



**The use of mesh in hernia repair, risk management and the advantages of day surgery**

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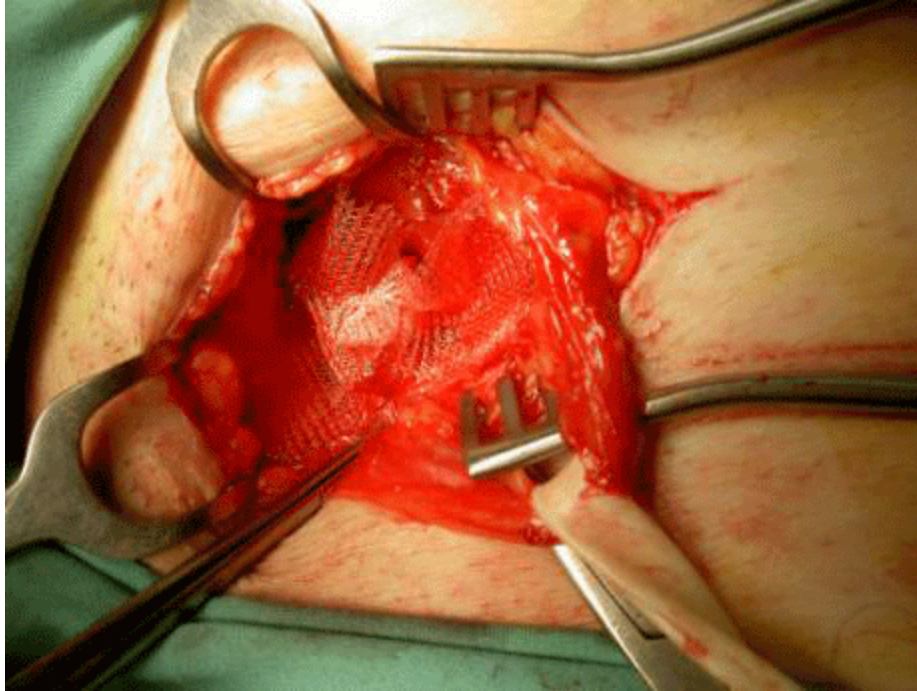
**Key words:** day surgery, hernia, mesh, local anaesthesia

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**Introduction**

This is the first in the series of articles on hernias and conditions of the scrotum and testes.

This article has been prepared for primary care physicians. The introduction is based on my experience with over 6000 hernia operations. It deals with the history, examination, terminology, basic anatomy, pathology and briefly the different surgical approaches. This



### **The use of mesh in hernia repair**

is the first in a series dealing with all the common hernias, their differential diagnosis and then conditions of the scrotum and testis.

In Australia the patient must present to the GP to obtain a referral to a specialist – otherwise the government health system will not cover the cost of the consultation or surgical fees.

The adult patient usually notices discomfort or a bulge or both. The patient may relate it to a specific incident – especially at work, for repeated episodes. The swelling is often noticed in the shower whilst standing.

The doctor listens to the description of the onset of the symptoms – it instills confidence into the patient and actually saves time. The history can be important in making a positive diagnosis, and differentiating between hernias and other conditions. Occasionally a patient describes recurring swelling that cannot be demonstrated at the time of examination. The presence of the hernia cannot be found at examination, before careful and repeated evaluation.

The patient's hernia region is then examined. The process should be explained to the patient as palpation of the adjacent scrotal region can cause embarrassment (this is part of risk management in Australia where soaring indemnity payments has become an issue).

The site is first **inspected** standing up at rest and then whilst coughing and straining. The hernia is usually apparent. During this process all possible sites for hernias should be inspected, including the opposite side for an inguinal or femoral hernia. It is surprising how often an additional femoral hernia or inguinal hernia can be detected in this manner. This avoids referring patients with an incomplete diagnosis. The hernia then may be palpated whilst standing. Then the hernia is palpated whilst the patient coughs and strains – looking for a cough impulse. Care must be taken not to hurt the patient by attempting to forcefully reduce an irreducible hernia.

The patient then lies down and is examined again.

The scrotal and testes region should also be examined whilst the patient is standing and then recumbent. Some conditions are only detected whilst the patient is standing. This includes a saphena varix, varicocele or communicating hydrocoele.

The scrotal contents and the testes and other structures are palpated carefully to exclude other conditions. The findings should be recorded – especially any abnormality. The patient should be advised, for example about the presence of a varicocele, so that following surgery it is not thought to be a complication of surgery (risk management).

Further general assessment firstly of the directly related areas and then other regions is required before giving comprehensive advice.

