

# **Hernias**

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## **Introduction - Hernias**

Hernias were once the leading cause of acute intestinal obstruction. Public awareness and general policy of early repair has markedly reduced the frequency of incarceration of intestine in these musculofascial defects. The common sites for these defects, in order of frequency, are inguinal, umbilical, incisional and femoral. Techniques of repair continue to evolve but tension-free, mesh repairs are the current standard.

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## **Objectives - Hernias**

At the completion of the basic clerkship, the student should be able to:

1. Take a history and elicit, on functional inquiry, those factors that might pre-dispose to the development of a hernia.
2. Perform a physical examination that reflects knowledge of the anatomy of hernia at the inguinal or femoral canal.
3. Define the term "direct" and "indirect" as applied to inguinal hernias.
4. Develop a differential diagnosis in the case of a mass in the inguinal or femoral region, or in the scrotum, making reference to the features that may distinguish hernias from other soft tissue masses.
5. Describe the complications of untreated abdominal wall defects.
6. Define the terms "incarceration" and "strangulation".
7. Describe the basic principles of a surgical repair of a "direct" and "indirect" inguinal hernia.

## **Background Information**

## **Hernias – Background Information**

### **I. History of Inguinal Hernia Repairs**

Inguinal hernia repair began with the Greeks and Egyptians who used tightly fitting bandages and trusses. The first surgeries employed by the Greeks involved incision of the scrotum and dissection of the hernial sac; the wound was left open to granulate or cauterized to augment healing.

Galen developed the concept of hernia formation by “rupture” in the 2<sup>nd</sup> century. Before the first human dissections, he postulated that a hernia was formed by rupture of the peritoneum and stretching of the fascia and muscles. Another Grecian, Paul of Aegina, was the first to differentiate incomplete from complete inguinal hernias in approximately 700 AD. Complete hernias composed of the hernial sac entering the scrotum; for this he suggested ligature of the sac and spermatic cord with amputation of the testicle.

Little changed until the 14<sup>th</sup> century when Guy de Chauliac distinguished inguinal from femoral hernias. He also developed reduction techniques, utilizing taxis and the Trendelenburg position to aid in the reduction of incarcerated hernias. In the 15<sup>th</sup> century, much to the chagrin of the medical establishment, barber surgeons developed a safe technique to reduce a strangulated bowel without perforating it.

During the Renaissance, human dissection flourished and the subsequent knowledge of anatomy allowed for the development of relatively effective surgical techniques. Despite the newfound anatomy knowledge, any attempts to open the inguinal canal lead to sepsis. This halted further advances in hernia surgery until Lister, a British surgeon and professor, developed the first aseptic techniques utilizing undiluted carbolic acid dressings.

Marcy, Lister’s first American pupil, published a paper on antiseptic hernia repairs using carbolized catgut ligatures. Despite advances, reoccurrence rates and surgical complications were high.

In the late 19<sup>th</sup> century Edoardo Bassini, a Venetian physician developed a surgical technique that recreated the deep and superficial inguinal rings. His technique was quickly adopted by the medical establish and modified to improve its durability.

Today various surgical techniques have been developed through years of trial and failure. Techniques are still changing today. No single repair has been shown to be superior in all cases. Surgeons today still battle the imperfections of hernia repair that frustrated their forefathers. Many surgeons prefer the time tested sutured repair, while new laparoscopic techniques have be proven effective in the proper hands. Today the open tension-free prosthetic mesh repair is popular among surgeons.

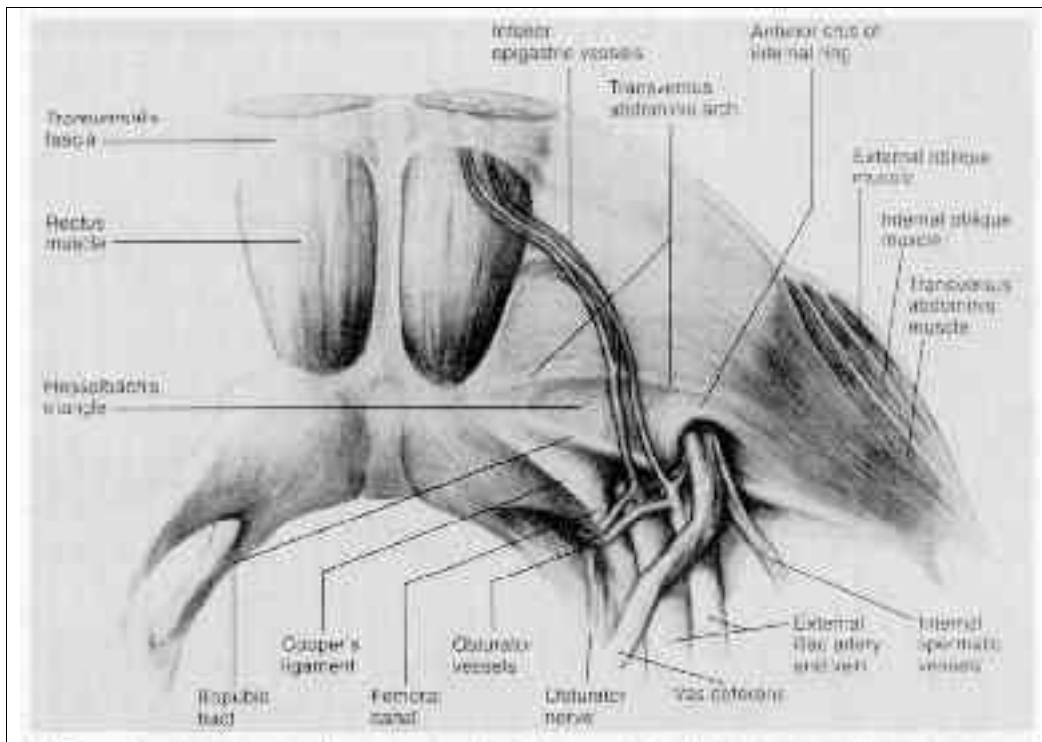


Patients with incarcerated hernias presenting to emergency rooms are not sent to ride horses or dangled up side down. However, serious efforts with pressure and manipulation supplemented by analgesics and sedation are periodically displayed in present day emergency rooms. If an incarcerated hernia reduces spontaneously after analgesia and recumbence or is soft and non-tender, reducing on gentle pressure, this is a reasonable intervention. Exceeding these boundaries however is **not** reasonable. These patients should have urgent operative intervention.

