy is second only to that in malaria.

R.D. Williams and R.M. Zollinger (1959) found that cases of female and children victims of abdominal trauma are rare as compared to young males in the age group of 20-30 years.

D. Elonomy et al (1960) found forty percent injuries to spleen in vehicle occupants and 38.3% injuries to spleen in pedestrians following vehicular accidents. They reported incidence of splenic injuries by blows and kicks to the abdomen as 10%, fall against an object as 6.6%, and fall from height as 5% of cases.

J.F. Dickson and H.R. Hornberger (1961) found that penetrating wounds of the lower thorax often involve the diaphragm and upper abdominal viscera and exploration of abdomen is necessary in firearm wounds of lower chest area.

O.S. Lung and K.V.D.Cammack (1961) reported that 76% of non-penetrating abdominal injuries were due to automobile accidents. They noted that 70.4% injuries to spleen in vehicular occupants and 5.6% in pedestrians, following vehicular accidents. Spleen injuries were found in 9.25% cases

of falls and 3.7% cases of blows and kicks. They reported less incidence of splenic injuries following penetrating wounds of abdomen, viz., firearm wounds (7%) and stab wounds (1.4%).

R.A. Griswold and H.S. Collier (1961) found that spleen is most frequently involved in non-penetrating injuries of abdomen(26.20%), followed by kidney (24.2%) and intestines (16.2%).

I. Leonard (1962) reviewed 196 cases of penetrating abdominal injuries and found knife to be the most common agent for these injuries (66.45%), followed by bullet (21.29%). Small intestines was the most frequently injured (30.32%) in such cases followed by liver (27.09%).

J.P. McCarroll (1962) reported 42% incidence of abdominal and 46% incidence of pelvic injuries among pedestrians in vehicular accidents. The contributory factors for this pattern of injuries were bad weather, infirmity, poor lighting and crossing roads at points other than a marked safety zone, elderly persons with defective vision or hearing and adults under influence of alcohol. After pedestrians, next in frequency of fatal casualties of accidents were drivers of vehicle, front seat passengers and lastly rear seat passengers.

L. Persky and W.E. Forsythe (1962) found that children with pre-existing renal diseases, viz., hydronephrosis, Wilms' tumor, etc. are more prone to renal trauma.

E.F. Nation and B.D. Massey (1963) divided injuries to the kidney as (a) open-due to penetrating trauma and (b) closed-due to non-penetrating trauma. Closed type injuries accounted for 90% of the renal trauma.

Solhem Kaare (1963) found high incidence of abdominal and pelvic injuries among pedestrians and passengers in vehicular accidents. Majority of cases of abdominal trauma were seen in young males in the age group of 20-30 years.

A.L. Shirkey et al (1964) found delayed rupture of spleen occurring as late as six months after the subcapsular haematoma.

D.D. Killen (1964) reported that on rare occasions, a large branch of the superior mesenteric artery may be lacerated with resultant profuse bleeding between the leaves of the small bowel following vehicular accidents.

P.W. Braunstein (1964) stated that massive retro-peritoneal haematoma may occur in pelvic fractures in traffic victims following rupture of the major vessels by bone fragments, but in many instances, it progresses gradually over a period of hours.

I.M. Thompson, E.L. Johnson and G. Ross (1965) found that diseased bladder, viz., neurogenic bladder dysfunction, tuberculosis, bladder tumor, etc., are more prone to rupture with lesser degree of trauma.

L.F. Peltier (1965) reviewed 186 cases of pelvic fractures and found that majority of them were due to automobile accidents and only 4% of cases showed separation with fracture of pubic symphysis.

L.I. Epstein and R.E. Lempke (1965) found rupture of diaphragm in 4.5% cases of multiple injuries. Increased incidence of injury and herniation of left diaphragm was noted following blunt abdominal trauma.

Taylor (1965) reported that the right lobe of liver is five times more prone to injury than the left lobe in traffic accident victims. He found that diseased gall bladder with impacted stone in the cystic duct is more prone to rupture following vehicular accidents.

E.T. Mays (1966) described bursting injuries of the liver following blunt abdominal trauma, mainly due to automobile accidents. These injuries manifested in the form of stellate or linear crevasses. Bursting injuries of liver were also found to be caused by low velocity missile.

J.T. Adams, E.A. Elebute and S.J. Schwartz (1966) reported injury to pancreas in children mainly by contre-coup forces, e.g., injury as a result of handle bar of a bicycle.

L.C. Carey and L.W. Worman (1966) stated that excessive bleeding occurs along the track of penetrating wounds within liver associated with massive disruption of the involved lobe.

L.S. Spingate and L. Adelson (1966) found that diseased conditions, viz., malaria, leishmania, kala-azar, leukemia, etc. and pregnancy state increases the susceptibility of the spleen to trauma.

M.J.V. Smith, R.F. Seidel and A.F. Bonacarti (1966) described that children under fifteen years of age are more prone to renal trauma due to larger size of the kidney in relation to body size and underdeveloped perirenal fat in the Gerota's fascia.

E. Netterville Rush and James D. Hardy (1967) reported dominance of firearms over knives in causing penetrating abdominal injuries. Majority of abdominal injuries were seen in young males in the age group of 20-30 years. Female and children were the rare victims in their study of 155 cases.

G.D. Lundberg, C.J. Davis and D.E. Nelson (1967) reported that laceration of mucosa of stomach followed by haematemesis occurred often after closed cardiac massage.

J.E. Pridgen and A.F. Heriff (1967) reviewed 776 cases of penetrating abdominal wounds and found colonic injuries in 15.33%, gall bladder rupture in 2.9% and mesenteric injuries in 3.47% of cases. Vascular injuries, involving aorta were present in 0.5% and iliac vein in 0.64% cases. The other injuries include- 2.57% bladder injuries, 4.12% pancreatic injuries, 13.14% stomach injuries, 22.8% liver injuries and 21.26% small bowel injuries.

J.H. Foster and J.J. Chandlier (1967) found extensive infarction of liver in those people who survive for some time after liver injuries.

G.F. Asbury (1968) reported that majority of cases of rupture of diaphragm occurred following vehicular accidents and 95% of cases showed left dome tear. Young adult male was the most common category involved.

H.D. Morris and A.W. Dunn (1968) stated that straddle fracture (communited fracture of tie arch) was the most common type of unstable pelvic fracture seen in automobile accidents. The anterior urethra is most commonly ruptured in a "straddle" injury.

J.J. Flaherty et al (1968) found bladder injuries to be most commonly associated with fracture of pubic rami and symphysis pubis.

K.B. Doersch and W.E. Dozier (1968) stated that seat belt sign showed contusions, abrasions and ecchymosis of lower abdominal wall. It is associated with mesenteric and intestinal injuries.

S. Sevitt (1968) studied 250 cases of fatal road accidents and found abdominal injuries in 19 cases and fracture pelvis in 23 cases. He reported that central apoplexy of one or both the adrenal glands occur in 20% of cases with severe closed injuries of chest or abdomen, following automobile accidents.

B. Fox (1969) noted unilateral adrenal haemorrhage and necrosis after stomach operation.

Bruce H. Smith et al (1969) reviewed 219 motorcycle accidents during 1943-1966 resulting in 223 fatalities among military personnel and showed that period of maximum incidence was 5 P.M. to 12 Midnight. 88% of the victims were operators of the motorcycle and 9% were passengers.

C.E. Carlton and R. Scott (1969) noticed that kidney is involved in 8% cases of penetrating abdominal injuries.

P.H. Kindling, R.F. Wilson and A.J. Walt (1969) described laceration along the falciform ligament of liver in drivers and passengers of automobiles and stellate lacerations in pedestrians in vehicular accident.

S.A. Resnicoff and J.H. Morton (1969) stated that intramural haematoma of duodenum due to blunt injury of abdomen usually extends from Ampulla of Vater to the jejunum.

Meyer (1970) said that patients may collapse or even die without any visible injury in cases of blunt abdominal trauma due to vasovagal inhibition through the solar plexus. He also said that injuries of hollow viscus such as stomach, small intestine, etc. are uncommon because of the protection afforded by their mobility. He reported that majority of the abdominal injuries were due to automobile accidents and these were commonly multiple (20%) and often associated with bone injuries. Stab wounds accounted for 80% of all penetrating injuries of abdomen and firearm injuries were present in 14% cases.

A. Evans and R.A. Moggs (1971) reported renal pedicle injuries following vehicular accidents with mechanism being one of the acceleration and deceleration leading to shearing of renal vessels with intimal damage, dissection and thrombosis.

Cameron Camps (1971) described three types of pedestrian injuries as (a) Primary impact injuries, (b) Secondary impact injures, and (c) Secondary injuries. He noticed that majority of the primary impact injuries were responsible for injuries to abdomen and pelvis due to victim being struck from front or side by impact of head light or mud guard. He found that diaphragm, liver, spleen and pelvic girdle are frequently injured in run over victims.

R. Chandulal (1971) analysed 74 cases of fatal road accidents in the year 1966. He found that the age group between 20-40 years was the most vulnerable group followed by the age group 1-20 years. Fracture of pelvis occurred in 16 (19.7%) cases. Injuries to liver occurred in 19 cases (26.5%), spleen in 14(18.6%), bladder in 5 (6.7%), kidney in 4(5.6%), intestine in 3(4.5%), diaphragm in 3(4.5%) and ovary in one (1.3%) case. Pedestrians were the most common victims. Lorries (48%) were the main agencies causing the accidents followed by cycle (25%), car (17%) and buses (13%). Alcohol was found in 8 postmortem cases.

B.W. Nathasone (1972) reviewed 30,000 therapeutic abortions and reported that the incidence of iatrogenic uterine perforations was 0.8% per 1,000; every tenth patient in his review was nulliparous According to him, uterine position and the inexperience of the physician were the most common etiological factors.