## **HERNIA PRESENT**

If a hernia is present it is an obligation to counsel the patient as to the required treatment, and choose an appropriate specialist for a decision regarding surgery. You know best about the patient's health. The patient may not be fully aware of the different possibilities available.

You may be able to discuss with the patient some of the possible risks of surgical intervention. It is the doctors duty as part of the risk management program, to convey to the patient the possible risks and outcomes following surgery, in a meaningful way.

Some of the issues I encounter are: doctors are not always aware that most of the procedures can be carried out under anesthesia infiltration. I believe local anesthesia reduces the risk to the patient in many ways.

It is also helpful to let the specialist know about medical problems from which the patient suffers, such as:

- (a) therapeutic agents, which alter the bleeding status of the patient.
- (b) presence of a heart valve or murmurs, which may require antibiotic cover for the surgery.

Of course, as a surgeon I have a responsibility to check all of this before considering surgery. As part of the risk management program it is wise for the surgeon to communicate these different findings to other specialists involved in the care previously. This is because there is a small risk attached when altering previously prescribed medication. Ideally a consensus view should be obtained.

The patient may ask you about the need for surgery or the urgency of the surgery and the type of surgery to be undertaken.

It is up to the surgeon to explain this and at the same time outline possible risks. In my practice this is supported with literature and also a website under development ([www.melbourneherniaclinic.com](http://www.melbourneherniaclinic.com)), for patient information and brochures.

It is hoped that this series of articles will leave you more informed regarding some of these issues.

I recommend:

- (1) Repair under local anesthesia and sedation.
- (2) Day surgery where appropriate.
- (3) The use of the tension free repair with mesh as popularized by Lichtenstein (see British Hernia Centre, [www.hernia.org](http://www.hernia.org)).

There are other developments being made continually. During these presentations we will try to keep you updated on these different techniques and methods. We will provide some references to other Internet sites wherein detailed descriptions of other methods are demonstrated and discussed.

Herniae unlike skin cancer, other malignancies and many infections, are a common universal problem. The incidence is not affected by geographic distribution, race, genetics, skin pigmentation, dietary habits, climate or environment.

The optimal treatment for most herniae is operative. The symptoms from which the patient suffers and the risk of obstruction or strangulation influence the decision to operate, as well as the timing of such surgery. The age and health of the patient, the risk involved and the availability of resources may affect the decisions.

The severity of symptoms or the possibility of strangulation must be balanced against the risk of the anaesthetic, the operative or post-operative complications and the long term success of surgical repair.

Teaching about herniae has not altered substantially for many years. The pre-clinical student studies the anatomy of the abdominal wall, inguinal canal, femoral canal and

scrotum in great detail. The Clinical student is taught to apply this, together with the history and demonstration of physical signs to arrive at a precise diagnosis.

The residency staff are required to understand the pre-operative and post-operative care.

The primary care physician should do all this and be able to counsel a patient – patients wish to know the different possibilities. The primary care physician is also usually responsible for the initial assessment of the degree of urgency, referral for surgical assessment and the decision regarding where and by whom the surgery should be performed.

The surgeon in training is required to develop the clinical skills and operative techniques to deal with herniae. This might include the open technique by a variety of methods or even a laproscopic repair. At the recent International Hernia Conference in London – June 1993. It appeared to be the consensus the easiest method to teach of all the newer operations (in the last 20 years) was the Lichtenstein repair, that is a single layer of mesh placed between the muscles of the abdominal wall using the anterior incision (under local anesthesia).

The nursing staff work side by side and they should be knowledgeable in these different aspects, so they can best administer the care pre-operatively, be part of the surgical team and then give post-operative care.

## **CURRENT SITUATION REGARDING HERNIAE**

Herniae have been a surgical problem since time immemorial. Many of the great names of surgery are attached to advances made in the anatomical understanding and surgical repair. However the results of hernia surgery in the past were not always good.

Now the results of surgical correction have improved with both the morbidity and mortality from surgery falling substantially. Most hernias can be repaired under local anesthesia. Patients spend only a few hours in hospital. The cost savings of this are enormous and allow resources to be diverted to other problems. A variety of surgical techniques have evolved and all are designed to provide a short stay in hospital, rapid mobilization and early return to work, whilst at the same time claiming there is minimal pain.

The recurrence rate is said to be less. However all surgeons can attest that they see other surgeons' recurrence as well as their own.

Many series now quote recurrence rates of 0.1 – 0.5 %, these usually come from centers of specialists, primarily devoted to the care of hernias. These are very impressive figures. One problem however, in assessing these series is in judging the extent of follow-up undertaken.

***How accurate was the re-examination and what was the percentage of patients who were actually examined after 5 or 10 years?***

With increasing availability of safe and early surgery, strangulation is a much less common event now. Patients tend to present earlier and bowel resection rates have also decreased.