## II. Anatomy of the inguinal & femoral region

Intimate knowledge of inguinal anatomy is required for a surgeon to perform effective hernia repairs. Delicate nerves and vessels, the spermatic cord and layers of intertwined fascial and muscular planes must be identified during surgery. Fortunately the anatomy of groin is relatively consistent between individuals, and

only the hernia itself varies in size, location, and composition.



This illustration of the posterior anatomy of the inguofemoral region demonstrates some of the basic surgical anatomy required for effective hernia repair. (taken from Sabiston: Textbook of Surgery Sixteen Edition)

### a) Inguinofemoral region

Alike the rest of the abdominal cavity, the inguofemoral region is lined by **peritoneum**. The **preperitoneal space** intervenes between the peritoneum and the **transversalis fascia**. Adipose, blood vessels, nerves and the ductus deferens run in the preperitoneal space.

The **external iliac artery & vein** pass under the iliopubic tract through the femoral canal where the arteries give rise to the **inferior epigastric & deep circumflex arteries**. The **external iliac vein**, running posteriomedial to the accompanying artery, **receives** venous blood from the **inferior epigastric veins**. Moving medial from the femoral canal the external iliacs give a pubic arterial branch that gives off the **obturator artery** crossing **Cooper's ligament** entering the obturator foramen.

## **b) Inguinal canal**

In the adult, the inguinal canal is approximately 4cm long, running superior to the inguinal ligament from the internal ring (deep ring) to the external ring (superficial ring). In the male the canal contains the spermatic cord, in females it contains the round ligament of the uterus. In both sexes it contains blood and lymphatics along with the **ilioinguinal nerve**.

Lateral to the inferior epigastric artery and 1.25 cm superior to the middle of the inguinal ligament is the **deep (internal) inguinal ring**. The ring is formed by an out pouching in the transversalis fascia that continues down the canal forming the superficial walls (**internal fascia**).

The **superficial (external) inguinal ring** is formed by an opening in the external oblique aponeurosis as it arches from the inguinal ligament, up over the inguinal canal inserting on the pubic crest.

The **anterior wall** of the inguinal canal is formed by the aponeurosis of the external oblique. The lateral portion of the canal is reinforced by the internal oblique.

The **posterior wall** of the inguinal canal is formed mainly by the transversalis fascia with the medial portion reinforced by the **conjoint tendon** (internal oblique and transverse aponeuroses merging at the pubic tubercle).

The arching internal oblique and transverse abdominal muscles form the **roof** of the canal. The superior portion of the inguinal ligament forms the **floor**. The **lacunar ligament**, formed by an extension of inferior portion of the inguinal ligament, helps reinforce the most medial portion of the floor and can be demonstrated inserting on the pectineal line of the pectin pubis.

## **c) Iliopubic tract**

The iliopubic tract, or **deep crural arch**, is a thickening in the inferior margin of the transversalis fascia that can be seen

running deep to the inguinal ligament and inferior epigastric vessels supporting the floor of the canal.

The iliopubic tract runs from the iliopectinal arch to the superior pubic ramus and can only be appreciated when viewing the region from an internal (intra-abdominal) aspect. The tract serves as an invaluable landmark during laparoscopic inguinal hernia repair.

#### **d) Hesselbach's triangle**

Hesselbach's (inguinal) triangle is bordered superolaterally by the inferior epigastric vessels, medially by the rectus sheath and inferiorly by the inguinal ligament.

Hernias occurring in the inguinal triangle are considered **direct inguinal hernias**, whereas **indirect hernias** occur lateral to Hesselbach's triangle (lateral to the inferior epigastric vessels) following a patent processus vaginalis.

#### **e) Cooper's ligament**

Cooper's ligament is located on the posterior aspect of the superior ramus of the pubis, formed by periosteal and fascial tissue. Cooper's ligament is used as a fixation point in laparoscopic and open repairs.

#### **f) Preperitoneal space**

This space is mentioned due to the nerves, lateral femoral cutaneous nerve & genitofemoral, that course through it and are easily disturbed by hernia surgery.

The **lateral femoral cutaneous nerve**, of L2/L3 origin, courses along the iliac muscle exiting at the anterior superior iliac spine (lateral attachment of the inguinal ligament).

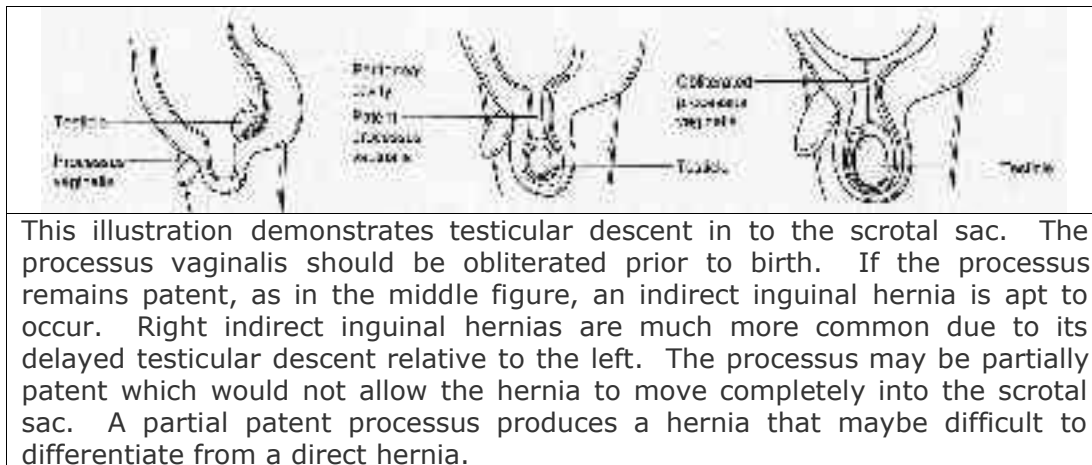
The **genitofemoral nerve**, of L2 or L1/L2 origin, descends along the anterior belly of the psoas forming the genital branch that enters the inguinal canal via the deep ring and femoral branches that enter the femoral sheath.