J.I. Tonge et al (1972) studied injury patterns in traffic crash fatalities and analysed 908 traffic crash victims over a period of six years (1963-1968) who died in Brisbane, Australia. Most of these accidents occurred between 6 P.M. to 9 P.M. The peak incidence of accidents involving pedestrians occurred between 7 P.M. to 8 P.M. 37% of all fatalities occurred on the weekends (Midnight Friday to Midnight Sunday).

L. Persky and W. Houch (1972) found that 80% of the renal injuries occurred in an average age group of 30 years.

M.J. Orloff and A.C. Charters (1972) noticed retro-peritoneal haematoma occurring in 1-2% of non-penetrating abdominal injuries. This had a mortality rate ranging between 19% to 38%.

R.C. Harrison and H.T. Debas (1972) reported rupture of stomach in a 25 year old woman after doing ten push ups.

W.R. Nothrup and R.L. Simmons (1972) stated that pancreas tolerates injury poorly. Local injury to pancreas either by blunt or penetrating means leads to discharge of enzymes which digest the pancreatic lobules with devastating consequences.

J.P. Evans (1973) reported that blunt wounds following automobile accidents may result in either perforation, avulsion, intramural haematoma and serosal tears of small intestines.

Polson and Gee (1973) reported injuries to liver in 40%, stomach in 5% and pancreas in 1% cases in cases with multiple organ injuries following automobile accidents. Penetrating wounds of the liver were usually caused by knives. Majority of the stomach injuries were caused by penetrating stabs of the abdomen. They reported rupture of the bowel with eversion of the margin in blast injuries of abdomen and said that transverse colon may be crushed against the front of the spine due to blunt abdominal trauma.

B. Risberg (1976) noted 45% of liver injuries following penetrating wounds of the abdomen. He found higher incidence of abdominal stab injuries during weekends. He reported that cases of female and children victims of abdominal and pelvic trauma are rare as compared to young males in the age group of 20-30 years.

Marc B. Osias (1976) found that majority of the renal injuries were non-penetrating (95%) and were present among males (77%). In this category, automobile accidents accounted for 48.7%, sports for 16.88%, blows for 7.14%, falls for 18.83% and cycle accidents for 8.44% cases. In category of penetrating trauma, firearms accounted for 71.42% and stabs for 28.57% of cases. Minimal renal injury (contusion) and moderate renal injury (renal-laceration) were noted in 51% and 36% of cases respectively. Severe fragmentation of kidney and pedicle injuries were present in 13% of total cases.

David Charles and Joel Rankin (1977) stated that gravid uterus may rupture in cases of direct violence due to automobile accidents especially in the last trimester of pregnancy.

Frederick W. Ackroyd (1977) noticed simple laceration of the liver in knife wounds and found spleen to be most vulnerable of all abdominal organs to blunt trauma. He stated that pancreatic injuries resulted in fatal haemorrhage.

Herbert B. Hechtman (1977) reported that retro-peritoneal haematoma occurs commonly in pelvic and spinal fractures and following injuries to the pancreas, duodenum and urinary tract. He stated that in blunt trauma of abdomen, bowel is usually injured at the junction of the mobile and fixed portion, i.e., first portion of jejunum, distal portion of ileum, etc. Pancreas and duodenum, due to their fixed position against the lumbar spine, are trapped by compressing abdominal trauma like the steering wheel. He also reviewed penetrating colonic injuries and found the frequency of involvement of ascending colon as 31%, transverse colon as 28% and descending colon as 33%. Firearms were the main cause of these penetrating injuries.

Jeffrey R. Woodside and Thomas A. Borden (1977) stated that diseased kidney due to carcinoma, renal cyst and hydronephrosis are more prone to rupture by mild trauma.

Sean Duerr and Thomas Cocco (1977) reported a case of cerebral embolization as a result of firearm wound of abdomen. The probable course was that the bullet passed through the diaphragm and entered the left ventricle and then to the brain.

Stafon Jacobson and Rolf Lewander (1977) found injury to spleen following torsion trauma. This torsion trauma could be one of the cause of spontaneous rupture of spleen.

Thomas M. Parker and Donald L. Bricker (1977) reported a case of renal artery aneurysm following automobile accidents. This presented as a mass in the chest near to the right side of the diaphragm.

William R. Olsen (1977) found that delayed rupture of subcapsular haematoma of the spleen occurred in 15-20% of blunt splenic injuries.

Ashish K. Mandal and Marilyn A. Boiiano (1978) reviewed firearm wounds of the aorta and inferior vena cava in civilian practice and found injury in three cases out of total 9.2% cases.

G.A. Barashkov and L.N. Gubar (1978) studied characteristics of automobile injuries in 788 car trauma victims and found that 72.4% of cases had multiple organ injuries. This resulted in massive hemorrhage in 55.6% cases and injuries to vital organs in 54.7% of cases

G. Kelly, L. Norton and G. Moore (1978) reviewed 34 cases of duodenal injuries and found 67.6% cases due to firearm wounds, 14.7% cases due to stab wounds and 17.6% cases resulting from blunt trauma.

J. Chandra et al (1978) analysed 577 cases of vehicular accidents between 1972 & 76 and found that commonest age group involved was 21-30 years and that abdominal injuries were responsible for death in 38(6.5%) cases. Injuries to the liver occurred in 78(11.9%) cases, kidney and spleen in 19(3.3%) cases each and fracture of pelvis in 33(5.7%) cases. In victims, the male : female ratio was 84.2% : 15.8%. Category of victims involved: There were 254 (44.4%) pedestrians, 71(12.3%) cyclist, 127(22%) scooter/motorcyclists, 13(2.27%) car occupants, 29(5.6%) bus and truck occupants and 83 were with unknown history.

J.K. Mason (1978) stated that fall of roof or debris and fall from height cause hyperflexion fractures of dorsal and lumbar spine. He found that many stabs do not pierce the peritoneum and remain within the abdominal wall musculature.

Moshe Engelberg, Robert J., Jedeikin and Mordechi Zager (1978) reported traumatic rupture of left sided liver due to traffic accidents in a case of Kartagener's syndrome.

Robert M. Hardway (1978) reviewed 17,726 victims of Vietnam War and found abdominal injuries in 2454 cases. The highest mortality rate was found in ureteric injuries (10.5%).

S.K. Lahiry and A.L. Brown (1978) reported urinothorax left side following blunt trauma to the kidney in a traffic accident victim. The case showed complete disruption of right uretero-pelvic junction.

Sonny S. Oparah and Ashish K. Mandal (1978) reviewed 16 cases of thoraco-biliary fistulas. They found that five had blunt trauma, three had stab wounds, and eight firearm wounds. They found perforation of right hemi diaphragm and laceration of right lobe of liver in all sixteen cases.

Ward O. Griffen and Calvin B. Ernst (1978) found that superior mesenteric artery is commonly injured due to penetrating abdominal wounds and rarely due to blunt trauma abdomen. It is always complicated by bowel ischaemia.

J. Chandra, T.D. Dogra and P.C. Dikshit (1979) stated that road side accident deaths is a penalty paid by us for modern civilization. In their total series of 3227 medico-legal autopsies conducted over a period of 10 years (1967-76), they reported 70.62% incidence of accidental deaths which included death from fall and train accidents. Out of these, 49.76% cases were due to vehicular accidents. Maximum deaths were found in the age group of 21-30 years (27.38%) followed by age group of 11-20 years (23.69%). Their statistics about accident victims is as follows: There were 374 pedestrians, 207 scooter/ motorcycle riders, 49 car occupants, and 153 bicyclists. The heavy vehicles, viz., truck and bus were found to be the offending vehicle for accidents in 28.09% and 17.14% cases respectively. They reported that the abdominal injuries were responsible for causing death in 7.06% of cases and laceration of liver occurred in 17.2% cases of accidents.

Sam et al (1979) reported a longitudinal fracture of the sacrum as a result of fall from 25 feet after the person landed on his buttocks.

Danak et al (1980) reported that mortality from penetrating wounds of pancreas in about 20% and every third victim sustaining pancreatic trauma develops either pseudocyst, haemorrhage, sepsis, pancreatitis or fistula.

D. Bergvist, H. Hedelini and B. Lindblad (1980) found increased incidence of knives as a cause of penetrating abdominal injuries in urban population and detected dominance of firearm injuries over knives in causing penetrating injuries to the abdomen in rural population. They said that majority of the cases of abdominal and pelvic trauma were due to automobile accidents and young males in the age group of 20-30 years were the most common victims involved in these accidents.

Fawzi A. Iliya, Samir N. Hajj and Herbert J. Buchsbaum (1980) reported two cases of firearm wounds to the pregnant uterus and found that pregnant uterus affords a protective shielding to the abdominal viscera underneath it. They said that a bullet striking the gravid uterus spends much of its energy which diminishes its velocity and ability to penetrate other organs.

Goonetileke (1980) found that damage to abdominal organs, e.g., liver and spleen was rare in falls of less than 70 feet. He found liver injuries were the most common injuries seen in falls of more than 70 feet.

John G. Grieco (1980) found majority of cases of retro-peritoneal haematoma following vehicular accidents. He described 20% cases of retro-peritoneal haematoma due to penetrating trauma of abdomen.

Phillips A. Tibbs et al (1980) found that spinal cord transection secondary to fracture dislocation of cervical vertebrae may mask the usual signs of serious blunt abdominal trauma.

Ronald E. Rosenthal and E.R. Lowery (1980) stated that fracture dislocation of thoraco-lumbar spine occurs due to motor vehicle accidents, falls from height, and secondary to metastatic carcinoma.

Suresh Raina, M.D. George and W. Machiedo (1980) agreed with the observation of the Polson and Gee regarding colonic rupture due to compressed air injury.