As surgery becomes increasingly safe, the problems of persisting post-operative pain, quality of life, the ability to work, as well as the recurrence rate have become more important issues. (combined meeting of the European and America Hernia Societies June 2003 - London).

Extra measures to increase the strength and durability of the repair are being increasingly stressed. These include:

- A. Suturing, with a modern synthetic monofilament non-absorbable suture. One variety of this technique is the Darn technique. There multiple layers are formed. Together with this some surgeons use a relieving incision in the anterior sheath of the rectus muscle to reduce tension on the suture line.
- B. There has been an increasing reliance on the use of mesh in hernia repair. The most common mesh used is a polypropylene monofilament mesh, which is being used in some countries now in 95% of hernia repairs. The aim is that the non-absorbable monofilament sutures and mesh give immediate strength and allow early mobilization and return to work, particularly in the first month or two when the strength of the scar is being tested. The use of absorbable suturing has been largely discarded because it has been proved to be ineffective. Years ago people would be kept in hospital for many days or even weeks following hernia repair. It was thought the mobilisation and exertion increased the risk of recurrence substantially because of the increased tension pulling the sutures out.
- C. The new techniques being developed with mesh rely less and less on the suturing and more on the design on the mesh and the placement of the mesh. The aim being to achieve smaller incision and less suturing, because it is felt that the suturing contributes to post operative and long-term pain.

The most popular technique worldwide now is the Lichtenstein technique (from Los Angeles). This uses suturing to keep the hernia in its place but does not pull the muscles down to the inguinal ligament. Once the hernia is replaced a mesh is then used to reinforce the whole area. Thus was borne the term “tension free hernia repair.”

The Lichtenstein technique has superseded the Bassini repair. The muscles of the posterior wall of the inguinal canal were pulled down to the inguinal ligament under tension. This technique has become very unfashionable because it is felt that there is too much tension on the suture line. It has been shown that there is a high recurrence rate for the direct inguinal hernias using the Bassini repair.

It is the suturing that keeps the hernia contents in place, but it is the mesh that gives the immediate and long lasting strength to the repair.

In this series the use of non-absorbable monofilament sutures for hernia repair has been advocated. These give immediate and lasting strength, particularly in the first month or two when the strength of the scar is still increasing.

As refinements in both suture materials and mesh have occurred they have reduced the risk of infection. However, should infection develop, there is the risk of chronic sinus formation and the need to remove the sutures and mesh – a surgical disaster.

### **The Setting**

The surgery can be carried out in specially designed free standing Day Surgery Units. Protocols for this have been very successful and increasing workloads throughout the world is taking place in such facilities. It has been shown that infection rates for day surgery are lower than for patients who remain in hospital. Careful planning is involved between the patient and the Day Surgery team.

Day surgery is also carried out at major hospitals where there is the option of keeping the patient overnight. This has some advantages for the elderly or with higher medical risks. It is pleasing however to see that day surgery has led to good results with fairly few readmissions because of careful selection. The main cause for readmission has been postural hypotension or vasovagal fainting at home that evening.

The aim of day surgery is to give a good outcome and to reduce waiting lists and costs.

One of the major changes during the last few decades is the increasing importance of rapid mobilization, shorter stay in hospital and rapid return to normal life and the work force.

### **Pre Operative Assessment:**

To achieve these short and long-term goals requires a thorough pre-operative assessment.

The patient should be assessed in the office for factors which might influence local complications e.g. Infection or bleeding, and factors that might lead to general complication such as lung or cardiac disease. Be aware of problems, which may actually predispose to the development of the hernia and may influence the risk of recurrence such as, obesity or even patients using steroids. There maybe problems present which make

the use of local anesthesia an obvious advantage such as a previous history of deep vein thrombosis or factors, which may increase the risk of deep venous thrombosis.

With aging population and longer survival of patients with cardiac problems, many medications are in use, which may require modification pre-operatively. This in particular refers to the use of Aspirin, which is commonly stopped 10 days pre-operatively. Many patients are on Warfarin so require modification prior to surgery. Another hazard to consider is the patient with a heart murmur or valve where prior cover with antibiotics is desirable. Some would recommend the use of antibiotics, where foreign material is used such as a mesh. However this is not a usual case but should be certainly considered where there are extra risks such as use of steroids or diabetes.

Diabetes, anaemia, liver disease and smoking are all factors, which may lead to local or general complications as well as impairing the strength of the repair.

### **Assessment – Pre Operatively:**

A. Factors which might influence local complications, such as:

1.	Infection
2.	Bleeding

B. Factors, which might cause general complications.

C. Factors influencing the strength of the repair

1.	predisposing factors which may require to be corrected e.g. bladder obstruction,
2.	steroids,
3.	obesity.

