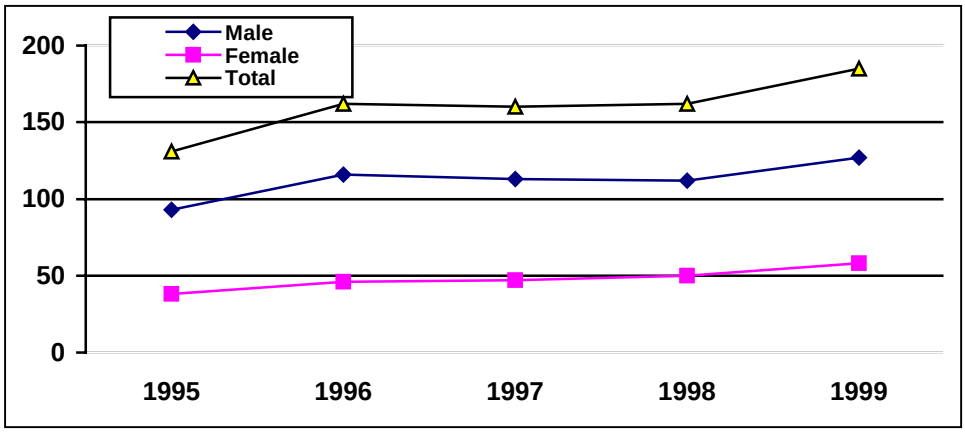
ABDOMINAL INJURY

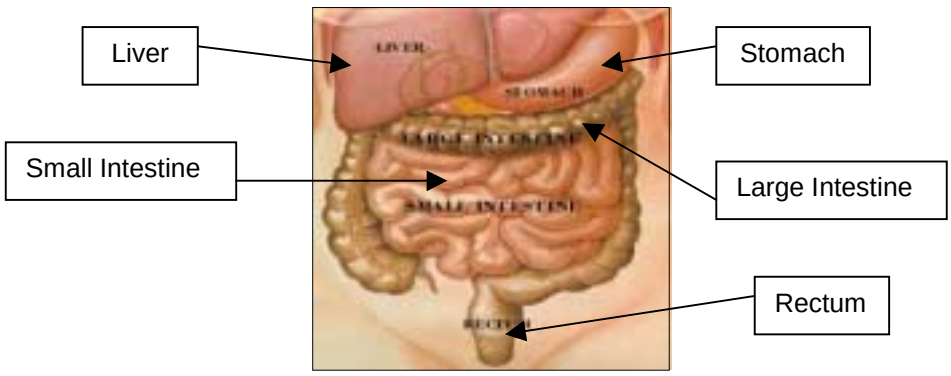
800 patients were admitted to Liverpool Hospital during 1995-1999 with the diagnosis of abdominal injury. 561 (70.1%) of these patients were male, and 239 (29.9%) were female. The average age of the patients was 33 years, however they ranged from one year up to 99 years.

Below is a graph representing the number of patients admitted with an abdominal injury. The graph is broken down into male and female patients, and the years that they were admitted. The male score is more than double the female total. There is also a small upward trend in the number of patients of both sexes with abdominal injury that have been admitted to Liverpool Hospital over the recent years.



What is an abdominal injury?

An abdominal injury is any injury to the abdomen, or any of the organs inside the abdomen. It can arise from blunt trauma (e.g. car crash, fall) or penetrating trauma (e.g. gunshot or stabbing). The abdomen extends from the diaphragm (about nipple line) to the buttocks and contains many organs. These organs vary in their susceptibility to different injury patterns, and this along with their location and function is shown below. Although each organ is dealt with individually, most seriously injured patients will have a combination of damaged organs.



DIAPHRAGM

The diaphragm separates the thorax (chest) from the abdomen. It is shaped like a dome, and is a thin sheet of muscle. Besides separating the chest from the abdomen, the diaphragm also is the most important muscle of breathing. The diaphragm can move 10cm during a breath. It contracts and flattens out during inspiration, thereby providing a larger volume for the air to rush in to the lungs.