Also coursing through the preperitoneal space are vessels; external iliac vessels, the inferior epigastric artery and veins, the obturator artery, and the arteria corona mortis. The **ductus deferens** courses from a superiolateral location entering via the deep inguinal ring

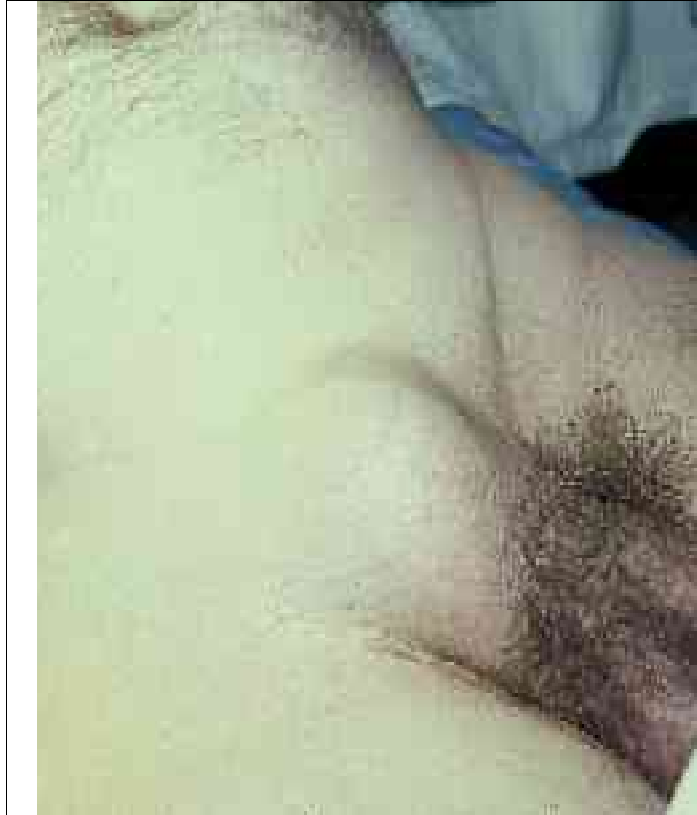
### III. Inguinal and Femoral hernias

#### a. Indirect Inguinal Hernia

An **indirect inguinal hernia** occurs when any intra-abdominal structure protrudes through the deep inguinal ring entering the inguinal canal. An indirect inguinal hernia is a congenital lesion. The processus vaginalis must be patent for this type of hernia to occur. A patent processus vaginalis alone is not sufficient for an indirect hernia to occur; other factors must be in place. A patent processus vaginalis is relatively common in males, occurring in approximately 1/5.







This right inguinal hernia does not descend into the scrotum. Determining whether this is a direct or indirect hernia would be difficult on physical exam, and making this distinction has little clinical relevance. Obviously, demonstrating the anatomical origin of the hernia at surgery is very important, as a high ligation or closure of the sac is essential for control of an indirect hernia and repair of the fascial defect is required for a direct hernia.

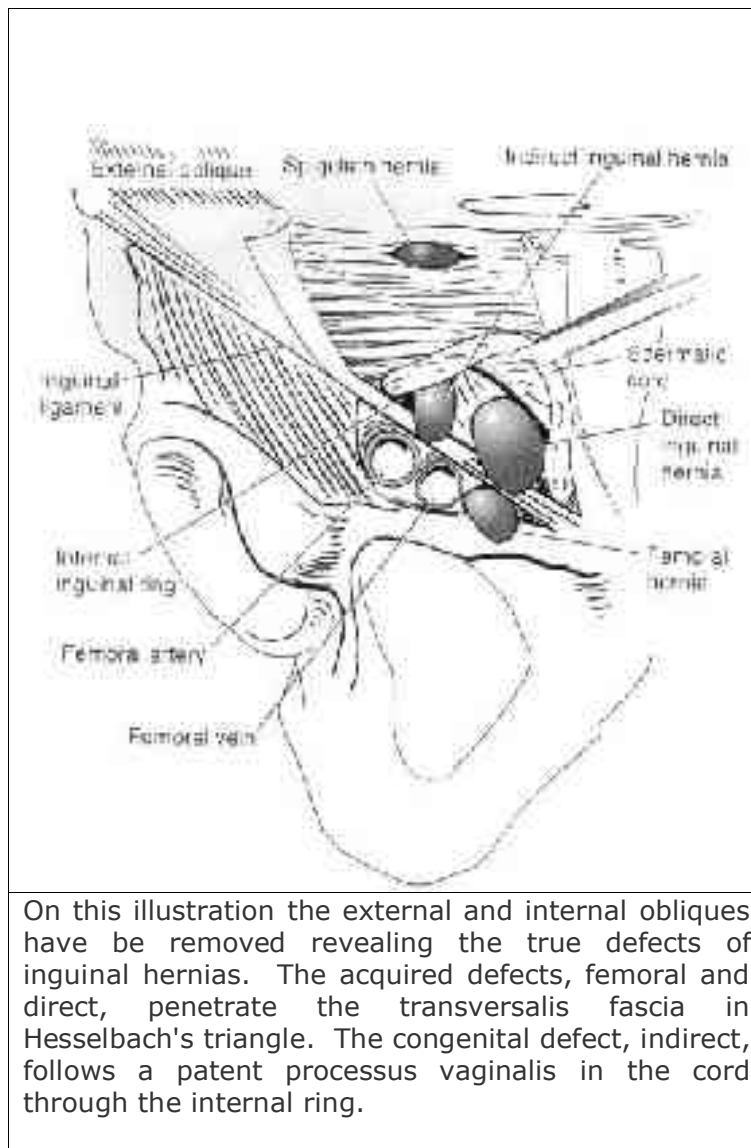


As seen in this picture the patent processus is open to the scrotum and the indirect hernia has descended into the scrotum and can be readily identified as an indirect inguinal hernia on physical examination (complete indirect inguinal hernia). The sac is in the spermatic cord, lying anterior to the other structures.

## **b. Direct Inguinal Hernia**

A **direct inguinal hernia** occurs when the posterior abdominal wall is directly penetrated at Hesselbach's triangle by intra-abdominal structures. Unlike the indirect hernia, direct hernias are acquired lesions and do not rely on a patent processus vaginalis to form. For this reason they tend to occur in older men, where the posterior abdominal wall is weaker. Once the "posterior" wall of the inguinal canal [transversalis fascia in Hesselbach's triangle] is breached, preperitoneal fat is the first tissue to extrude, sometimes followed by a peritoneal sac. The sac is usually small, with an open neck, and therefore lower risk to incarcerate. During repair, it is seldom necessary to open the

sac or try to excise it. The herniated tissue is simply pushed back and the fascial defect occluded by a mesh “plug”.