James (1981) reported that in posterior abdominal stab wounds, colon, stomach, liver and diaphragm were the organs most frequently injured.

V. Ibanez Martinez et al (1981) reviewed 122 cases of age under 7 years affected with thoracic and/or abdominal trauma not due to birth injuries. They found 154 injuries in total which included 63 abdominal, 58 renal, 28 thoracic and 5 vertebral. Automobile accidents, falls, and penetrating injuries in this order were the etiological factors. There was a high incidence of multiple organ injuries among the victims.

D. Charles Livingston and Aust. Bradley (1982) reviewed traumatic injuries of the spleen and found that majority of the splenic injuries were due to automobile accidents. They found that 17% of splenic injuries were due to firearm ammunition and 14% injuries were due to stabs.

Frederick S. Crammer and Richard D. Heimbach (1982) reported rupture of stomach in healthy individuals due to barotrauma in scuba diving.

Gordon and Shapiro (1982) said that kidney are rarely injured in blunt abdominal trauma because of their well protected anatomical position in the posterior abdominal wall. Distended viscus such as urinary bladder, stomach, pregnant enlarged uterus, may rupture as a result of sudden increase in pressure within these organs in cases of blunt abdominal trauma. Intra-peritoneal haemorrhage occurs mainly due to injury to spleen, liver and tearing of abdominal vessels. Pancreatic laceration can lead to profuse retro-peritoneal or intra-peritoneal haemorrhage and escape of pancreatic juice which may give rise to retro-peritoneal fat necrosis, mesenteric fat necrosis or chemical peritonitis.

Milton Brinton, Susan E. Miller and Donald D. Trunkey (1982) reviewed aortic injuries and found that incidence of aortic injuries was 60% in firearm wounds, 33% in stab wounds and 7% in blunt trauma of the abdomen.

Rao R. Ivatuary et al (1982) reviewed sixty victims of penetrating gluteal injuries and found intra-abdominal injuries ranging from laceration of iliac vessels due to stabs to the involvement of bladder and small bowel due to bullet injuries.

Tsuyoshi Sugimoto, Hisashi Sugimoto and Kenmaemura (1982) reported 6.8% incidence of traumatic liver cysts following blunt hepatic injuries. They found no relationship between the severity of injuries and cyst formation, thus contradicting the work of Vernon Jones et al done in 1970.

A.S. Cass (1983) noticed that 77% of kidney injuries were due to traffic accidents. He reported incidence of non-penetrating kidney injuries by falls in 9%, blows in 5.5% and sports related accidents in 4.5% cases. He found incidence of penetrating wounds of kidney due to firearm wounds in 3% and knives in 1% cases.

D. Bergvist et al (1983) reviewed 1407 cases of blunt abdominal trauma during 30 years period and found that majority of blunt trauma victims (71%) were due to road traffic accidents. They found that liver (40.15%), spleen (34.64%) and kidneys (20.17%) were the organs most commonly injured. Most of the cases (64.40%) had associated chest injuries. Pelvic fractures were present in 30.5% cases. One fourth of the victims died from their abdominal injuries. They found higher incidence during summer due to increase in sport induced injuries. They detected increased incidence of abdominal trauma in victims older than 61 years of age which was 21.73% in 1950-59 series, 35.55% in 1960-69 series and 47.45% in 1970-79 series.

H.R. Guly and I.P. Stewart (1983) reported that traumatic abdominal wall hernia is most commonly caused by blow to the abdominal wall with a small blunt object typically a bicycle handle bar.

Richard G. Strate and John G. Grieco (1983) reviewed the literature of blunt injury to the colon and rectum and found that 90% of the colonic injuries were due to vehicular accidents and transverse colon was the most frequently injured organ.

A.O. Adeyemo et al (1984) analysed 148 cases of thoracic injuries in road traffic accidents in Nigeria over a period of 5-1/2 years. They found associated fatal abdominal injuries with haemoperitoneum in 7 cases (4%). There were 127 male and 21 female victims. Five of the seven victims with fatal injuries were drivers and other two were front seat passengers.

George F. Woelfel et al (1984) reported an unusual constellation of severe thoracic and abdominal injuries in a passenger restrained by a lap harness seat belt during a high speed automobile accident. Abdominal injuries were seen in the form of massive fragmentation of the spleen and deep laceration of the left lobe of liver.

P.K. Ghosh (1984) reviewed 230 cases of vehicular accidents in Delhi to find incidence of abdominal and pelvic trauma in relation to different categories of the victims. His statistics are as follows: Abdominal injuries were seen in 42.20% pedestrians, 21.42% motorcyclists, 25.71% pedal cyclists, 34.09% vehicular occupants and 27.27% vehicular drivers. Pelvic injuries were found in 17.77% pedestrians, 21.42% motorcyclists, 25.71% pedal cyclists, 15.90% vehicular occupants and 9.09% vehicular drivers.

Anderson (1985) described delayed rupture of subcapsular haematoma of liver upto 24 hours or more. He said that subcapsular haematoma of liver in infants can lead to death particularly in breech presentation due to birth trauma or blood dyscrasias.

MarkFielder et al (1985) reviewed firearm wounds of abdomen and found that small bowel and the large bowel were injured with equal frequency (26.38%) followed by liver (22.2%). They also said that spleen and kidneys were involved in 6.94% of cases and aorta in 8.33% of the cases. Injuries to the duodenum, diaphragm and inferior vena cava were found in 5.55% of the cases. Pancreas was injured in 4.16% of cases and urinary bladder in 1.38% of cases. Superficial abdominal wall trauma was present in 27.77% of victims. 13.88% of victims showed stomach injuries. They also reported a case of pregnant lady in which a bullet passed through the fundus of the uterus with both mother and infant surviving.

A.K. Sharma (1986) reviewed 65 cases of abdomino-pelvic trauma and found that majority of injuries were due to non-penetrating trauma (86.15%), out of which 91.07% cases were due to vehicular accidents. Penetrating abdominal and pelvic injuries secondary to injuries else where accounted for 44.45% of total cases of penetrating abdominal and pelvic injuries. Majority of the victims of vehicular accidents were pedestrians (52.94%), followed by passengers (17.64%). Majority of abdominal and pelvic injuries were as a result of primary impact injuries (33.33%) followed by run over of a vehicle (21.56%). Liver was involved in majority of victims (52.30%) followed by mesentery in 30.76% cases and then the spleen in 21.53% of the cases. Pelvic bones involvement were observed in 43.07% of total cases.

A.C. Cass et al (1987) reviewed 214 deaths due to urologic injuries. Out of these, blunt trauma accounted for 200 deaths and penetrating trauma accounted for 14 deaths. The site of fatal injury

was kidney in 120 cases, ureter in 4 cases, bladder in 66 cases and urethra in 16 cases. Multiple urologic injuries were present in 20 victims and comprised kidney plus ureter in four, kidney plus bladder in six, bladder plus urethra in eight and kidney plus bladder plus ureter or urethra in two victims.

Brian J. Rowlands et al (1987) studied 160 nonpregnant victims, 18 years of age, of penetrating abdominal trauma. Large bowel and small bowel injuries were present in 54 and 34 cases respectively. 102 high risk cases ($P<0.01$) were identified as victims with gastro-intestinal penetration/ major liver injury/ pancreatic injury / close range shotgun wounds and major splenic injuries.

Guido Barbagli et al (1987) reviewed 38 cases of urethral trauma. The site of injury was the penile urethra in three cases, the bulbous urethra in seven cases and prostato-membranous urethra in 28 cases. Anterior urethral traumas were less common than those of the posterior urethra. Injuries were mainly caused by fall astride injuries and direct blows to the perineum.

Ian. V. Lau et al (1987) studied biomechanics of liver injury by steering wheel loading. Wheel stiffness was found to be primary determinant of abdominal injury severity. The most frequently seen lacerations were tears of Glisson's membrane encapsulating the liver, but more critical injury was laceration of the central venous junction between lobes, resulting in severe haemoperitoneum.

Paul S. Collins et al (1988) analysed 85 patients for intra-abdominal injuries secondary to the penetrating trauma and found that overall mortality was 17.6%. Gunshot wounds were responsible for 21% deaths, stabs for 10% and shotgun blasts were responsible for 33% deaths. They found 127 intra-abdominal vascular injuries. Majority of these injuries were to superior mesenteric artery and its branches. The highest mortality occurred with portal vein and combined aortic and vena caval injuries. There were 194 organ injuries. Liver injuries were responsible for highest number of deaths.

R.H. Daffner et al (1988) studied patterns of high speed impact injuries in motor vehicle accidents in 250 drivers and 250 front seat passengers. They found that presence of severe life threatening injuries to the central nervous system, thoracic and abdominal viscera caused other serious injuries to be overlooked.

B.J. Brainard et al (1989) studied injury profiles in 115 pedestrian motor vehicle trauma cases. The mortality rate was 22% and 17 out of 25 victims who died showed presence of abdominal injury and/or head and chest injury. The average injury severity score (ISS) among all cases was 20.5. The majority of victims were men (72%) and average age of all the cases was 35 years. The abdominal organ systems were involved in 21% of the cases. The number of pelvis fractures present were 35.

D.C. Viano et al (1989) studied biomechanics of the human abdominal and pelvis injuries in lateral impacts. Abdominal injuries consisted primarily of liver lacerations. There were two cases of pubic ramus fractures in the pelvic impacts. Although serious pelvic injury was infrequent, lateral pubic ramus fracture correlated with compression of the pelvis, not impact force or pelvis acceleration. Pelvic tolerance was set at 27% compression.

E. Arajarvi and S. Santavirta (1989) reviewed injuries of seatbelt wearers in severe traffic accidents. They found that there occurred 3,468 fatal vehicular accidents during the period 1972-1985, in which one or more of the drivers or passengers sustained an injury leading to a fatal

outcome within 30 days. The most common abdominal injuries were the liver injuries (40.2%) and spleen ruptures (26.5%).