A previous history of deep venous thrombosis, or factors which might increase the risk of such an occurrence, should be noted and measures taken to reduce the risk.

These might include such steps as low dose Heparin, calf stimulators when under GA or compression stockings. The use of local anaesthetic is thought to be a significant factor in reducing this occurrence.

Obesity makes the surgery more difficult and increases risk of complications and recurrence.





***Hernia apparent on physical examination***

Each patient is an individual. No single approach is suitable for all and each case should be treated on its merits and the options discussed with the patient before obtaining informed consent. This is all part of the risk management process which is so important today.

In many countries hernias are operated upon by primary care physicians, and not specifically trained surgeons.

When assessing pre-operatively, or in the office, look for factors which might influence local complications, for example, infection and bleeding, factors which might cause general complications; factors which might cause general complications and factors influencing the strength of the repair. Look for predisposing factors which may need to be corrected, like bladder obstruction, use of steroids or obesity.

A previous history of deep venous thrombosis, or factors which might increase the risk of such an occurrence, should be noted and measures taken to reduce the risk.

Diabetes, anaemia, liver disease from alcohol and heavy smoking are all factors which might lead to either local or general complications as well as impairing the strength of the repair.

Obesity makes the surgery more difficult and increases risk of complications and recurrence.

## **External herniae of the abdominal wall – an introduction to the subject of herniae.**

An abdominal wall hernia is a protrusion of the abdominal contents through a defect in the abdominal wall. The term hernia also applies to other sites, including oesophageal hiatus, diaphragmatic and internal abdominal herniae.

### **The Sac**

In most cases the lining of the abdominal wall, the peritoneum, protrudes through a defect and forms a sac, which is described as having a neck, body and fundus. The sac may be permanently prolapsed or only prolapse with increased intra abdominal pressure.

### **The Contents**

The abdominal contents protrude into this sac – either intermittently or permanently. They may consist of omentum or bowel or occasionally other organs.

### **Extra Peritoneal Fat**

At some sites, such as the midline linea alba and femoral canal, extra-peritoneal fat rather than peritoneum protrudes through the defect. There is sometimes a small sac associated.

### **The Ring**

The edge of the defect is called the ring. The changing relationship between the coverings of the hernia, the sac, the contents and the ring are responsible for the symptoms, signs and complications, which can develop with herniae.

### **The Cause of Herniae**

The abdominal wall has well-recognised anatomical sites which are potential weak zones resulting in herniae.

*Predisposing Factors are:*

A potential weak zone – possibly related to congenital factors

## **UNDERSTANDING HERNIAS:**

1. The **inguinal canal** is the most common site by far for the development of a hernia. The 3-layered abdominal wall is modified. Here as well as at other common sites where herniae are formed, the basic three-layered structure of the abdominal wall is deficient. This with inguinal hernias is associated with the descent of the testis, leaving the posterior wall of the inguinal canal as a potential weak zone.

- a) **Indirect herniae** occur in infants and children because of a congenital pre-disposition, most commonly in males associated with the descent of the testis and incomplete obliteration of the processes vaginalis.

They are also common in young adults and indeed any age. They descend from the internal ring lateral to the inferior epigastric artery along the cord, or in females the round the ligament.

- b) **Direct inguinal hernias** do not develop until later in life and almost exclusively in males. The musculature and fascia of the posterior wall undergoes attrition. Commonly the process is bilateral.

It is not always possible to clinically distinguish between direct and indirect inguinal hernias.

2. **The femoral canal** is a potentially weak zone - as the major vessels to the lower limb traverse through the pelvis.

The midline of the abdominal wall – the linea alba, is the most common other site. The single aponeurotic layer is usually thick and strong, but splits can develop causing areas of weakness.

3. **Epigastric hernias** occur at sites of such localised defects. Divarication of the recti muscles result in a generalized weakness occurring in the midline.

- a.. **Umbilical hernia** develops at birth through a defect in the umbilicus; a para-umbilical hernia can develop at a later date.

- b. **Incisional hernias** – at the site of a previous operation.

- c. **Recurrent hernias** – at the site of a previous hernia repair.

- d. **Rare hernias** – often at specific sites – lumbar or spigelian hernias.

*Hernias may result from:*

- A. Increased intra-abdominal pressure – either acute or chronic. B. Any other factor which might further weaken the retaining mechanism – muscle, aponeurosis and fascia.

### **THE TYPE OF DEFECT**

The type of defect through which the hernia protrudes is a major factor in:

- A. The symptoms or complications which can occur, and

B. The method chosen to deal with the sac and the repair of the defect.

A narrow defect with a firm ring is more likely to result in pain and irreducibility, bowel obstruction or strangulation.