### a. Femoral Hernia

A **femoral hernia** is much like a direct inguinal hernia. It penetrates the posterior abdominal wall directly and is an acquired lesion. A femoral hernia occurs through Hesselbach's triangle below the iliopubic tract; a space bounded superiorly by the iliopubic tract, inferiorly by Cooper's ligament, laterally by the femoral vein, and medially by the insertion of the iliopubic tract into Cooper's ligament. Unlike inguinal hernias, femoral hernias

occur more commonly in females.



This femoral hernia was mistaken for large inguinal lymph node. A request for an excisional biopsy was made. Always develop a differential diagnosis for a groin mass. There are visible, peristalting bowel loops behind this patient's thin abdominal wall, suggesting incarceration and obstruction of the small bowel.

✓✓



In this thin patient, the hernia could be identified as femoral by its location *below* and *lateral* to the pubic tubercle. The base is broad and firmly tethered with the mass tender and non-compressible. There were early symptoms of intestinal obstruction.

#### d. Incidence of Inguinal and Femoral Hernias

	<b>Direct</b>	<b>Indirect</b>	<b>Femoral</b>
<b>Men</b>	40%	50%	10%
<b>Female</b>	rare	70%	30%
<b>Children</b>	rare	All	rare

**75%** of all hernias occur in the inguinal area, half of which are indirect inguinal hernias. Femoral hernias account for only 3% of all hernias. The vast majority of hernias occur in males, although femoral hernias are more common in females (5:1 = female:male). One quarter of all males with develop an inguinal hernia in their lifetime, verses only 3% of females

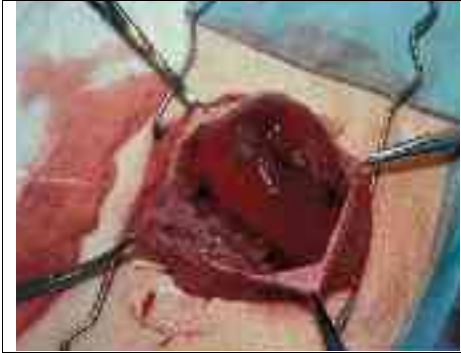
**Indirect inguinal hernias** are considered a congenital lesion, where a patent processus vaginalis is required for hernia development. For this reason indirect hernias can be seen at any age. **Right-sided** indirect inguinal hernias are more common due to the delay in descent of the right testis.

**Femoral & direct inguinal hernias** are acquired lesions, where weakening of the abdominal wall is required for this lesion to occur. For this reason direct inguinal hernias are commonly seen in older males and femoral hernias are seen in both older males and females

#### IV. Umbilical hernias

##### a. Umbilical Hernias

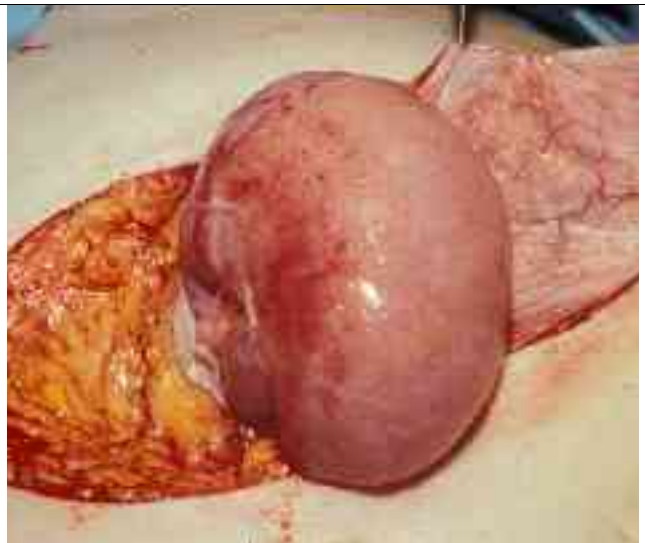
Umbilical hernias occur in three forms, with the most common type also being the least threatening. This **simple umbilical hernia** occurs when a small defect, caused by incomplete closure of the umbilicus, allows intra-abdominal contents to protrude through the abdominal wall. The defect may be insignificant during youth, only to weaken and stretch with age allowing for the development of a hernia.



Umbilical defects approaching 2 cm in diameter with a rigid margin, pose a risk of incarceration and strangulation. The patient in this picture had an umbilical protrusion recognized for many years. It was easily reducible and surgical management was not entertained. After spinal surgery, in hospital, the hernia incarcerated and a bowel obstruction developed. Emergency surgery revealed strangulated intestine and omentum. A resection was required.



Umbilical hernias are common in patients with cirrhosis and ascites. This patient developed ulceration and necrosis of the skin at the apex of the hernia. Eventually an opening through the peritoneal sac developed and the patient's ascitic fluid drained externally. The hernia was repaired by suture and the redundant skin excised. A peritoneal drain was placed to evacuate the reforming ascites. These fluid losses were replaced with albumin and saline. Diuretics were also administered. The drain was removed when peritoneal closure of wound was anticipated (2 weeks).



This patient had an incarcerated, symptomatic umbilical hernia for many years. There was no evidence of intestinal obstruction. The sac has been dissected to its neck. As expected the sac contained a large segment of greater omentum.

This patient had a chronically incarcerated umbilical hernia and suffered from recurrent bouts of incomplete small bowel obstruction. In this intraoperative photograph a dilated loop of small bowel is seen protruding from an umbilical defect. The peritoneal sac is seen to the right grasped by forceps. Serosal thickening on the incarcerated bowel has resulted from the chronic incomplete obstruction.

## **b. Incidence of Umbilical Hernias**

Umbilical hernias are congenital in origin and often occur during infancy; spontaneous closure by the age of 2 years is common. In North America the incidence of umbilical hernia in black infants is 8 times higher than in white infants. Most umbilical hernias that appear before the age of 6 months disappear spontaneously by 1 year of age. Even large hernias (5-6 cm in all dimensions) have been known to disappear spontaneously by 5-6 years of age.