M. Schmitz et al (1989) analysed 160 autopsies during the period from 1971 to 1987 at the Institute of Forensic Medicine, in Hamburg, Eppendorf. 72.5% of the children died after traffic accidents. 62% of the children died because of a head injury and 13% died due to haemorrhagic shock following abdominal organ injuries. The majority of the children died by injuries of only one cavity.

M.W. Gordon et al (1989) conducted an audit of trauma deaths and studied all the 50 trauma deaths in the Accident and Emergency Department of the Royal Infirmary of Edinburgh over a four year period. Injury Severity Score (ISS) and probabilities of survival (Ps) were calculated for all cases. Two thirds had a Ps of zero while 7 (14%) had a Ps of 0.5 or more. Four deaths (8%) were considered to be due to uncontrolled bleeding following abdominal organ injuries.

O.P. Sharma (1989) reviewed 30 diaphragmatic injuries in 28 patients between 1976 and 1988. Blunt trauma by motor vehicle accidents were the major etiological factors in most cases. The left diaphragm was injured in 72% cases. The most commonly injured intra-abdominal organ was the liver (57%) followed by spleen (39%) and pelvic fractures (21%). Ethanol intoxication was detected in 47% of the patients involved in road accidents.

Soren B. Albrektsen et al (1989) analysed 218 medico-legal autopsies on persons with traumatic injuries in the year 1984-85. Most vulnerable age group was found to be of 60-70 years. Males were involved in 63% of cases and females in 37% of cases. Most common abdomino-pelvic injury was pelvic fracture, occurring in 42 cases followed by retro- peritoneal haematoma, occurring in 21 cases. Injuries to liver occurred in 19 cases and spleen in 16 cases. Renal/ureteric injuries occurred in 10 cases. Intestinal/mesenteric lacerations were present in 9 cases. Four cases showed urinary bladder rupture/lacerations /contusions. Pancreatic laceration was found in one case.

D.C. Viano et al (1990) studied involvement of old drivers in multivehicle side impact crashes and reviewed National Accident Sampling System (NASS) and National Crush Severity Study (NCSS) cases with fatal abdominal injury. Sixty four percent of near side seated occupants were over 50 years old and 36% over 70 in fatal multivehicle side impacts. In contrast, 26% of the victims in single vehicle frontal crashes were 50 and 8% over 70 years old. Majority of cases occurred in daylight hours, on dry roads and without alcohol involvement.

E.M. Guirguis et al (1990) reviewed 274 adult patients with multiple system injuries brought to trauma centres at the Hamiltan General Hospital (HGH) and the Ottawa Civic Hospital (OCH). In the Hamilton group, 106 consecutive patients from April through July 1987 were included. The majority of the cases (72%) were male; and the median age was 26 years. Blunt trauma was the etiological agent in 96.2% cases with motor vehicle accidents (MVA) being the most common cause (76.4%). Abdominal injuries were present in 19.1% cases. In the Ottawa group, 168 cases were included between April 1987 to October 1988. 73% of the cases were males with the median age group involved was 39 years. Blunt trauma accounted for 91.7% of the injuries with MVAs being responsible for 58% of injuries. Abdominal injuries were found in 30.4% cases.

E.M. Orsay et al (1990) evaluated 1,364 trauma victims and trauma resulting from the motor vehicle crashes (MVCs) was found to be the leading cause of death in person 1 to 38 years old. Use of safety belt reduced the incidence of abdominal injuries sustained in MVCs.

B.W. Sathiyasekaran (1991) conducted a study on 1906 accident trauma victims at the Casualty Department of Government General Hospital, Chennai, South India. This group forms 15.3% of the total attendance of patients to the casualty department. Of those brought to hospital following accident trauma, 1.8% were dead; 35.1% were due to road traffic accidents and 20.9% to occupational accidents. Males accounted for 80% of the cases and 46.9% occurred in the age group 21-40 years. Injuries involving lower extremities accounted for 35.4% of the total injuries.

M. Bishop et al (1991) evaluated comprehensive algorithm for blunt and penetrating thoracic and abdominal trauma in 400 cases during four months period. The mean Injury Severity Score (ISS), Penetrating Abdominal Trauma Index (PATI) and Trauma Score (TS) scores in the series were 21 +/-10, 34 +/- 12 and 13 +/-3. The overall patient mortality of the study group was 17 per cent; it was 61 percent in those cases with major deviations from the algorithm and 6 percent in cases who complied with the algorithm. The ISS, PATI, and TS scores were 29 +/-9, 32 +/-12 and 13+/-2, in patients with deviations and 20+/-10, 37+/-12 and 14+/-2 in patients who complied with the algorithm. Of the 37 patients who died with major deviations from the algorithm, the deviations was directly contributory to death in 21 cases (57%) and probably contributory in another 14 cases (38%). There were 108 patients with ISS scores between 20 and 50. In this groups, mortality was 55 percent when a major deviation occurred and 5 percent without major deviations from the algorithm.

P.Debeugny et al (1991) analysed 93 cases of thoracic blunt trauma with the age group ranging from 1-1/2 to 15 years. They found associated skeleton lesions in 67 cases and abdominal injuries in 19 cases.

Wanda W. Young et al (1991) reviewed trauma registry database from six trauma centres in Pennsylvania and found 23.3% significant and 30% tertiary femur/pelvic injuries. In the abdominal injuries category, 2.2% significant and 13.9% tertiary injuries were found. Acetabular or pelvic ring fractures were present in 39 patients. Major abdominal organs or vascular injuries were found in 54 patients. 143 patients showed minor abdominal organ injuries. Abdominal injuries caused 2% deaths in patients with single injury and 6.3% deaths in patients with multiple injuries. Femur/pelvic injuries caused 4.5% deaths in patients with single injury and 6.2% deaths in patients with multiple injuries.

D. Pattimore et al (1992) studied torso injury pattern mechanism in car crashes. The data score was the cooperative crash injury study which holds detailed injury information on over 6200 car crash occupants. Restrained front seat occupants with a ISS of 16 + who were involved in frontal or side collision were selected. A total of 286 occupants fell into these selection criteria. The likelihood of all torso injuries including spleen and pelvic injuries increased in side impacts.

J.D. Feczko et al (1992) conducted an autopsy case review of 142 non-penetrating (blunt) injuries of the aorta. Seventy percent of the victims were men with a mean age of 37.5 years and 30% were women with a mean age of 46 years. Thirty-five percent of the 142 victims had elevated blood alcohol levels. The majority of the aortic lacerations (102) were sustained in automobile crashes. Of these, 42% were broadside collisions and 58% were head-on collisions.

K.E. Daly and P.R. Thomas (1992) analysed 434 traumatic deaths (mean 52 years) occurring in the South West Thames Region during 1988. Of the deaths, 59 per cent occurred before arrival at hospital, particularly in the semi-rural areas. Road traffic accidents are the commonest cause of

death from trauma, being most prevalent in the area containing major trunk roads. The majority of death due to multiple injuries (70 per cent) occurred before arrival at a hospital.

K. Rumball and J. Jarvis (1992) reviewed seat belt fractures in young children at a tertiary referral centre between 1974 and 1991. There were ten cases, eight girls and two boys; with an average age of 7.5 years (3 to 13). Four distinct patterns of injury were observed most commonly at the L2 to L4 level. Four children had intra-abdominal injuries. There was a delay in diagnosis of the intra-abdominal injury in five cases. All cases showed contusion of the abdominal wall (seat belt sign).

L.F. Zantut et al (1992) presented a report of five patients who had suffered blunt abdominal trauma with gall bladder lesion between 1986 and 1991. They concluded that the gall bladder injuries are usually associated with other lesions and is related to very serious trauma or to deceleration.

Martin A. Croce et al (1992) evaluated a total of 926 patients at the Presley Regional Trauma Centre over a five year period (November 1985 through October 1990): 592 following penetrating trauma and 334 following blunt abdominal trauma. The mean age was 30 years; the male to female ratio was 8:1 for the penetrating group and 2:1 for the blunt group. Sixty four percent of the penetrating injuries were gunshot wounds and 36% were stabbings. Of the blunt abdominal injuries, 87% were sustained in motor vehicle crashes, 7% were the result of pedestrian- vehicle collisions and 6% were sustained in either falls or assaults. The mean Abdominal Trauma Index (ATI) value and Injury Severity score (ISS) were 16 " 12 and 16 + 10 for the penetrating group, and 14 + 9 and 29 + 14 for the blunt group, respectively. The overall mortality was 2.6% (1% for penetrating and 7% for blunt group). The liver was the most frequently injured organ (30%), followed in descending order by the small bowel, colon, diaphragm and stomach.

Mary L. Brandt et al (1992) analysed 13 children of the diaphragmatic injuries. There were 7 boys and 6 girls, ranging in age from 1 to 15 years (average 7.5 years). 8 patients sustained penetrating trauma and five patients sustained blunt trauma. Nine patients had associated injuries, most commonly involving the liver. Diaphragmatic injury occurs in 3% to 5% of patients with blunt trauma to the abdomen.

P.K. Ghosh (1992) conducted epidemiological study of victims of vehicular accidents in New Delhi during the year 1983-84. This study concluded that the mortality and morbidity connected with road traffic accidents are increasing at an alarming rate throughout the country as a result of the rapid industrialization and increase of fast moving vehicles combined with lack of traffic sense of road users of this country.

A. Bradbury and C. Robertson (1993) studied patterns and severity of injuries sustained by 174 vehicle occupants. Drivers (DR) accounted for 66% of the cases, 20% were front seat passengers (FSP), and 14% were rear seat passengers (RSP). Majority of the cases were young males. High speeds and alcohol intoxication were associated with an increased severity of injuries.