A wide bulge in an area of generalized weakness with an ill-defined edge or ring is less likely to be painful and develop complications.

Generally, a hernia which has a well-defined narrow ring is simpler to repair than one where there is a wide bulge with a poorly defined ring. Surgery is preferred for the former type but one can more reasonably delay with the latter.

### **CONTENTS OF HERNIAS & TERMINOLOGY:**

Omentum, small or large bowel or any other viscous or combination may be found in a hernia. Omentum is the most common. It hypertrophies possibly as a result of episodes of sub-acute irreducibility, until it becomes so bulky that it may become irreducible. Adhesions develop between the omentum and the sac. These adhesions are mostly at the fundus and body, but not at the neck. This is typical of indirect inguinal and umbilical herniae.

#### **Reducible Hernia**

A reducible hernia is one whose contents return into the abdominal cavity. This is spontaneous when the patient stops straining or lies down. Reduction can also follow manipulation by the patient or physician. Often the patient is best able to reduce the hernia.

The lump may reappear immediately on standing, coughing or straining, or the reappearance may be delayed.

#### **Irreducible Hernia**

An irreducible hernia is one whose contents cannot be returned into the abdominal cavity.

#### **Acute Irreducibility**

There is usually acute local pain. There may be central abdominal colicky pain as well. The swelling is tense and tender and lacks a cough impulse. Obstruction and strangulation may soon follow. An elevated temperature, tachycardia and abdominal signs may develop. There may be erythema over the hernia, usually indicating strangulation of contents. This type of hernia needs emergency surgery.

## **Chronic Irreducibility**

These are not usually as painful or tender. Abdominal pain is not a feature. Emergency surgery is not necessary, although a chronically irreducible hernia may still become strangulated. Herniae are a very common problem and while they can cause abdominal pain, the possibility of a co-existent lesion in the bowel, such as a carcinoma of a colon, particularly in the elderly, must always be borne in mind.

## **PRACTICAL MANAGEMENT – OF A POTENTIALLY STRANGULATED HERNIA**

In early cases, gentle manipulation or “taxes,” to reduce the hernia may be attempted – whilst the patient is recumbent with the foot of the bed elevated.

When analgesics are given the hernia sometimes reduces spontaneously because the ring and surrounding muscles are relaxed. Similarly in the theatre the hernia reduces on induction of the anaesthetic. This suggests that the process is not so advanced and at operation the contents will be found to be viable.

**At operation** the contents should be controlled so that they do not slip back and can be inspected to determine whether resection is necessary. Should the contents slip back before inspection, a laparotomy may be necessary. In addition the infected or gangrenous contents can contaminate the abdominal cavity.

With strangulated hernias it is sometimes difficult to be sure which layer is the sac during dissection. The bloodstained fluid within the sac can look like bowel. The fluid layer reduces the risk of damage to the bowel as the sac is opened. Once the sac is opened the contents can be inspected and grasped gently while the ring is divided. With a tight ring there is a danger of damage to the bowel whilst dissecting. This must be avoided by careful and gentle dissection. Then the contents are delivered further into the wound, and in the case of bowel, both the proximal and the distal limb as well as the site of constriction must be inspected to ensure they are viable.

## **In Summary**

The terms obstructed or incarcerated are used to describe an acutely irreducible hernia at an early stage. It implies that the process may proceed to strangulation, but these changes have not yet occurred. Rapid progress to overt strangulation with necrosis followed by perforation and peritonitis may occur.

Should an acutely irreducible hernia reduce spontaneously and immediate surgery not be arranged, a close clinical watch must be instituted for irreversible damage may nevertheless occur.

The symptoms and signs of the development of strangulation can be masked particularly in:

A. Infants

B. The elderly or frail

C. Those who have been given a narcotic agent for the relief of pain and D. The obese.

A close clinical watch is instituted if uncertain. Surgical action is preferred rather than excessive delay.

## **TERMINOLOGY**

### *Obstructed, Incarcerated and Strangulated*

These clinical terms are used to describe events associated with an acutely tender irreducible hernia. These terms suggest the blood supply is occluded and the delay will result in ischaemia, necrosis and gangrene.

While obstruction and incarceration suggest the sequence is less advanced than strangulation, clinical differentiation is difficult and demands surgical exploration.

Any acutely painful irreducible hernia should be considered strangulated and treated by surgery.

The sequence of events are best related to the findings at operation.

## **Pathology**

Initially the omentum or loop or bowel with its mesentery are trapped at the tight ring (imprisoned or incarcerated). Lymphatic obstruction results in an oedematous appearance and serous fluid is found in the sac.