## **V. Incisional and Parastomal Hernias**

### **a. Incisional and Parastomal Hernias**

Incisional and parastomal hernias are the protrusion of intra-abdominal contents through a surgically formed defect. Incisional hernias are a huge problem, eventually developing in 5-10% of patients where access to the abdomen was gained through a long midline incision. Often there is a readily identifiable contributing factor; in many instances, however, the wound appears to heal only to become weaker over a period of months, with attenuation of the fascial layer and finally formation of a complete defect. Initially, the defect may be oval shaped, in line with the incision, but eventually will be circular; skin over the peritoneum will become progressively more attenuated.



In an industrial accident this patient suffered a pelvic fracture with avulsion of the bladder and rectum. He required both permanent colostomy and ileoconduit. A large parastomal hernia causing obstruction to the drainage of the conduit and difficulty with fitting of the appliance developed.



This unfortunate patient had a sigmoid colostomy performed for incontinence. A large ventral incisional hernia first developed, this was repaired. Then a large parastomal hernia developed at the sigmoid colostomy site. The scan shows loops of small intestine entering the sac around the sigmoid colostomy stoma. The original incisional hernia has also recurred.



This dialysis dependent renal failure patient had a colostomy performed for management of perforation of diverticular disease. In subsequent years a ventral incisional hernia developed which was relentlessly progressive resulting in a massive sac-like herniation covered by parchment thin ulcerated skin. On the apex of the hernia the skin has broken down to the point of ulceration.

Given the frequency of surgeries performed on the abdomen, incisional hernias cause morbidity and disable thousands annually.

Fortunately, incisional hernias are usually diffuse bulges that are unlikely to result in strangulation. Small defects with rigid margins have the potential to cause strangulation. Apart from the obvious cosmetic disfigurement, incisional hernias cause pain, pulling, dragging and heavy sensations often preventing return to work. For some people, with physically demanding occupations, this can be permanent.

## **VI. Other Hernia Sites**

### **a. Epigastric:**

Epigastric hernias occur in the linea alba. They are an acquired defect and are often multiple in nature. In obese patients they can be difficult to appreciate by palpation. Patients with epigastric hernias commonly complain of a painful tearing sensation in the midline on moving into a recumbent position.

### **b. Spigelian**

**Spigelian** hernias occur when the abdominal contents protrude through a defect at the semilunar line. The semilunar line is found on the lateral boarder of the rectus abdominis muscle



where it intersects the semicircular line of Douglas.

### **c. Obturator**

This rare hernia occurs mainly in elderly females. Abdominal contents protrude through a weakened pelvic floor in the obturator canal. Patients will present with symptoms of intermittent bowel obstruction and anteriomedial thigh paresthesias due to compression of the obturator nerve coursing the superior aspect of the obturator canal.



This emaciated elderly female incarcerated and strangulated this segment of small bowel in the obturator canal. Note the compression ring on the bowel to the left. It was reduced with great difficulty. Do you think it requires resection? The obstruction was complete and there were no symptoms of obturator nerve compression.

### **d. Sciatic**

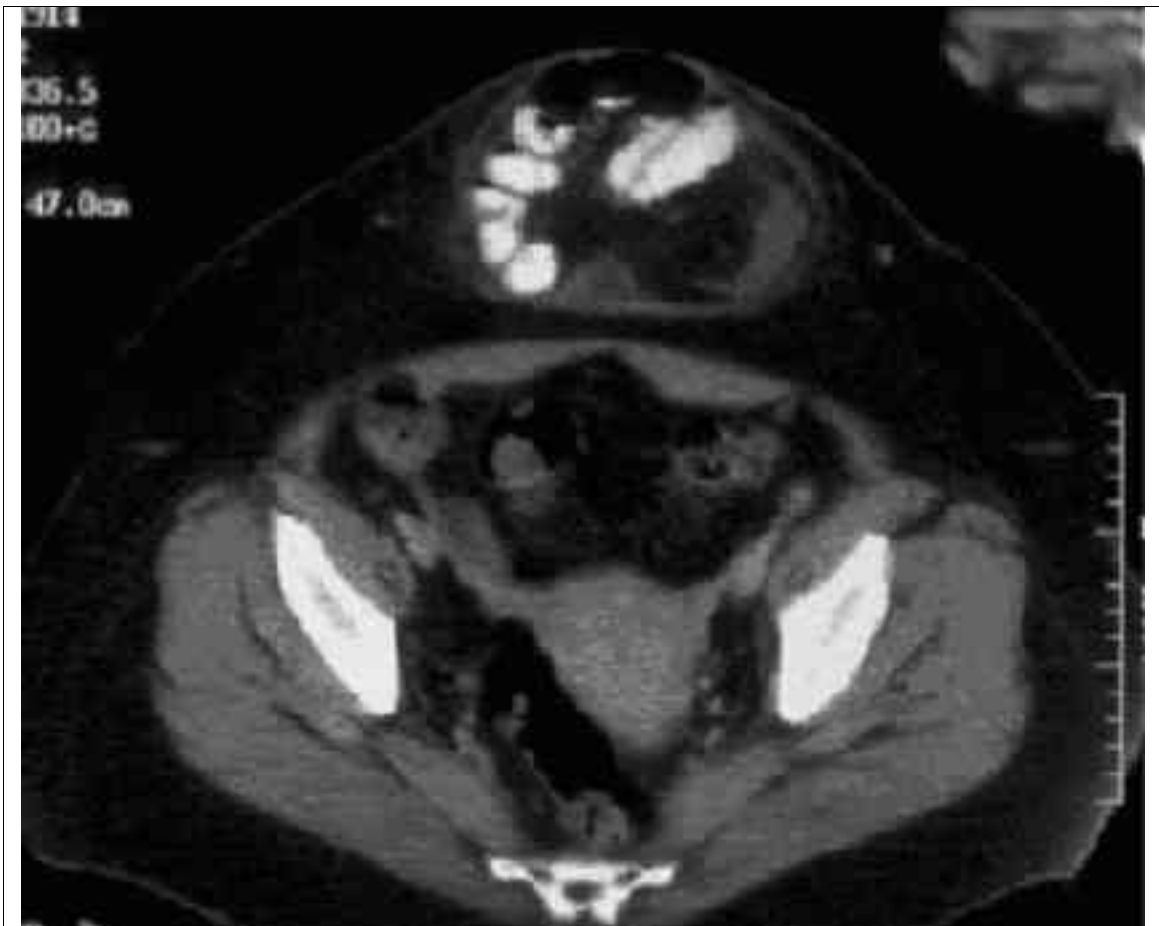
The greater sciatic foramen can also be the site of a relatively uncommon hernia. Diagnosis can be difficult. Patients often present with pain on standing and diagnosis is often made once bowel obstruction intervenes. Of note, a sciatic hernia rarely causes sciatic nerve pain.