Injury to the Diaphragm

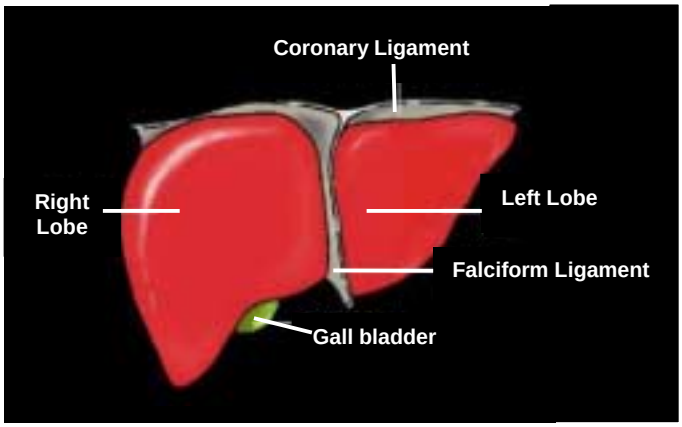
Common Causes - The diaphragm can be injured by blunt and penetrating trauma. Any part of the diaphragm may be damaged, but the left side is more commonly injured because the liver protects the diaphragm on the right side. Most tears in the diaphragm are about 5 – 10 cm in length, but large tears are more common in blunt trauma.

Following an injury, the ability to keep the contents of chest and abdomen separate decreases. Even with small tears, the abdominal contents (usually the bowel) may protrude into the chest cavity creating a hernia. This is rare, but dangerous if the blood supply to the hernia is cut off or breathing is compromised.

Diagnosis - Diaphragmatic injury may be difficult to diagnose unless suspected clinically. Chest x-ray is unlikely to show anything unless there is a hernia. A CT scan may pick up a tear, especially if it is large. Diagnosis may also be made at operation by looking at the diaphragm, either directly by opening the abdomen (laparotomy) or via key-hole surgery using a telescope (laparoscopy).

Treatment - Tears in the diaphragm require an operation in which the abdomen or chest is opened and the hole closed. If the tear has allowed the abdominal contents to move into the chest, the operation may be needed urgently.

Outcome - There are usually no long-term problems associated with injury to the diaphragm once it is repaired. If a tear is not suspected and missed, a hernia may occur several years after the injury.



LIVER

After the skin, the liver is the largest organ in the body. It sits under the diaphragm in the upper right side of the abdomen, where it is protected by the lower ribs. It is a solid organ and has 2 lobes, left and right. The liver has many functions. It is the body's metabolic controller, produces which helps to digest fat particles in food and filters and stores blood. As a result it has a very large blood supply.

Injury to the Liver

Common Causes - Due to its size and site the liver is one of the most frequently injured organs in the abdomen. Both blunt and penetrating trauma can damage the liver. Blunt trauma can cause small bruises and lacerations on the surface up to complete disruption of the liver. The overlying ribs may also be broken, and the sharp ends can cause further damage. Penetrating trauma causes direct damage via the knife or gunshot wound. Liver injury can be life threatening due to haemorrhage because of the liver's rich blood supply. When bleeding is severe, the remaining blood is unable to supply the rest of the body with the normal amount of oxygen. This is called shock.

Diagnosis – This depends on the patient's vital signs and symptoms on arrival at hospital. If stable, a patient may have an ultrasound examination to look for bleeding in the abdomen. They may also have a CT scan, which shows liver injury well. If the patient is unstable or requires an operation for another reason the diagnosis may be made at operation.

Treatment – Many minor liver injuries are now treated with bed rest and no operation. This includes small bruises and lacerations and some more serious injuries may also treated this way if there is little bleeding. If there is a lot of bleeding this must be stopped. This can be done either by blocking the bleeding artery using a small tube guided from the artery in the groin to the right site by x-rays (angiography) or at emergency operation. Sometimes part of the liver is removed.

Outcome – This is dependent on the severity of the injury and the other injuries sustained. Patients with minor injuries often go home after a short

period of bed rest and make a full recovery, however contact sports and other possibly dangerous activities should be avoided until cleared by a doctor. Patients with severe injuries may require several operations, and therefore have a delayed but usually good recovery.