With venous obstruction, bruising and ecchymoses develop and extend. The fluid in the sac becomes increasingly blood-stained.

With persistent complete arterial blockage, the omentum or the loop of bowel, superimposed on previous widespread ecchymoses, becomes plum-coloured and then black because of anoxia. The fluid becomes heavily blood-stained and foul smelling, with bacterial invasion.

The site at which the contents are constricted is often more severely affected – “constriction rings” are formed. When the obstruction is released at a later stage no blood oozes from the surface of the bowel or at the site of the constriction rings and the normal colour does not return. Arterial pulsation and peristalsis in the bowel do not reappear.

## OVERVIEW

Hernia surgery is changing rapidly since the introduction of the routine use of mesh and laparoscopic surgery.

About 10 years ago laparoscopic surgery was introduced and proved an immediate boom for gallstone sufferers. Some of the early patients developed major complications but this has now settled with experience at acceptable levels.

Following these developments laparoscopic hernia repair developed an impetus and went through a very expansive period, which has now settled back in many countries. In some 15% of cases were carried out laparoscopically by what has been termed key hole surgery, but this has now been reduced to about 7% of cases. This will be discussed in future articles where various methods are compared and as these evolve.

Development of laparoscopic hernia repair stimulated I believe what could be termed other competitive open techniques where small incisions were made and mesh has been designed to place between the layers of the abdominal wall and the peritoneum through a muscle splitting incision.

### **Types of repair:**

- A. Open technique (from in front) – This can be carried out under local anaesthesia with or without sedation or general anaesthesia. Local anaesthetic can be infiltrated post operatively for post operative pain relief.
  - 1. Shouldice technique – suturing only. The excellent results at the Shouldice Clinic in Canada have been difficult to replicate at non specialist centers. The technique has been commented upon as difficult to learn.
  - 2. Bassini repair- suturing only – the oldest technique. Non-absorbable suturing is essential but high recurrence rates are reported. Some Surgeons use a relieving incision with this and claim better results.
  - 3. The Lichtenstein repair. This is a mesh reinforcement. Lichtenstein was the originator of the so called “tension free repair” – uses a flat mesh. The procedure is carried out under L/A with Neurolept sedation – an essential component of the technique.
- B. Open pre-peritoneal mesh placement – (from behind):

Increasingly especially designed meshes usually polypropylene allow the mesh to be replaced in the deeper plan between the muscles and peritoneum without a large incision.

There are several proponents of these techniques. One example is a kugel repair where a compressible mesh is inserted through a small split in the muscle. The mesh then regains its shape to form a wide buttress.

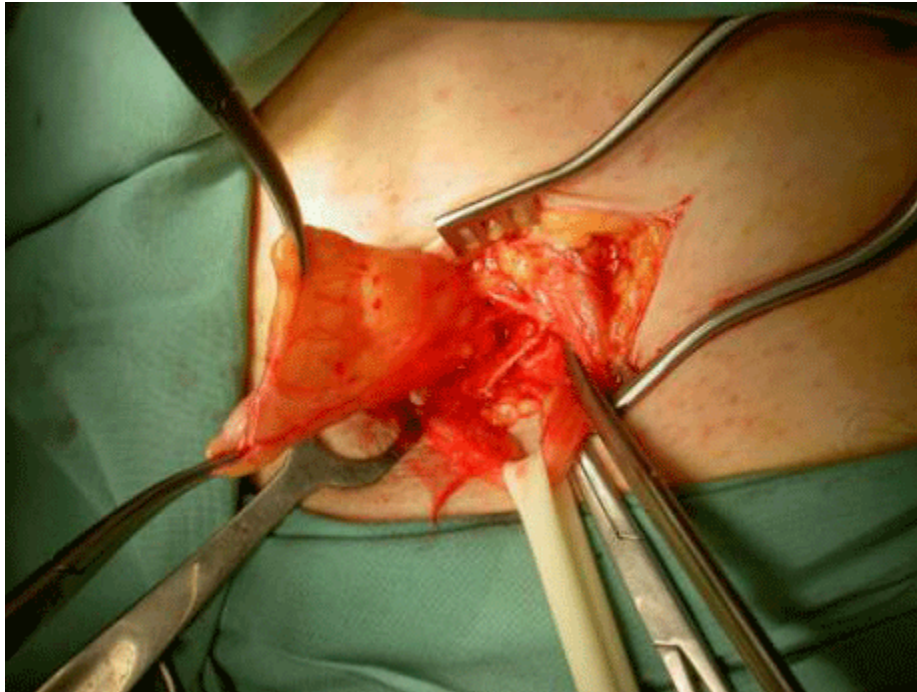
Another technique is a Prolene hernia system where a double layer of mesh, an umbrella where a plug is used.