## **VII. Complications of abdominal wall hernias**

### **a. Incarceration**

**Incarceration means** the confinement of a herniated structure in its protruded position. Incarceration commonly occurs when the neck of the defect is small and rigid, allowing entrance of the hernial sac and its contents but inhibits reduction.

Once incarceration has occurred, strangulation may quickly intervene leading to a surgical emergency. If bowel (usually small bowel) is contained in the hernia then symptoms of obstruction will eventually occur. Incarceration in external hernias is the number one cause of small bowel obstruction in patients who have not undergone previous abdominal/pelvic surgery. Always look carefully for incarcerated hernia in a patient with bowel obstruction when there has been no prior abdominal surgery; this may require invagination of the scrotum into the external ring or careful, deep palpation medial to the femoral vessels in obese individuals.



This obese patient developed a recurrence at the site of a previously repaired umbilical hernia. The sac rapidly enlarged and its contents could not be reduced. Although it could be shown by CT scan to contain small bowel, contrast passed freely through the incarcerated bowel. The hernia is high risk for the development of obstruction and ischemia because of its narrow neck. The hernia is pedunculated and although the abdominal wall defect is not shown it is only 5 cm in diameter. Prolene mesh was placed beneath the abdominal wall (sub-lay) and the margins of the defect sutured down onto the mesh with nylon. No attempt was made to approximate the margins of the defect.



Omentum may become incarcerated in hernias (in this instance umbilical hernia), remain viable and act as a plug preventing the entry of small or large bowel. This saves the patient a far more serious complication. Even though the omentum is viable, traction may result in symptoms making repair necessary. Cosmesis maybe an issue for some patients.

## **b. Strangulation**

Once pressure at the neck of the hernial defects exceeds venous outflow pressure the hernia quickly becomes engorged with blood. The elevated pressure quickly impedes arterial flow leading to ischemia and subsequent edema and necrosis of tissue.

Approximately one quarter of strangulated hernias contain only omentum, but the other 75% contain tissue which compromises bowel circulation. Prolonged strangulation of a hernia quickly raises mortality rates due to peritonitis and sepsis.



This patient is prepped for surgery. Where would you make the incision? He has had cramping pain and vomiting for 24 hours. The visible mass is tender, firm and irreducible. X-rays show a complete SBO.



Femoral hernias are high risk for intestinal entrapment and strangulation. The margins of a femoral hernia, inguinal, lacunar and Cooper's ligament are rigid and unforgiving. Intestine may enter a surprisingly small defect. In this case necrosis has developed at the point of pressure at the hernia neck. After release of the hernia, intestinal contents are already seen flowing into the distal bowel. A limited intestinal resection was possible through the groin incision.

The groin site should be carefully examined for incarcerated hernias in patients with bowel obstruction even if they have had previous abdominal or pelvic surgery. A resection and repair carried out through a groin incision is considerably less morbid than a vertical laparotomy incision.



An incarcerated inguinal hernia with bowel obstruction was explored. When the sac was exposed its contents appeared hemorrhagic. The sac was opened, bloody and foul smelling fluid aspirated and a strangulated non-viable loop of small bowel was demonstrated. The internal ring was enlarged laterally, carefully controlling the ischemic bowel. It was possible to deliver the bowel through the inguinal wound and perform a short resection. The hernia was then repaired. If appropriate mesh plugs or patches can be used.



Incarceration and strangulation of the antimesenteric boarder of the small bowel without complete obstruction (**Richter's hernia**) can occur at the femoral site in particular, because of its rigid margins.



This massive incisional hernia led to serious problems when it was Ignored by this dysfunctional patient. Loops of small bowel, caught By adhesions within the sac developed ischemic areas, perforated, Fistulated to the skin and caused recurrent cellulitis.

### **VIII. Factors contributing to abdominal wall thernias**

Factors contributing the formation abdominal wall defects can be separated into congenital and acquired defects.

**Congenital defects** account for the majority of hernias. A patent processus vaginalis is the primary cause for the development of indirectinguinal hernias. Pelvic floor deformities can contribute to the development of hernias. Rarely, collagen deficiencies contribute to the development of direct hernias.

**Acquired defects** are normally responsible for direct hernia formation. Wear-and-tear; straining to urinate and defecate, coughing, and heavy lifting contribute to weakening of the abdominal wall

## **VIII. Factors contributing to failure of healing of abdominal incisions**

A large number of factors have been identified as contributing to the development of incisional hernias. Strategies and surgical techniques are recognized which will reduce the frequency of, but will not erase this problem.