A.K. Sharma et al (1993) studied pattern of childhood trauma in Department of Paediatric Surgery, S.M.S. Medical College and Child Health Institute, Jaipur, Rajasthan. They said that there is a definite increase in incidence and related mortality due to trauma by abdominal and skeletal injuries. Fall from the house roofs is the commonest mode of injury although road traffic accidents are also recognized to be on the increase. The overall mortality was 77%.

Bernard R. Boulanger et al (1993) reviewed 10,205 adult blunt trauma cases from July 1986 through October 1991 and identified 80 cases (0.8%) of blunt traumatic diaphragmatic rupture (BTDR). There were 59 (79%) left, 16 (20%) right and five (6%) bilateral BTDRs. Most of these 80 TDRs were men (74%) and the mean age and ISS were 39.0" 20.9 years (range 15-97) and 41.0 " 16.3 respectively. Motor vehicle crashes were the most common injury mechanism (86%), and pedestrian (11%) and motorcycle trauma (3%) accounted for remaining cases. All 16 cases with right BTDR had associated intra-abdominal injuries which included liver in 93%, spleen in 44%, hollow viscus in 31%, pancreas in 6%, bladder in 6% and kidney in 12% cases. Cases with left BTDR had injuries in liver in 34%, spleen in 58%, hollow viscus in 20%, pancreas in 7%, bladder in 12% and kidney in 10% cases. Pelvic fractures were seen in 41% cases of left BTDRs and 31% cases of right BTDRs.

D.C. Viano and D.V. Andrzejak (1993) studied biomechanics of abdominal injuries by armrest loading in the liver and spleen. The STIFF armrest resulted in severe abdominal and thoracic injuries. Injuries of the liver and spleen included deep lacerations, tears of major hepatic arteries and veins and serious haemoperitoneum. These injuries averaged AIS=4. In SOFT armrest, the injuries averaged AIS=2. The stiff armrest protruded into the abdomen and showed little sign of deformation with abdominal loading. The situation is consistent with the occurrence of lacerations at hepatic junctions and between lobes. The soft armrest crushed fully, indicating that abdominal compression was lower and was limited by armrest deformation.

F. Baumer et al (1993) analysed two cases of seat belt syndrome in automobile accidents involving the children. These cases had combination of injuries involving the thoracic lumbar vertebrae and intra-abdominal organs. They showed the "assurance" of children as passengers on the back seat with a pelvic belt to be dangerous and no longer justifiable. They advocated installing a three point safety belt system.

G. Girelli et al (1993) studied pattern of injuries caused by use of seat belts in motor vehicle accidents. They found that with lap seat belts, abdominal and vertebral injuries were encountered. Skin abrasions were found associated with internal injuries in 30% of cases.

H. Leon. Pachter et al (1993) reviewed seven cases of post traumatic splenic pseudocysts formation following blunt abdominal trauma, over a three year period. Five cases were males and two were females. Mean age group involved was 32 years. Splenic cysts varied in size from 7 cm to 15 cms.

Jack W. McAninch et al (1993) analysed 84 cases of renal gunshot wounds and classified renal injuries in five categories-16 contusions (18.4%), 12 minor lacerations (13.8%), 44 major lacerations (50.5%), six vascular injuries (6.9%) and nine combined lacerations and vascular injuries (10.3%). Most common associated organ injury was to small bowel and colon, occurring in 32 cases each (38.1%). Injuries to liver occurred in 28 cases (33.3%), stomach in 25 (29.7%), spleen in 19 (22.6%), diaphragm in 14 (16.6%) and pancreas in 13 cases (15.4%) Mesentry was injured in 10 cases (11.9%), adrenals in 4 (4.7%), ureter in 3 (3.5%), renal pelvis in 2 (2.3%) and bladder in one case (1.2%).

J.H. Siegel et al (1993) studied 76 frontal (F) and 45 lateral (L) motor vehicle crash victims with multiple injuries [39-belted (B) and 82-non belted (NB)]. They found that belt use did not protect against lung, liver, spleen, pelvis or lower extremity injury. Pelvic injuries ($P<0.001$) were higher in lateral crashes. In FB crashes, safety restraints were the primary cause of bowel or colon injuries ($P<0.006$). Contact-intrusions (CI) of the car occupant compartment in frontal crashes were the main

cause of liver injuries, but in lateral crashes, side door CI caused aorta, liver and pelvic injuries. In contrast, contact only (CO) injuries of the steering assembly were responsible for injuries to the liver in frontal crashes and side door CO for liver and spleen injuries in lateral crashes.

Katsuhiko Sugimoto et al (1993) reviewed 106 cases of blunt liver injuries in the six year period from April 1986 through March 1992. They found subcapsular haematoma in 15 and central rupture in 25 cases. Superficial liver laceration was present in 27 cases. Deep liver injuries of simple type were found in 18 cases and of complex type (with tissue necrosis) were found in 21 cases.

K.P. Edwards (1993) reported that the incidence of pelvic fractures has increased greatly; automobile and motorcycle crashes, pedestrian accidents, and fall from great heights are the most common causes. Pelvic fractures caused by high energy trauma have reported 10% to 50% mortality, which occur due to associated trauma to the abdominal organs and vessels with resultant haemorrhage. Single breaks with no displacement in the pelvic ring, which includes injuries to the ischium, ilium, pubis and sacrum, are stable fractures and account for one third of all pelvic fractures.

L.P.H. Leenan et al (1993) reviewed 14 cases with severely complicated unstable fractures of the pelvis from 1980 through 1990. There were 13 men and one woman (mean age, 28 years). Five cases were injured in car crashes, six were struck by cars while riding bicycles and one was run over by a truck, where as three cases were crushed, one in a large press, one between a lift truck and a wall and one under a container. The mean ISS for the 14 cases was 48 (range, 34-66). Eight fractures also involved the acetabulum. The injuries were accompanied by anorectal (nine), urogenital (eight), vascular (three) and nerve (three) injuries.

Michael F. Rotondo et al (1993) reviewed 46 cases of penetrating abdominal injuries over a 3-1/2 year period. Injuries to the aorta and portal vein were found in four cases and one case respectively. Internal iliac artery was injured in 10 cases and internal iliac vein was involved in 6 cases. Celiac axis was injured in one case. Superior mesenteric artery and vein were injured in one case each. Inferior vena cava injury was found in seven cases.

Michael Rhobes et al (1993) reviewed 1115 cases of paediatric trauma over a six year period. Of the patients, 22% were preschool (age 0-4 years) and 34% were adolescents (age 12-14 years). The mechanism was blunt (96%), with motor vehicular crash being the most frequent cause. The mean ISS was 11.1 with 39% of ISS > 9. 23% of the cases showed significant extremity pelvic injuries (AIS score > 3). AIS abdomen > 3 score was found in 6.1% of the cases. 3.9% of the victims had significant bowel, spleen and liver injuries.

Ming Liu et al (1993) studied 55 victims (44 men, 11 women) following blunt abdominal injury. The mean age involved was found to be 43 years (range, 17-78). Mean ISS was 18.5 + 10.5. Splenic injuries were present in 16 cases. 7 victims showed injuries to small intestines. Retro-peritoneal haematoma and mesenteric injuries were found in six cases each. Liver and mesocolon injuries were present in four cases. Pancreas was injured in three cases. Colon injury was present in two cases. Injury to the stomach and kidney was found in one case each. The most common mechanism of injury was traffic collisions (76.3%) and 45.2% of these were motorcycle related collisions.

M.R. Felenda and K.K. Dittel (1993) studied 50 cases of pelvic ring injuries between January 1990 and December 1991. They found 14 cases with unstable type B and C pelvic injuries. They stated

that any classification of pelvic ring injuries has to take respect of the mechanism of injury, the anatomy and the dimension of instability.

O. Orsi et al (1993) reported a case of associated injuries caused by a seat belt in road accident. The abdominal trauma was present in the form of abdominal wall ecchymosis and perforation of the small intestines.

P.C. Dischinger, B.M. Cushing and T.J. Kerns (1993) analysed injury patterns associated with direction of impact in 3675 car or truck drivers. Injuries to abdomen and pelvis were significantly greater in lateral collisions. Drivers in lateral collisions were found to have multiple abdominal injuries. In category of frontal crashes, abdominal injuries were found in 21.2% cases and pelvic injuries in 5.5% cases. Liver was injured in 2.8% cases, spleen in 2.6%, kidney in 1.8% , intestine with mesentery in 1.6% and bladder in 0.2% of cases. In category of left lateral collisions, abdominal injuries were present in 28.7% cases and pelvic injuries in 20% cases. Injuries to liver occurred in 4.3% cases, spleen in 8%, kidney in 2.7%, intestine with mesentery in 0.8% and bladder in 3.5% of cases.

Rao R. Ivatuary et al (1993) analysed 57 cases of penetrating splenic injuries between 1988 and 1992. 21 sustained stab wounds and 36 received gunshot wounds. Most common associated injury was to diaphragm in 22 cases, followed by stomach in 15 cases. Injuries to liver occurred in 12 cases, colon in 11, duodenum and small bowel in 8 cases. Kidney was injured in seven and pancreas in six cases. One case showed involvement of bladder and portal vein in the injury.

Robert C. McIntyre, Jr. et al (1993) reviewed fifty seven cases of paediatric trauma with pelvic fractures. The majority of injuries were from motor vehicle crashes (n=21, 36.8%) and auto-pedestrian collisions (n=18, 31.6%). Twenty three children (40.4%) had unilateral anterior fractures (type I), seven (12.2%) had unilateral posterior fractures (type II), 23 (40.4%) had unilateral anterior and posterior fractures (type III) and four (7%) had bilateral anterior and posterior (type IV) fractures. Fourteen intra-abdominal injuries were identified in 11(19%) children which included six splenic lacerations, three liver lacerations, two rectal tears, one colon injury, one small bowel injury, and one external iliac artery and vein injury. The mean Injury Severity Score (ISS) was 13.3 + 1.2 (range, 4-35). The mean Revised Trauma Score was 7.57+0.08 (range, 5.23-7.84).