Various combinations are possible.

### C. Laparoscopic Repair (keyhole Surgery)

There are two main techniques for placing a mesh in the layer between the peritoneum and muscle wall.

1. TAPP - Trans-Abdominal Pre-Peritoneal mesh – the mesh is placed by inflating the abdominal cavity initially with gas and opening the peritoneum from within, then placing the mesh and repairing the peritoneum. The mesh is usually stapled into position.
2. TEPP - Total Extra Pre-Peritoneal technique. Here the mesh is placed without entering the abdominal cavity, by dissection between the peritoneum and the muscles, often using a large balloon to separate the layers so that the mesh can be placed by stapling into position.



*Operation showing the sac and the cord*



Both these operations are refinements of the open extra-peritoneal repair popularised years ago and for which there are still many proponents.

### **Direct and indirect inguinal hernia**

Inguinal herniae are the commonest by far encountered in practice. They occur at any age. They are at least 20 times as prevalent in males as females.

There are two basic types but they both protrude through the external ring of the inguinal canal.

The INDIRECT descend along the spermatic cord or round ligament.

The DIRECT bulge through the posterior wall of the inguinal canal medial to the inferior epigastric artery, posterior to and separate from the spermatic cord.

The indirect occur at any age, from infancy to the elderly. In children or females the hernia is invariably indirect. Direct herniae occur with increasing frequency in males as they age.

The persistence of the processus vaginalis sac at birth following the descent of the testis results in the development of indirect herniae in children. This is the congenital type of the sac.

With incomplete descent of the testis there is usually an associated indirect hernial sac.

Persistence of a patent processus vaginalis is also responsible for communicating hydroceles of the testis and encysted hydroceles of the cord.

There is no conjecture as to whether this congenital type of sac is responsible for the development of indirect herniae in adults or whether the herniae developed as a new event, associated with failure of the muscular shutter mechanism at the internal ring. The 'congenital sac' theory assumes there is a congenital sac which only fills with contents in adult life.

It is not always possible to distinguish clinically between a direct and indirect inguinal hernia.

Some guiding points are size:

1. It is uncommon for direct hernias to reach down into the scrotum, and they are generally smaller.
2. It is common for direct hernias to bulge forward. They are often bilateral in the older person.

3. The impulse as detected by palpation at the internal ring, is directly forward rather than oblique.
4. Pressure over the internal ring will prevent the descent of an indirect hernia but not a direct hernia.

While these are all practical points in differentiation there is a significant error rate. The basic need is to be able to decide which hernia should be operated on and which can be observed and reviewed.

Generally indirect herniae should be surgically repaired because they become larger, cause symptoms and may obstruct and strangulate.

In children this is especially so because strangulation is more prone to occur with little warning.

Direct herniae usually do not cause marked symptoms or become very large, nor do they obstruct or strangulate; surgery can usually be safely delayed.

Many other factors will decide whether surgery is carried out, but generally it is advised for either type. A truss is sometimes used to prevent the hernia protruding and to minimise the discomfort. A truss is often used when the patient declines or is considered unfit for surgery. A truss however, is not always effective and often only delays the issue.

## **THE SURGERY**

### **Herniotomy**

In children removal of the indirect sac is usually considered to be sufficient – herniotomy.

### **Hernioraphy**

However, in adults there is a mechanical defect in the structure of the internal ring which if not repaired will result in recurrence of the hernia. The internal ring must be narrowed and the (Ed?) wall (ED?strengthened). using transversalis fascia, the arching muscular and aponeurotic fibers of the internal oblique and transversus muscles. Thus recurrence of an indirect inguinal hernia is prevented and the development of a direct inguinal hernia at a later stage is averted.

The aim is for a combination of early and long lasting strength using a suture which holds its ties well and does not have the propensity to develop chronic infection with subsequent sinus formation.

Early on it is the suturing which entirely holds the repair together, but within a period of two to three months the wound has reached its maximum strength and the suturing plays a lesser role.

With a DIRECT HERNIA, the bulge can be reduced by imbrication of the thin tissue of the posterior wall. Imbricate means to turn in on itself. This reduces the hernia without exerting tension on the surrounding muscle and inguinal ligament. However it is generally considered that this is not sufficient to repair a direct inguinal hernia, and once the posterior wall has been reconstituted in this manner, additional measures are necessary.

This involves suturing muscular and preferably aponeurotic tissue of the arch down to the inguinal ligament. This is difficult to achieve without tension as the tissues are usually weak over a fairly wide area. In order to narrow this gap, a relieving incision is made in the anterior layer of the rectus sheath – sometimes termed Tanner's slide. Nevertheless it is thought to be the excessive tension on this suturing which is the main cause of recurrence of direct inguinal herniae. Generally it is believed that direct inguinal hernia recur following repair more frequently than indirect herniae.