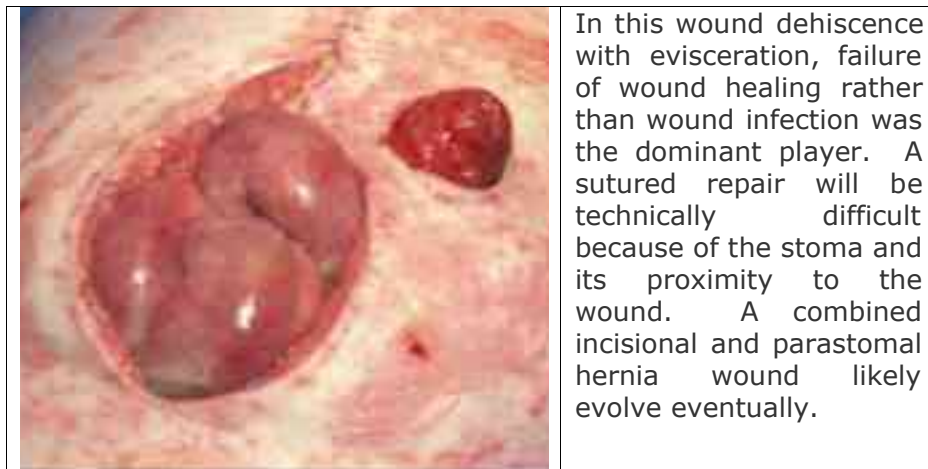
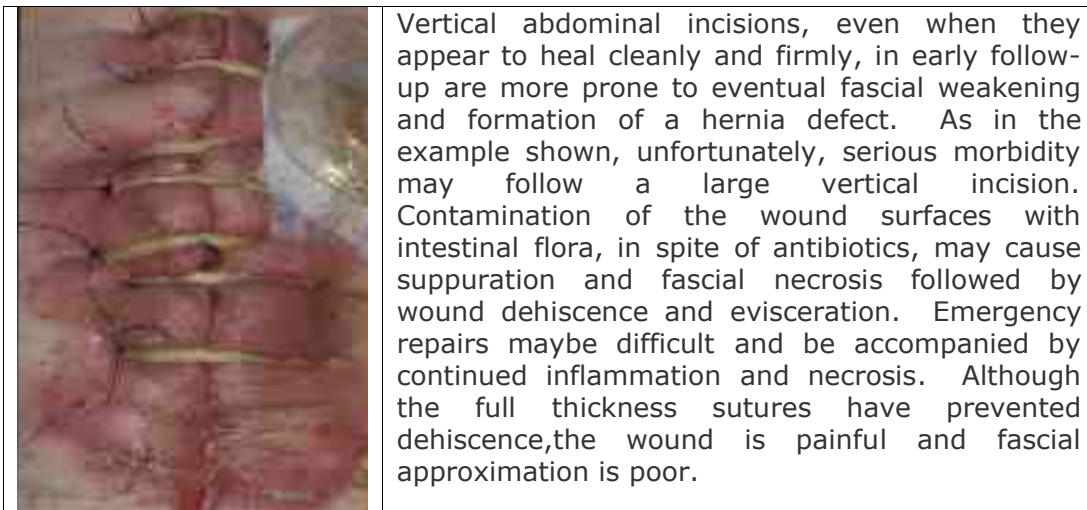
1. Obesity, especially morbid obesity, Other reasons for abdominal distention[massive omentum-“beer belly”, ascites]
2. Chronic obstructive airway disease [cough, increase in abdominal pressures, hypoxia and poor oxygen delivery to the healing wound.]
3. Type of incision, i.e. more frequent after vertical than transverse. Long incision has greater risk than short. Multiple incisions destroy nerve and vascular supply. Radiation therapy to the area of the incision reduces blood supply.
4. Creation of a stoma (parastomal hernia formation)
5. Age > 70 years
6. Exposure to certain drugs [steroids, antimetabolites, immunosuppressants]
7. Chronic diseases [renal, liver and cardiac failure]
8. Severe malnutrition
9. Diabetes[insulin dependent]

Studies have also shown a decreased ratio of collagen I:III, due to increase collagen III, increase the risk of incisional hernia formation and reoccurrence (especially post inguinal hernia repairs).

### **a. Dehiscence**

**Dehiscence** by is “a bursting open, splitting, or gaping along natural or sutured lines”; dehiscence may occur suddenly in the

early post-operative period, accompanied by some bleeding and discharge of serosanguinous fluid. The primary failure of healing is at the fascial level; skin sutures may "hold", containing the extruded viscera; if the skin closure is disrupted, evisceration will occur. With improvement in suture materials and suturing techniques this complication occurs less frequently. Often, dehiscence develops more gradually, caused by infection and associated fascial necrosis. Needless to say, serious wound problems such as those shown below, are followed by a very high incidence of herniation.







Fascial necrosis occurred after a Hartmann's resection (sigmoid colostomy) for a pelvic abscess presumed to have originated from the sigmoid colon. Residual suture material and necrotic fascia was excised and the defect repaired with prolene mesh. The skin was left open to be closed later (delayed primary closure). A successful outcome is more likely with this approach than attempts to close the abdominal wall with full thickness sutures.

## Assessments

### Assessments – Hernias

#### I. Functional Inquiry

Patients recently developing external hernias should be screened for collateral conditions that would lead to increases in abdominal pressure. These would include respiratory disease with cough and forced expiration, and obstruction to the intestine or to the bladder outlet. Failure to identify these provoking issues may lead to early recurrence after repair.

#### II. Symptoms

Patients with a groin hernia commonly present with complaints of a bulge in the inguinal region that may or may not be associated with minor or vague discomfort. Extreme pain in relation to a groin hernia usually indicates **incarceration** and **strangulation** of the hernia's contents. Occasionally a patient may present with **paresthesias**, symptoms of inguinal nerve compression or irritation.

### III. Physical examination

**Examination** of the patient standing demonstrates loss of symmetry between the inguinal areas or a discrete bulge. Coughing or the **Valsalva maneuver** may accentuate the bulge. Next the clinician places their hand on the abdominal wall and repeats the Valsalva maneuver, noting any presence of hernia, then places his/her fingertip into the inguinal canal repeating the Valsalva maneuver again.

Movement in a medial direction suggests an **indirect inguinal hernia**, whereas direct anterior motion deep to the finger in the superficial ring suggests a **direct inguinal hernia**. Although differentiating direct and indirect inguinal hernias is not essential at examination, differentiation of a femoral hernia is important.

**Femoral hernias** protrude inferior to the inguinal ligament, adjacent to the femoral vessels

The patient should be examined in the **supine** position, repeating the same techniques used in standing. If the groin mass is not appreciable, have the patient stand or walk for a short period of time.

The mass, if **incarcerated**, may be reduced with gentle pressure towards the inguinal ring in the Trendelenburg position. **Reduction** of an incarcerated hernia should be abandoned if it does not return easily to the abdomen. Hernias which become incarcerated will require surgical management; attempting to reduce it with a combination of force, sedation and analgesia serves little purpose.



Even a large, incarcerated groin hernia may not be obvious. During physical exam, the inguinal region should be fully exposed and the hernia orifices palpated. Obesity may conceal a sizeable mass.

#### **IV. Differential diagnosis of a groin mass**

Simple hernias reduce when the patient is recumbent. Incarcerated hernias are not mobile, but taut and tethered to the hernial defect borders. Listed below are some of the more common groin lesions misidentified as groin hernias.

- **Ilioinguinal adenitis, lymphoma and other neoplasms** do not reduce on recumbence and are mobile allowing for differentiation from the simple or incarcerated hernia.
- **Varicoceles, epididymitis & testicular torsion** are discrete conditions of the scrotum; palpation of the mass reveals lack of continuity with superficial ring.
- Careful palpation of a **hydrocele**, excess fluid accumulation in a persistent processus vaginalis, demonstrates a discrete neck that can be "pinched off" from the cord above.
- A **psoas abscess** results from the dissection of a retroperitoneal infection along the psoas muscle to the groin. A mass may appear below the inguinal ligament that mimics a femoral hernia. History should suggest the presence of an intra-abdominal inflammatory process (e.g. pancreatitis).