SPLEEN

The spleen is in the upper left side of the abdomen, and is protected by the lower left ribs. It is oval-shaped and about 12cm in length. The spleen's functions are the breakdown of damaged blood cells and the storage and release of blood in times of demand. The spleen also plays an important role in defence against infection. To fulfil these functions the spleen has a good blood supply and 5% of the body's total blood volume passes through the spleen every minute.

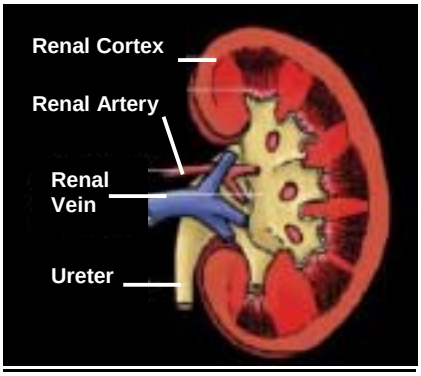
Injury to the Spleen

Common Causes - Like the liver on the right, the size and site of the spleen mean it is commonly injured by both blunt and penetrating trauma. Although the ribs provide some protection, blunt trauma may cause anything from a small bruise to complete disruption, especially if there are rib fractures. Penetrating trauma will cause direct damage from the passage of the bullet or knife.

Diagnosis - This is similar to liver injury.

Treatment – Due to the good blood supply splenic injury may result in heavy bleeding. If this happens the spleen can be removed or repaired at an emergency operation. Angiography may also be used to stem the bleeding. If the blood loss is small and has stopped, bed rest in hospital without an operation may be used.

Outcome – Recovery depends on the severity of the injury and the treatment required. A normal life is possible without a spleen, however there are precautions that must be taken. Its role in defence against infection means that the removal of the spleen can leave the patient open to severe infections. Patients need vaccination against Streptococcus pneumoniae and should take regular antibiotics to prevent any infection starting. Those patients whose injury has not required removal of the spleen may make a full recovery depending on their other injuries. They should not undertake heavy work or contact sports until they are given the go-ahead by their doctor.



KIDNEYS

The kidneys are located on either side, towards the back of the abdomen and below the liver and spleen. Each is about 10-12 cm in length and they are partially protected by the last 2 ribs. Each kidney is composed of millions of nephrons. The nephrons filter the blood, excreting waste products as urine, which travels to the bladder by the ureters. The kidneys also play an important part in the control of blood pressure and red blood cell production. These functions mean that the kidneys also have a good blood supply.

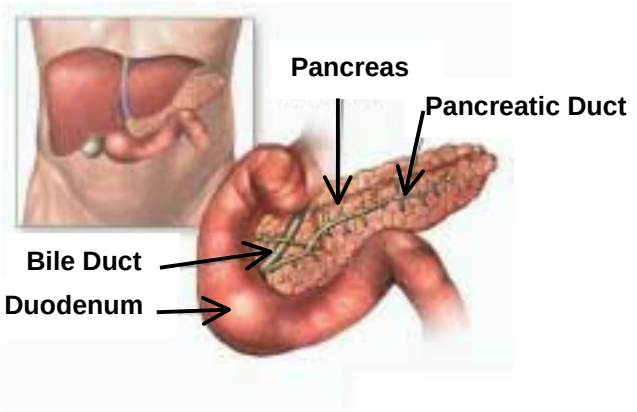
Injuries to the Kidneys

Common Causes – Like in the liver and spleen, penetrating trauma causes direct damage to the kidneys, whilst blunt trauma may produce a range of injury from minor bruising to fragmentation.

Diagnosis - Blood in the urine is a sign that there is a kidney or urinary system injury, although it is not always present. Diagnosis of injury to the kidney may also be made by ultrasound or CT or at operation.

Treatments - Most injuries to the kidney are minor, and do not require an operation or removal of the organ. As with injuries to the liver and spleen if the patient is stable, the doctor may decide that it is most appropriate to treat the injury without an operation. In the event of heavy bleeding, an angiogram or the removal of the kidney will be needed.

Outcome - It is possible to live with only 1 kidney as long as it is functioning normally, which is why people can chose to donate a kidney in special circumstances. Other kidney injuries not requiring removal do well with observation and rest. These patients will usually make a full recovery, other injuries allowing.