### **Hernioplasty**

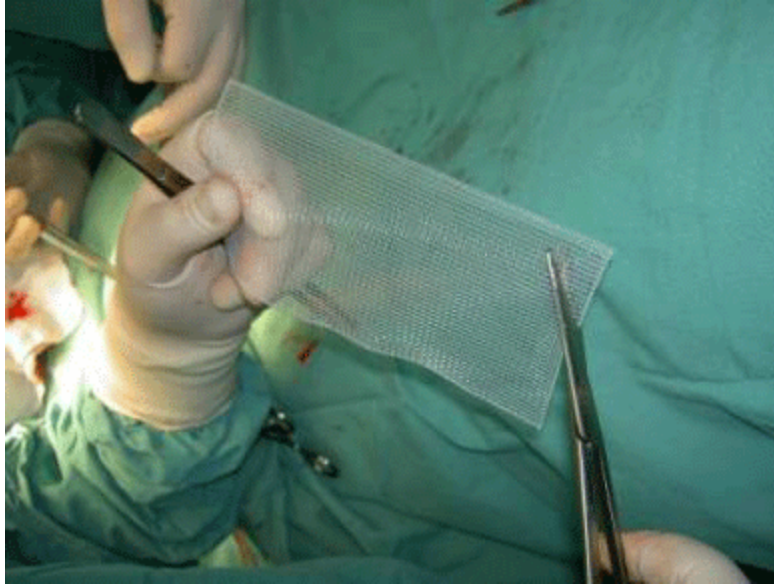
Over the years many additional methods have been used to reinforce this repair with different types of grafts and implants. This process is termed hernioplasty.

An example of hernioplasty is the placement of non-absorbable synthetic mesh such as polypropylene mesh over the posterior wall. This acts as a buttress and a trellis into which fibrous and scar tissue grows.

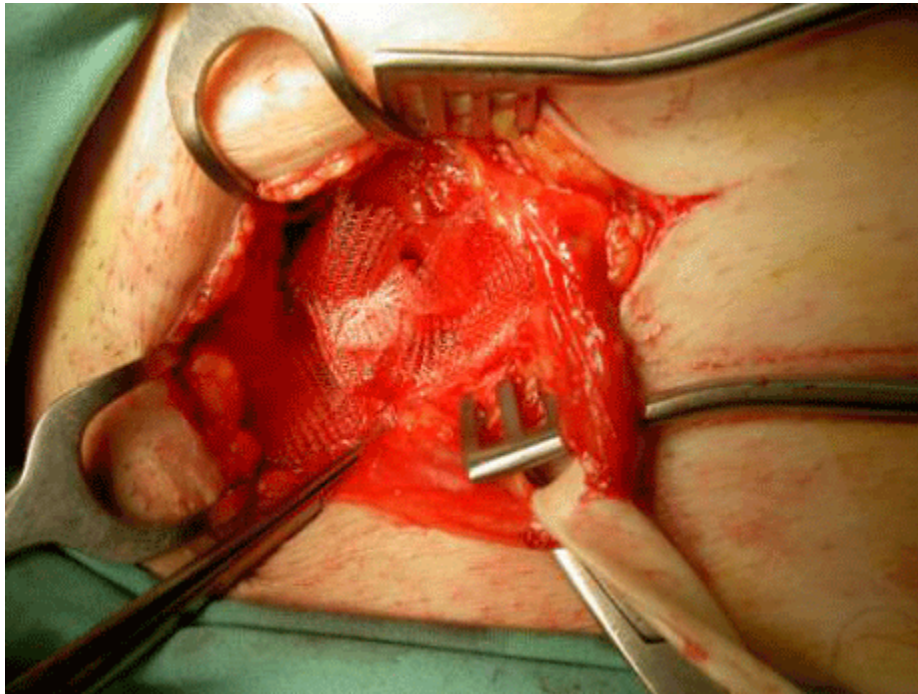
Prosthetics, i.e. the addition to the body of some artificially prepared material are commonly used in surgery now. They have many desirable features but limitations as well. For herniae they must be strong and durable and pliable and should not cause a prolonged or excessive inflammatory response. They should be inert and not rejected. They should be sutured in place with similar materials so friction and tension are reduced.

With a mesh there is immediate strength and with time a strong wall is formed. The repair is reinforced without having to pull muscle and aponeurotic tissue tightly down onto the inguinal ligament.

Chronic infection and sinus formation unfortunately can occur but they are a much less frequent event with the modern material used.



*Sample of mesh used in 'day surgery'*



*Mesh inserted*