Y. Haland, P. Lovsund and A. Nygren (1993) studied injuries in car side collisions and found that AIS 3-6 injuries (serious to fatal) were received by the abdomen/pelvis (25%). The rear side collisions caused 11% abdomen/pelvis injuries. Most of the injuries to the abdomen and pelvis were life threatening.

A.J. Mazurek (1994) studied epidemiology of paediatric injuries and found road traffic accident trauma (RTA) as the number one cause of paediatric deaths. He found that boys were more commonly injured than girls and most injuries occurred in the summer months. 25% of the cases showed multiple organ injuries including chest, abdomen, pelvis and extremities injuries.

C.L. Ong, D.J. Png and S.T Chan (1994) reviewed abdominal trauma cases and found it to be a leading cause of death in the 1-44 age group. In their study, the most common cause was road traffic accidents followed by stab wounds and fall for heights. Blunt abdominal trauma accounted for 79% of the cases. The spleen and liver were the most common organs involved in blunt abdominal trauma.

C. Rangger et al (1994) noted 25 cases of paediatric pelvic fractures. The age group involved was from 4 months to 14 years.

E. Mayr, W. Braun and A. Ruter (1994) classified pelvic injuries in types A to D according to stability. Type A consists of fractures of the pelvis not involving the ring and Type B consists of stable rotational injuries. Type C and D encompass the unstable injuries: C is purely rotational and D has a combined rotational and vertical instability. The location of injury is indicated by adding numbers 1-9 (1: rupture of symphysis pubis; 2: transpubic fracture; 3: acetabular fracture; 4: iliac wing fracture; 5: sacro-iliac fracture-dislocation; 6: sacro-iliac disruption 7: sacral wing fracture; 8: transforaminal sacral fracture; 9: central sacral fracture). These numbers are arranged in increasing order, one hemipelvis after the other.

E. O. Odelowo (1994) studied pattern of trauma in motorcycle accidents and found that these motorcycle accident cases constituted 10.3% of 715 road traffic accident victims. There was male preponderance with ratio of 5.7:1. The age group involved was 18 to 30 years. 25% of the cases showed multiple organ systems involvement including abdomen and pelvis regions.

G. Solovei et al (1994) reviewed 32 cases of dissection of the abdominal aorta after closed blunt trauma between 1982 and 1993. The cases were predominately male and most often victims of an automobile accident (18 cases) or crushing trauma (6 cases). Dissection of the intima (17 cases) was the most frequent aortic lesion observed. These cases also showed disruption of the media in number of cases. Nearly all the lesions were subrenal and damage to abdominal organs was frequently observed.

G.V. Poole and E.F. Ward (1994) reviewed 348 cases of pelvic fractures during six year period. There were 220 men and 128 women with an average age of 31 years and a mean Injury Severity Score of 21.8. Almost two-third of cases were injured in motor vehicle accidents, and about one eighth were pedestrians struck by a vehicle. Small numbers of cases were injured in crushing accidents, motorcycle accidents, falls and miscellaneous injuries. Only 32 victims (9%) had an isolated pelvic fracture. Associated injuries to the head, chest, abdomen and upper and lower extremities were frequent.

J.R. Hill, G.M. Mackay and A.P. Morris (1994) studied abdominal and chest injuries caused by seat belt loading in accident cases. 29.6% cases had minor injury (AIS-1). 19.4% of the victims sustained chest/abdominal injuries rated at maximum AIS>or=2, and 4.5% were rated at maximum AIS> or = 3. Females were found to be at much greater risk of serious injury (AIS> or = 3) when aged > or = 70 years.

J.V. Lewis (1994) described a case with bilateral adrenal haemorrhage due to blunt trauma from a motor vehicle accident and found 26% incidence of adrenal haemorrhage in victims dying after severe trauma from postmortem examinations.

M. J. Swierzewski et al (1994) reviewed 91 unrestrained and 27 restrained fatally injured motor vehicle crash victims between 1983 and 1986. Injury Severity Score (ISS), major injuries in AIS-85 categories for the head, thorax, abdomen and in AIS-85 code 5 or 6 categories for the head, thorax, abdomen were the same in unrestrained and restrained victims. The incidence of major abdominal injuries in both groups fatally injured victims was the same.

N. Schwarz et al (1994) reviewed 17 cases of unstable fractures of the pelvic ring in children over two year period. They found that children were under 13 years of age at the time of injury. All but

four of the children had additional injuries. The pelvic fracture had a rotational instability in 9 victims and was vertically unstable in 8 cases.

P.M. King et al (1994) analysed 300 trauma cases using TRISS methodology. Blunt injuries (94%) were most frequently from motor vehicle accidents (46%). The mean Injury Severity Score was 21.16 and the mean Revised Trauma Score was 6.75. There were 51(17%) deaths - a Z value for the study group of 2.26. The M value was 0.78. The Z value for multisystem injuries including abdomen, chest, pelvis and extremities, only was 0.54, and the M value was 0.77.

P. Sahdev, M.T. Lacqua, B.Singh and T.D. Dogra (1994) reviewed 177 autopsies. Neurological injury caused death in 60% of cases and haemorrhage and shock caused death in 25% of cases. 23% of the deaths were felt to be preventable, 41% possibly preventable and the rest nonpreventable.

P.T. Simonian et al (1994) performed biomechanical analysis of the antero-posterior compression injury of the pelvis in seven pelvic specimens. They found that symphyseal gapping occurred after isolated symphysis pubis disruption. With additional disruption of the unilateral sacroiliac joint ligaments, symphysis pubis displacement was unaffected: however, the injured sacroiliac joint gap displacement, and sacroiliac joint flexion angulation on both intact and injured sides increased as compared to the specimen in the intact state. Further disruption of the ipsilateral sacrotuberous and sacrospinous ligament complex produced little additional motion at either symphysis pubis or sacroiliac joints.

R. Rigon, P. Trevisan and A. Giacomazzi (1994) reported their experience on six cases of pancreatic trauma. They stated that high speed motor vehicle accidents have contributed to an increasing incidence of pancreatic trauma. Early mortality is generally due to associated vascular and other intra-abdominal injury. In their study group, isolated pancreatic injury was found only in one case and one case showed associated fatal duodenal injury. They said that fistulas and pseudocysts are the most common complications and are seen in 20 to 35% of the victims. The overall mortality secondary to complications ranges from 10 to 20%.

W.C. Lee et al (1994) analysed 50 cases of acute diaphragmatic ruptures following blunt trauma during the ten year period (1982-91). The left hemi diaphragm was injured in 43 cases (86%) and the right in 7(14%) cases. The most common cause was road traffic accidents. 48 victims had associated injuries, mainly to the chest, abdomen and pelvis. 23 cases had intra-abdominal visceral injuries as well. There were three deaths (6%) and six cases were permanently disabled by craniospinal injuries and pelvic fractures.

W.L. Abrantes, M.S. de-Lucena and M.C. Schlobach (1994) evaluated 139 cases of splenic trauma in children, aged 5 months to 12 years for the period of 1981 to 1990. The contusions were responsible for injury in 135 cases (97.2%) with 58.7% caused by pedestrian/motor vehicle accidents. 41.6% of splenic injury were in grade I and II, 30.6% were in grade III and 26.5% in grade IV and V (Injury Scaling Committee). Multiple associated lesions occurred in 87 children (62.5%).

Alexander J. Ghanayem, et al (1995) studied unilateral open-book pelvic ring injuries. The average volume increase in the entire pelvis (from the top of the iliac crests to the bottom of the ischial tuberosities) between a nonstabilized injury with the abdomen closed and then subsequently opened was 15"5% (423cc). The average increase in entire pelvic volume between a stabilized and reduced pelvis and nonstabilized pelvis, both with the abdomen open, was 26"5% (692cc). The pubic diastasis increased from 3.9 to 9.3 cms in a nonstabilized pelvis with the abdomen closed and then subsequently opened.

Angela Sauaia et al (1995) studied 289 traumatic deaths and found that 79% of cases were men. Mean age was 36.8"1.2 years (range, 6 months to 92 years), and 190 (66%) were younger than 40 years of age. Predominant injury mechanism were gunshot wounds in 121 (42%), motor vehicle accidents in 75 (38%) and falls in 23 (8%) cases. ISS ranged from 9 to 75 (Mean, 35.7+ 1.2). Bilateral adrenal haemorrhage was present in one case. 30 cases showed severe liver injuries.

Ari Leppaniemi et al (1995) evaluated fourteen cases of blunt renal trauma. Of the 14 cases, 11 were male, and the mean age was 38 (range, 16-76) years. The trauma mechanism was fall in nine, personal assault in three and motor vehicle collisions in two cases. Three cases had a minor (grade I to II) renal injury. Nine of 11 cases with a major (grade III to IV) renal parenchymal injury suffered a grade III laceration. A perineal haematoma was present in 11 cases. None of the cases had a complete devascularizing renal injury. The mean ISS score was 21 (9 to 41). Associated bony pelvis injury was present in one case.

Ari Leppaniemi, Jarmo Salo and Reijo Haapiainen (1995) reviewed 172 cases of truncal stab wounds. There were 144 males and the mean age group involved was 33 years (range, 15 - 83). 147 cases showed abdominal injuries. The wounds were self-inflicted in 52 cases (30%). The site of the wound was the anterior abdomen in 146 cases, the thoraco-abdominal region in 11 cases, the left flank in 5 cases, the right flank in 3 cases, and the back in three cases. Four cases had stab wounds in more than one region.