PANCREAS

The pancreas is about 12.5cm long and is situated behind the stomach. It produces digestive enzymes and excretes these into to the duodenum – the beginning of the small bowel. The pancreas is divided into three areas – the head, the body and the tail. The other function of the pancreas is the control of blood sugar levels by producing insulin and glucagon.

Injury to the Pancreas

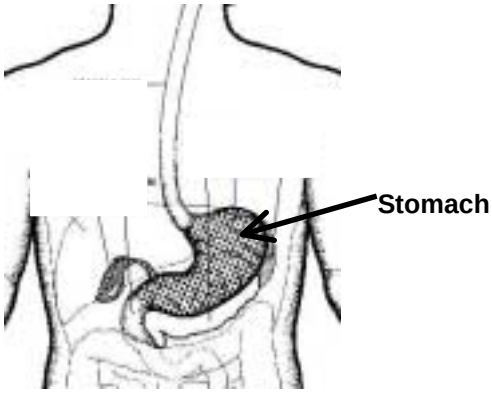
Common Causes – A large percentage of pancreatic injury results from penetrating trauma. The pancreas is surrounded by other organs and relatively cushioned from blunt trauma, except crush injuries. In these, the pancreas is crushed against the spinal column by, for example, the handlebar of a bicycle.

Diagnosis

Diagnosis of pancreatic injury is difficult. A high index of suspicion remains the doctor's greatest weapon in recognising the injury. An abdominal CT will show any damage, although this may not be obvious if the test is done immediately after admission.

Treatment - Minor injuries can be treated without an operation. Severe injuries may need the removal of all or part of the pancreas.

Outcome - Outcomes do vary. The pancreas is holds many digestive enzymes. If it is injured these enzymes can leak and start damaging the surrounding tissues causing an abscess. Even minor injuries can have this result and as a result the overall outcome is difficult to predict from patient to patient.



STOMACH

The stomach is the organ in which digestion starts. On swallowing food travels down the oesophagus (gullet) through the chest to the stomach, which is located just under the diaphragm on the left. The stomach contains extremely acidic digestive juices. Once the food has been liquefied and partially digested it passes into the duodenum. Empty, the stomach is around the size of a large sausage, but it can change size to accommodate a large amount of food.

Injury to the Stomach

Common Causes - The stomach is rarely damaged by blunt trauma due to its location and flexibility. Penetrating trauma may produce stomach injuries.

Diagnosis – This is made by a combination of patient signs and symptoms as well as suspicion generated by the site of a wound. Patients have rapidly developing upper abdominal pain because the acidic stomach contents have leaked into the abdomen.

Treatment – A naso-gastric tube is put down into the stomach via the nose. This drains out any food or fluid that is still in the stomach. An immediate operation to repair the injury and clean the surrounding contaminated organs is needed.

Outcome - The outcomes associated with injury to the stomach are usually good, with patients recovering quickly after the operation.

SMALL BOWEL

As food leaves the stomach it enters the small bowel or intestine. It is divided into three parts – the duodenum, the jejunum and the ileum - and is over 6 meters long. The duodenum is closely related to the pancreas and the other two parts lie in loops in the abdomen. The function of the small bowel is the digestion and absorption of food.

Injury to the Small Bowel

Common Causes – After the liver and spleen, the small bowel is the third most commonly injured abdominal organ, as it is vulnerable to seat belt injury. In a car crash the abdomen is squeezed between the seatbelt and the spine. Crush injuries of the duodenum and pancreas may be caused and the sudden increase in pressure may produce a blow-out rupture of the rest of the small bowel. The small bowel occupies a large volume of the abdomen and therefore is likely to be damaged in any penetrating trauma.

Diagnosis – If the patient is unstable immediate operation is required. Stable patients in whom the small bowel injury is suspected should have a Diagnostic Peritoneal Lavage as part of their investigations. If this test is positive, an emergency operation will be required.

Treatment - Patients who have small bowel injury require an operation. At this operation the entire length of the small bowel can be checked for damage and repaired or removed. If a resection is needed the two ends of undamaged bowel are joined together or tied off and joined at a later operation.