## Management

### **Management - Hernias**

#### **I. Repair of inguinal and femoral hernias (current)**

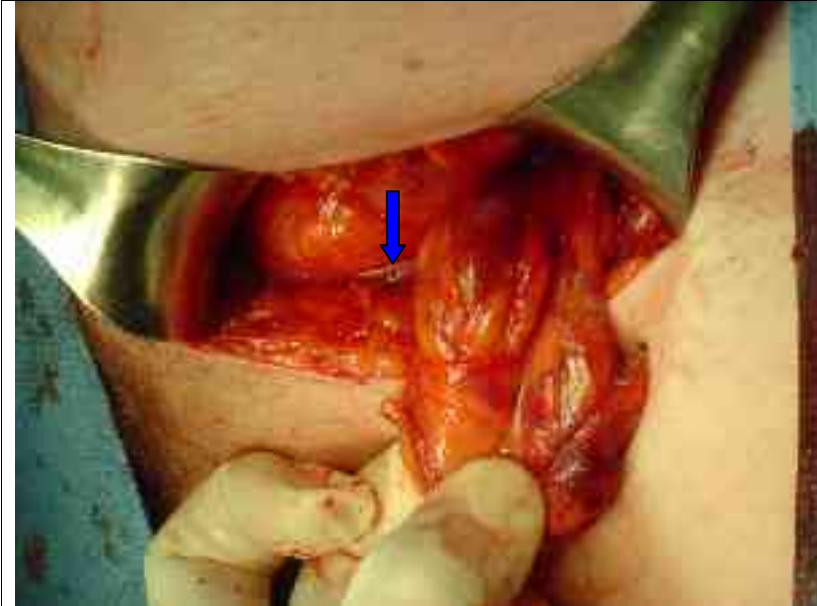
Elective repair of hernias has greatly reduced complications related to abdominal defects (bowel obstruction, incarceration and strangulation). Almost all hernias should be repaired. Discretion is used if the defect is small and the hernia easily reducible or the patient is an appreciable risk for operative complication.

Repairs of the inguinal hernias fall into 4 groups: fascial repairs (Bassini, Bassini with Tanner's slide, McVay, Ferguson, Shouldice), tension-free prosthetic repairs, laparoscopic (TAP, TEP) and percutaneous endoscopic external ring repair (PEER).

Fascial repairs carry a much higher risk of recurrence but have a decreased risk of infection. Infection in the tension-free mesh techniques is rare in practice. Due the low recurrence rates and low infection rates, this technique has taken favor by the majority of hernia surgeons. Open tension-free method also allows for local anesthesia and patient is handled as a day case.

##### **a. Open tension-free mesh repair**

This technique was introduced in the 1980's. A performed polypropylene (Marlex) plug used to fill the defect; large defects may require a mesh sheet overlay. This technique is simple, requiring minimal dissection. Reoccurrence rates with this technique range from 1% to 3% (similar to laparoscopic techniques).



In this operative photograph the pubic tubercle is to the left. A large femoral hernia sac has been dissected from the thigh, drawn through the femoral canal after cutting the lacunar ligament. The sac now presents above the inguinal ligament (blue arrow) through the direct area. Because of its narrow neck the sac was opened, the neck closed and the excess sac excised. The repair would be completed with a mesh plug or patch to Hesselbach's triangle exactly as for the repair of a direct inguinal hernia.

## **II. Repair of incisional hernias**

Many patients dislike the cosmetic effects of incisional hernias, and in combination with pain insist on repair. 3 techniques are utilized to close an incisional hernia; primary fascial repair, tension-free repair by synthetic mesh prosthesis and autogenous repair by vascularized innervated muscle flaps (usually used for large/recurrent defects).

### **a. Primary fascial repair**

Due to extremely high reoccurrence rates, up to 50%, the primary fascial repair has been abandoned and replaced by the tension-free repair.

### **b. Tension-free repair by synthetic mesh prosthesis**

Reoccurrence rates with this technique are much more acceptable (2%-10%). A polypropylene mesh (mono or double filament forms) or fluorinated polyester mesh (gel impregnated with antibiotics) is sub-laid in the defect with generous overlap of the wound margin and sutured into place.

Risks of the tension-free repair of incisional hernias include wound infection, infection of the mesh, seroma formation, wound sinuses, enterocutaneous fistula formation, and recurrence.

## **Case Studies – Hernias**

European Association of Radiologists: Obturator and Spigelian Hernia Case studies

<http://www.eurorad.org/case.cfm?uid=927>

<http://www.eurorad.org/case.cfm?uid=903>

## **Resources**

### **Resources - Hernias**

Lawrence, Bell and Dayton, Essentials of General Surgery Third Edition

- Chapter 7: Wounds and Wound Healing page 119
- Chapter 8: Surgical Infections pages 124-125
- Chapter 11: Abdominal Wall, Including Hernia

Townsend, Sabiston: Textbook of Surgery Sixteen Edition  
(available on MD Consult – books)

- Chapter 40: Hernias

Gastrointestinal Pathology Images

<http://www.bcnr.moph.go.th/webpath/gihtml/gi397.htm>

<http://www.bcnr.moph.go.th/webpath/gihtml/gi166.htm>

<http://www.bcnr.moph.go.th/webpath/gihtml/gi251.htm>

<http://www.bcnr.moph.go.th/webpath/gihtml/gi252.htm>

Vesalius.com: illustrations of the common hernias

[http://www.vesalius.com/cfoli\\_frms.asp?VID=32&StartFrame=1&tnVID=419](http://www.vesalius.com/cfoli_frms.asp?VID=32&StartFrame=1&tnVID=419)

Online Laparoscopic Technical Manual 2003: review laparoscopic techniques for inguinofemoral hernia repairs.

<http://www.laparoscopy.net/inguinal/ingher1.htm>

Laparoscopy Hospital: How do you do a laparoscopic repair of an inguinal hernia?

[http://www.laparoscopyhospital.com/LAP\\_HERNIA.HTM](http://www.laparoscopyhospital.com/LAP_HERNIA.HTM)

Surgical physiology of inguinal hernia repair - a study of 200 cases

<http://www.biomedcentral.com/1471-2482/3/2>