Barry A. McLellan et al (1995) reviewed 346 front seat vehicle occupants in lateral motor vehicle collisions. Driver side lateral crashes (57%) were more common than passenger side impacts. Over two-thirds of all cases (67.5%) used 3 point lap shoulder seat belt. These victims had a significantly higher mean Injury Severity Score (ISS) (24.7 compared to 20.1 for non-lateral crashes: $P<0.05$). Lateral impact crashes produced substantially more intra-abdominal injuries ($P<0.00001$) as assessed by Abbreviated Injury Scale scores.

Barry M. Renz and David V. Feliciano (1995) studied 254 trauma victims and found that 86.2% were male with mean age involved as 29.8 years (range, 16 to 72 years). The mechanism of injury was stab wound in 122 cases (48%), gunshot wound in 115 (45.3%), shotgun wound in 13 (5.1%) and blunt trauma in four cases (1.6%). Associated genitourinary injuries were present in 8 cases. 75 victims had peritoneal penetration; 64 had a nonbleeding laceration of the liver, spleen or kidney; 18 had a retro-peritoneal haematoma; and 3 cases had a minor superficial laceration of the serosa of the bowel.

B. W. Nolan et al (1995) retrospectively reviewed twenty seven cases of mesenteric injury from blunt abdominal trauma over a period of five years at their level I Trauma Centre. They said that blunt mesenteric injury is rare and can be difficult to diagnose, particularly cases with a devascularizing isolated injury.

D.S. Talton et al (1995) studied 50 trauma cases with fifty seven major blunt injuries to the gut from 1982 through 1993. Thirty two victims (64%) were injured in motor vehicle collisions. Of these, 29 were no restraints; three were wearing lap belts (none wore lap-shoulder restraints). Mean Injury Severity Score (ISS) in cases wearing lap belts was 13.3, compared with 28.6 in the 29 cases who were not using restraint devices ($P<0.01$). Small bowel perforations were the most frequent injuries followed by devascularization of the small bowel, colorectal injuries, duodenal and gastric perforations. Except for those victims with perforations of the small bowel, most cases had associated injuries to the head, chest or abdominal solid organs. They stated that injuries to the

abdominal hollow viscera are unusual following blunt trauma, but are the result of very high energy truncal trauma, and are associated with multiple additional injuries.

Frederick D. Brenneman et al (1995) studied penetrating abdominal trauma cases from January 1991 to November 1994 in Toronto (To) and from April 1994 to January 1995 in Chicago (Co). There were 67 cases at To (1.4 per month) compared to 161 cases at Co (18 per month). Stab wounds were more common (55%) at To while gunshot wounds predominated (64%) at Co ($P<0.01$). In To, the mean Abdominal Trauma Index (ATI) was 15 +14. This compared to a mean ATI of 18+17 at CO.

Gavin W. Bowyer (1995) reviewed 123 Afghan War casualties during five days period. The majority of injuries were caused by fragments (68% of casualties) followed by gunshots (22.8%) and mines (11%). Abdomen and pelvis showed 99 (8.1%) fragment wounds and 10 (28.6%) gunshot wounds. Seven cases showed penetration of the abdomen.

G. C. Velmahos et al (1995) analysed 551 cases (428 males and 123 females) of spinal cord injury. The mean age was 28 years (range, 13-61 years). The mechanism of injury was motor vehicle crashes in 30%, stab wounds in 26%, gunshot wounds in 35% and miscellaneous causes in 9% cases. The level of injury was lumbar in 82 cases. In the stab wound group, the kidney sustained a severe injury in four cases and the inferior vena cava was injured in one case. In the bullet injury group, the large bowel was injured in 35 cases (with the bullet retained in the body in 17 cases), the small bowel in 24 (bullet retained in 8), the stomach in 11 (bullet retained in 6) and the other organs (inferior vena cava, aorta, kidney, liver, spleen, etc) in rest of the cases.

G. Regel et al (1995) reviewed 3406 multiple trauma cases between 1972 and 1991 and found majority of cases in males (73.7%). 83% to 89% of the injuries were due to motor vehicle crashes. Only 4% cases suffered penetrating trauma (2.7% gunshot wounds and 1.3% stab wounds). Thirty six and two tenths percent of cases had intra-abdominal lesions and 28% cases showed pelvic injuries. Diaphragm rupture was present in 1.7% cases. Rupture of liver and spleen was present in 32% and 38% cases, respectively. Incidence of renal trauma was 4.5% to 15.2%. Eighty seven and six tenths percent cases had fractures of the pelvic ring, 38.8% of which were associated with acetabulum fractures. Isolated acetabulum fractures were found in 11.7% cases, complex fractures (i.e. including severe soft tissue trauma, and/or injuries of the pelvic organs) in 14.7% cases and complex open fractures in 3% cases. There was increase in pelvic trauma from 74 in the first decade (1972-1981) to 85 cases a year in the second decade (1982-1991).

G. Scannell, K. Waxman and G.T. Tominaga (1995) studied 364 paediatric trauma cases (aged 18 years or less) between 1985 and 1993. Their mechanism of injury were: motor vehicle accidents in 93(25%), pedestrians struck by vehicles in 93(25%), motorcycle or bicycle accidents in 55 (15%), falls in 25 (7%), sport related injuries in 9 (2%) and gunshot and stab wounds in 43 (12%) cases. Average Injury Severity Score was 27.0 + 21.4. Average Trauma Score was 11.7+ 4.1. 114 victims (31%) had abdominal and pelvic injuries.

I.H. Van Veen et al (1995) analysed thirty-nine cases with unstable pelvic fractures. The mean age of the group was 41 years (range, 15-77). Of these cases, 35 had sustained high energy trauma. The mean Hospital Trauma Index-Injury Severity Score of the population was 32(16-66). Sixteen victims had a type B fractures and 23 had a vertical instability (type C) fractures. In two cases, an open fractures was seen. Eight cases showed damage of the urogenital system and three cases had rectal injuries.

J. Medica and A. Caldamone (1995) studied paediatric renal trauma cases and found that blunt renal injuries are the cause of greater than 90% of renal injuries in children. They said that the kidney is the most common organ injured in blunt abdominal trauma. A vast majority of these injuries are the result of motor vehicle accidents. Children with congenital malformations of the kidney, such as uretero-pelvic junction obstruction, have been thought to be at an increased risk for a renal injuries when they sustain blunt abdominal trauma.

Joseph M. Klausner and Ron R. Rozin (1995) studied 122 cases of war casualties and found abdominal injuries in 96 cases. Eighty two (67%) cases had penetrating injuries; 61 from shrapnel and 21 from gunshot wounds. Forty (33%) suffered blunt trauma, nine (7%) burns, and four (3%) blast or crush injuries. The average number of abdominal organs injured per case was 1.8. Only in 27 out of the 96 (28%) cases with abdominal trauma was the injury confined to the abdomen.

J.R. Garrison et al (1995) analysed 70 trauma cases between 1989 and 1994. They found that majority of the cases had Grade IV/V liver or intra-abdominal venous injuries. The Injury Severity Score (ISS) was 38 on the average.

J.S. Augenstein et al (1995) studied occult abdominal injuries in the air bag protected 60 crash victims. The variety of abdominal injuries were found in vehicle occupants despite use of airbag protection. For the abdominal injury cases studied, deformation of the steering wheel system was the vehicle characteristic most frequently observed. They said that trauma victims should be carefully examined for any internal abdominal injuries in the presence of steering wheel deformation.

M.H. Craig et al (1995) studied 13 victims with major pancreatic injuries from blunt trauma. Twelve had been involved in motor vehicle collisions, none of whom were wearing seat belts. One victim was injured in an assault. Five cases had associated injuries to other abdominal viscera. Injuries were equally distributed throughout the pancreas, with two injuries in the head, three in the body, five in the tail and three with injuries in both the head and the body. Five cases had ductal injuries. Injury Severity Score averaged 28.5+2.6 (mean + standard error).

M. Ndiaye et al (1995) analysed 179 cases of trauma. Road accidents was the leading cause for these trauma cases. The initial mortality was 16.20% (29 cases) which was primarily due to abdominal injuries; mainly haemorrhage with haemoperitoneum in 44.82% of the cases.

P. Catoire et al (1995) evaluated seventy multiple trauma cases between January 1992 and June 1993. The age group involved was 38 " 17 years. The male/female ratio was 51:19. Injury Severity Score for all the cases was 37 " 10. Most common mechanism was car accidents (30 cases), followed by motor cycle accidents (17 cases) and falls (14 cases). Abdominal trauma was found in 26 cases.

P. Luthje et al (1995) analysed 1212 victims of pelvic fractures in Finland in 1988 and found that the overall incidence in women was 29/10 (5) and in men 20/10 (5). The female to male ratio was 2.9 in victims who were over 49 years of age, while in younger age groups, the ratio was 0.5. Half of the cases were pubic fractures. In half of the cases, the mechanism of injury was a fall and in one quarter, a traffic accident. Slightly more than half of the cases were stable and half of the cases were of moderate severity.

R. Avrahami et al (1995) analysed sensitivity and specificity of laparoscopic autopsy in comparison to conventional postmortem examination. Their sample contained 25 victims of vehicle accidents, gunshot wounds and in hospital trauma deaths. They found that there was a 100% correlation of

both procedures in all accidental cases. The sensitivity of laparoscopic autopsy was 93% for intra-abdominal lesions, with an overall sensitivity of 91%. For the retro-peritoneal area, the sensitivity was 58% owing to an intra-renal tumor and an extra peritoneal rectal tear in the small sample of in-hospital deaths. The specificity of laparoscopic autopsy reached 94%. They concluded that laparoscopic autopsy in highly sensitive for intra-abdominal abnormalities, especially in trauma victims. This technique is accurate, minimally invasive, easy to perform and not disfiguring.