Outcome - This depends on the extent of the damage to the small bowel and injuries to any other organs. Simple bowel injuries that are operated on soon after injury usually do well, and the patients can return to pre-injury function in a relatively short time. Complex injuries with severe damage to bowel and other organs are more difficult to treat, and usually have a much longer rehabilitation with more complications.

LARGE BOWEL

The large intestine starts in the right lower part of the abdomen when the small bowel empties into the caecum. The colon travels up the right side of the abdomen (ascending), across the upper abdomen at the back (transverse) and down the left side of the abdomen (descending) before the sigmoid colon joins the rectum and anal canal.
The large bowel absorbs water and any remaining nutrients from food to form faeces, which is stored in the rectum before elimination. The large bowel contains many bacteria which assist its function.

Injury to the Large Bowel

Common Causes - Most large bowel injuries are due to penetrating trauma. These injuries may be lethal, because an injury to the large bowel will allow faecal and bacterial contamination of the abdominal contents.

Diagnosis - when there is suspicion that the large bowel has been damaged, a Diagnostic Peritoneal Lavage may help to confirm this and determine the need for operation. Unstable patients should have an operation without any investigations.

Treatment - One method of operation will repair the damaged bowel, with or with out removing some, and clear any contamination. An alternate method cleans the area, removes the damaged section and then brings a piece of bowel out through the skin so that faeces does not enter the damaged abdomen – a colostomy. At a later operation this may be reversed and the bowel rejoined and placed back into the abdomen, so that the bowel can function as normal.

Outcome - This is dependent on the location and amount of tissue destruction as well as other injuries. The main problems in large bowel injury result from severe infection due to faecal contamination of the abdomen. The post-operative path will vary from patient to patient.

TESTS PERFORMED ON PATIENTS WITH ABDOMINAL TRAUMA

The abdominal examination is the first test Inspection is part of this examination. Inspection in this patient reveals a severe seat belt bruise. This suggests there may be injury to the small bowel.

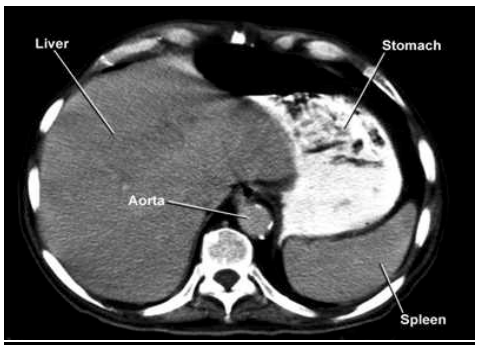
The lap part of the seatbelt should be placed over the iliac crests (the bony parts of the pelvis). When the seatbelt is worn incorrectly (over the abdomen), or if it rides up during the time of injury, the seatbelt can cause injuries like this.

Abdominal Examination - a doctor thoroughly examines the abdomen for tenderness and other signs that there may be damage to underlying structures. This examination precedes any other investigation and may determine following investigation or operation.

Diagnostic Peritoneal Lavage (DPL) - a surgeon makes a small cut under the umbilicus (the navel) into the peritoneum, the sac that surrounds some of the organs in the abdomen. A tube is passed and fluid infused into the peritoneum. The fluid is then removed and tested for blood and enzymes that are found in the small bowel. If these are positive the patient requires an operation because it means that an organ has been bleeding or the small bowel has been perforated. DPL's are rarely done in children and the use of DPL in adults is declining as ultrasound and CT increases. DPL is the best test to investigate possible small or large bowel injury.

Abdominal Computerised Tomography (CT scan) - This test is especially good at identifying injuries solid abdominal organs such as the liver or spleen. The computer uses x-rays to produce cross-sections or slices of the abdomen. Scans can only be performed on stable patients so an abdominal CT is not the investigation of choice in all patients.

This is a photo of one of the CT scanners at Liverpool Hospital.
The patient is put on the table and it moves in and out depending on what needs to be scanned. Any part of the body can be scanned.



This is an abdominal CT scan. Some of the organs are labelled.

X-rays – X-rays of the chest, pelvis and neck are standard in all patients brought to hospital with anything more than minor trauma.

Focussed Abdominal Sonography in Trauma (FAST) - this is a trauma-specific ultrasound that looks for "free fluid" in areas of the abdomen where blood is likely to accumulate if there is intra-abdominal bleeding. Ultrasound is the test allows a pregnant woman to see her baby for the first time, although it has many other uses. This is a service that is relatively new to Liverpool Hospital, and can only be performed by selected staff that is accredited.

This is the FAST machine that we use at Liverpool.

Laparotomy – this is an operation on the abdomen. In the emergency trauma patient, the surgeon makes an incision through the midline from the bottom of the chest where the sternum ends to the pubic bone. This allows inspection of the whole abdomen and repair or removal of any damaged organs.

SPECIAL CONDITIONS

Pregnancy and abdominal trauma

Trauma in pregnancy is more common than it used to be as more women maintain normal activity right up to the time of delivery. The stage of pregnancy has a direct effect on the outcome for the mother and her baby. Early in the pregnancy, the uterus is well protected by the abdominal organs and the pelvis. As the pregnancy continues and begins to show, the uterus grows out of the pelvis, which increases the risk of injury to the baby.
The most common complication of injury is premature labour. Rupture of the uterus, direct injury to the child and disruption of the placenta may also occur. Treatment of the mother takes priority for the medical team as then her body will look after the child. On very rare occasions emergency delivery is needed.

COMMON QUESTIONS

What does “fractured” mean?

Fractured is another word for broken. If you have fractured ribs, then they are broken.

What is “shock”?

Shock is not being frightened by an event and is not treated with a cup of tea or counselling. Shock is a failure to deliver sufficient oxygen to the cells in the body’s tissues and organs. There are many different causes of shock. The most common one in trauma is due to loss of blood and is called hypovolaemic shock. When a patient bleeds it may be internal or external. External bleeding is obvious and can be seen on the floor or the patient. Internal bleeding may be in the chest, the abdomen, the pelvis, or the long bones of the arm or leg. The treatment of shock is to locate the source of bleeding and control it with pressure, splinting or operation. The blood loss is then replaced initially by sterile fluids and then donated blood.

If the seat belt causes injuries, is it better not to wear it?

Definitely NOT! In Australia, we are required by law to wear seatbelts in the front and the back. Regardless of this, there are several important reasons why we should wear seatbelts. The seatbelt acts as a restraint in the event of a crash. If a person is not restrained in a crash, especially at speed, they are likely to be thrown about inside the car. As a result they will sustain increased injuries and may collide with other occupants also injuring them. Unrestrained car occupants may also be ejected from the vehicle through the windscreen or windows and receive further injuries on striking the ground. Ejection from a vehicle carries a very high risk of death or very serious injury. Seatbelts do cause some injuries but prevent many more and worse ones. If worn correctly seat belts are safe. The correct position for a seat belt is across the chest and lap, not across the lower neck and abdomen. This is especially important for children.

BETTER PRACTICE GUIDELINES

Better Practice Guidelines are available on a number of health related issues. These guidelines are compiled with the assistance of expert advice and research.

There is a collection of practice guidelines from various international sources of abdominal injury. One guideline deals with the evaluation of blunt abdominal trauma from the Eastern Association of Surgery in Trauma (EAST).

FACILITIES AT LIVERPOOL HOSPITAL

Intensive Care

The Intensive Care Unit consists of 22 beds. Seriously ill patients receive one-to-one nursing. Specialist doctors with expertise in caring for ill patients with complex needs provide the medical care. Patients who have suffered major abdominal trauma may be admitted to this unit for further treatment and monitoring before or after operation.

Ward

The Trauma, Orthopaedics and Plastics ward where most of the patients with abdominal injuries are admitted is on the third floor of the clinical building. The ward has 40 beds, with a staff ratio of one nurse to five patients. The phone number for the ward is (02) 98283103.

Social Worker

Liverpool Hospital has social worker facilities provided throughout the duration of hospital stay. A social worker is alerted to the arrival of a trauma patient in the Emergency Department, and will provide any necessary assistance.

For the rest of the hospital stay, social work cover and help is available in Intensive Care, the ward and the Brain Injury Unit. Social workers will also assist in the completion of Workcover and sick entitlement forms.

OTHER INFORMATION

Health at Yahoo

Health at Yahoo provides a dictionary of medical terms with easy to understand answers.
www.health.yahoo.com