R.D. Levy et al (1995) reviewed 26 cases of extra peritoneal rectal gunshot injuries. The average age of the cases was 28 years (range, 17-40 years). There were 23 males and 3 females. Associated injuries were common, occurring in 85.7% of cases. The small bowel was injured in 42% of cases. Concomitant injury to the genitourinary system was noted in ten cases and involved the urinary bladder in eight cases, the left uretero-vesical junction in one case, and the right testis in another case. Iliac vein, iliac artery and colon were injured in one case each. Pelvic fractures were present in ten cases.

Scott Anderson et al (1995) analysed the charts of 390 traumatized individuals (95% Blunt) with ISS (Injury Severity Score) greater than 12, for the twenty six month period from July 1992 to September 1994. They identified 61 missed injuries (Abbreviated Injury Scale, AIS>1) in 54 victims (13.8%) These injuries included three abdominal injuries.

Simon J. Hall et al (1995) studied fourteen cases of gunshot injuries to the penis and anterior urethra. All the cases were males, in the age group 18 to 43 years. The method of injury was a low velocity hand gun, usually a .22 caliber weapon, in 12 cases, a shotgun in one, and a high velocity hunting rifle in the last case. Nine cases sustained superficial penile wounds. Five cases showed involvement of corpus cavernosum with injury to the scrotum. Bladder rupture was present in one case.

Soumitra Sarkar et al (1995) studied 173 fatalities (155 drivers and 18 passengers) among motorcyclists in Los Angeles County between July 1988 and October 1989. Fourteen percent of helmeted riders had liver injury, compared with 12% of unhelmeted riders. Spleen injuries were present in 11% of cases in both helmeted and unhelmeted riders. The site of injury was kidney and intestines in 3% of cases in both helmet and no helmet use situations. Bladder and urethral injuries were seen in 3% of helmeted riders and 4% of unhelmeted riders. Splenic injuries were commonly seen with concurrent liver injuries.

Thomas E. Shuler et al (1995) reviewed twenty cases with unstable posterior pelvic ring injuries. Average patient age was 34 years with a range of 16 to 65 years. There were 11 males and 9 females. Eleven cases (55%) were injured in a motor vehicle collisions. Three (15%) were injured by a crushing mechanism, three (15%) were injured in a fall, and three (15%) were injured by pedestrian versus auto-collisions. Mean Trauma Score was 14.4, with a standard deviation of 3.3. Injury Severity Score had a mean of 22.9 " 10.6. Pelvic injuries were classified as Tile B (5) or Tile C (15). Associated abdominal injuries were present in nine (45%) cases.

Jan O. Jansen et al (1996) studied epidemiology of pelvic fractures in 628 cases in a Danish County during the 10-year period 1983-1992. There were 385 women and 243 men. The age was on average 58.4 (4-101) years. The incidence was 19 per 100.000 per year. There were no difference in the incidence of pelvic fractures between two sexes upto 70 years of age. In the older persons, the incidence was increasing with a higher incidence among the women ($p = 0.000001$). Severe trauma occurred in 366 victims (58%) and was more frequent in younger age groups (0-59 years). 63% of

the severe trauma was due to traffic accidents. Moderate trauma occurred in 262 cases (42%) and was more common in the older persons (>70 years) and more frequent in the women. 458 victims (73%) had stable fractures and 170 (27%) unstable fractures.

David A. Schulsinger et al (1996) evaluated 20 cases of penetrating scrotal trauma (mean age of 25 years) over a 33 month period. These cases had 21 testicular injuries from gunshot wounds. Nine of these cases (45%) had concomitant urologic injuries, including 7 corpora cavernosa, 3 glans penis, 3 urethral injuries and 1 bladder injury. Four of 9 victims (44%) with concomitant urologic wounds had multiple penile injuries. Four cases (20%) had associated orthopedic injuries.

Elias Degiannis et al (1996) studied 62 cases with penetrating injuries of the iliac arteries from January 1990 to December 1994. Out of these cases, 58 were men and 4 women with the mean age of 30 years (range, 18 to 56 years). Fifty three victims (85.5%) sustained bullet injuries which included injury to Common iliac artery in 26, External iliac artery in 19 and Internal iliac artery in 14 cases. Nine victims (14.5%) sustained knife injuries which included injury to Common iliac artery in 3, External iliac artery in 6 and Internal iliac artery in one case. Small bowel and large bowel injuries were present in 45 and 29 cases respectively. Iliac veins and inferior vena cava were injured in 31 and 7 cases respectively. Bladder was injured in 6 cases. Uterus was involved in 3 cases. Rectal injuries were observed in two cases. Liver, duodenum, and aorta were injured in one case each. Pelvic injuries were present in six cases.

Hunter Wessells, Alexander Meyer and Jack W. McAninch (1996) evaluated 120 cases of penetrating renal trauma between 1977 and 1995. They found that stab wounds accounted for 64% of injuries and gunshot wounds 36% of the injuries. Renal injuries were all lacerations : grade 2 in 31 cases; grade 3 in 71 and grade 4 in 18 cases.

Kevin Cline et al (1996) reviewed 26 cases of penetrating trauma to the male external genitalia between April 1992 and June 1995. These included 23 cases with scrotal trauma and 7 cases with penile trauma (4 cases had both penile and scrotal trauma). Of the scrotal wounds, 19 involved gunshot wounds, 3 involved avulsions, and 2 involved lacerations with sharp objects. Testicle fracture was found in 9 cases, including one who had bilateral fractured testicles. Urethral injury was present in only one case and corpus cavernosum injury was present in four cases.

Kimberly A. Davis, Jeffrey M. Brody and William G. Cioffi (1996) studied 58 cases of blunt hepatic trauma between January 1991 and October 1994. A total of 47 cases had liver injury grades ranging from I to IV (Liver Injury Grading System): 12 (25%) had grade I injuries; 18 (38%) grade II injuries; 13(28%) grade III injuries and 4(9%) grade IV injuries. Two cases showed associated injuries: one case showed a grade IV renal laceration and other case had hollow viscus injury. Average liver injury grade was 2.4+0.9.

Mark B. Noss, Albert Yee and Ronald T. Kodama (1996) reviewed 922 cases of pelvic fractures between January 1986 and June 1994. These cases form 22% of total 4219 trauma cases. 136 cases (3%) had a lower urinary tract injury. 119/136 cases (88%) had an associated pelvic fracture. In cases with a pelvic fracture, 27 male victims (3%) (average age 41, 22-72) had a urethral injury with an average ISS of 31(19-50). Pelvic radiographs in 24 cases showed that there were 4 type A, 13 type B, and 7 type C fractures (Tile Classification). Retrograde urethrograms in 17 cases showed that there were 3 stretch injuries, 4 incomplete, and 7 complete disruptions. Two were not classifiable.

Mary O. Aaland and Ken Smith (1996) evaluated 1873 trauma victims between July 1, 1993 and October 31, 1995. Blunt trauma, including assaults and falls, accounted for 85% of the cases and

remaining 15% cases had penetrating injuries. The average ISS was 11.2. Of 1707 admitted cases, 110(6.4%) were paediatric and 1597(93.6%) were adults. The majority of the missed injuries were nonspinal orthopedic injuries (63% of all delayed diagnoses). All of these fractures were closed. Pelvic fractures were present in 3 cases (7%). Intra-abdominal injury involving small bowel was found in 2 cases (3%).

Paul D. Jo, Roger R. Dmochowski and Morris Gavant (1996) studied 36 cases of blunt traumatic bladder rupture over a four year period. Average age was 32 years (range, 15-62). Twenty-three (64%) victims had extra-peritoneal bladder ruptures, 11 (31%) had intra-peritoneal ruptures, and 2(6%) cases had both intra-and extra-peritoneal ruptures. Thirty-four (94%) victims had associated pelvic fractures.

Peter T. Simonian et al (1996) studied mechanical stability of alternate forms of internal fixation of the transforaminal sacral fractures in the six fresh frozen cadaveric pelvic specimens. The mean age of the donors was 72 years (range, 64-83 years). The unstable transforaminal injury resulted in significant displacements at the symphysis pubis ($p = 0.027$) and across the transforaminal fracture ($P=0.046$), and flexion angulations of the intact ($P=0.028$) and fractured sacro-iliac joint ($P=0.028$).

Raymond S. Rosenbaum et al (1996) reviewed 20 cases of penetrating ureteral injury over a ten year period (1986-1995). Nineteen victims were male and one was female, ranging in age from 15 to 56 years. Nineteen cases had gunshot wounds and one case had a stab wound. All cases had associated injuries; 17 cases with bowel injuries, 8 cases with vascular injuries and 4 cases with other urologic injuries.

Scott A. Kahn et al (1996) studied 38 cases with gunshot wounds to the bladder between January 1990 and November 1994. Of these, 8 cases also had a rectal injury and 2 cases had an additional left ureteral injury. The most common associated injury was the small bowel (20) followed by the colon (11) and rectum (8).

Tyge Lind and Lars Bo llkjaer (1996) analyzed causes of injuries in 113 cases at the railway accident at Mundelstrup the First of March, 1994 when an intercity train (IC-3) smashed into a standing local train (MR). Three main types of injuries observed are as follows:
a) Whiplash=Nine of the 30 persons (30%) in the MR train and ten of the 82 cases (12%) in the IC-3 train had whiplash injuries.
b) Face=Thirteen of the sixteen passengers (81%) sitting in the "fly seats" had injuries of the face, while only 8 (12%) of the rest of the sitting persons in the IC-3 train had these injuries.
c) Thoraco-abdominal = In the IC-3 train, 38 persons were in contact with the tables between the seats and suffered injuries in thorax and abdomen regions.