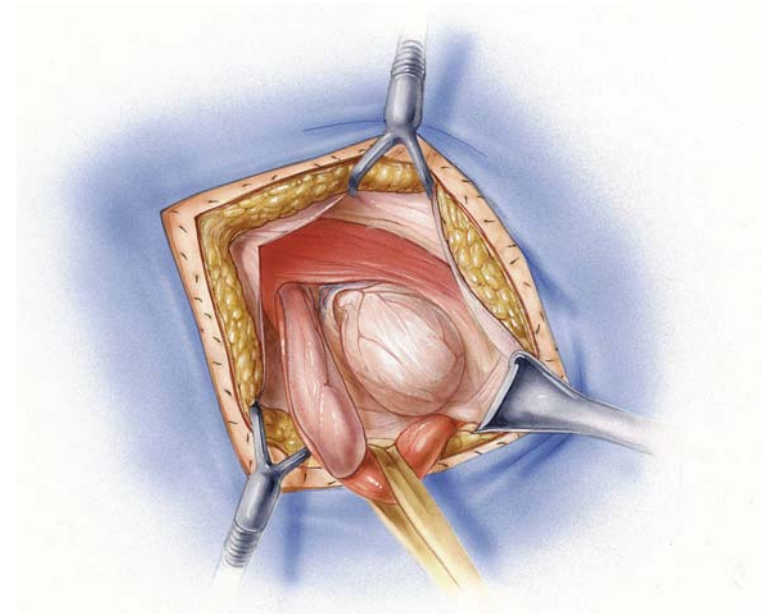
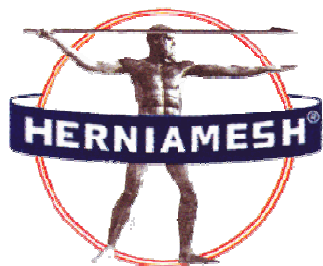


ATLAS OF TRABUCCO  
TENSION-FREE GROIN AND VENTRAL  
HERNIOPLASTY

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Second edition



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**ATLAS OF TRABUCCO  
TENSION-FREE GROIN AND VENTRAL  
HERNIOPLASTY**

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## TRABUCCO TENSION-FREE SUTURELESS GROIN HERNIA REPAIR

The last description of the current Trabucco Tension-Free Sutureless Groin Hernioplasty technique and clinical results was published in 2002 in *Hernia*, Fifth Edition by Nyhus and Condons. Lippincott, Williams & Wilkins, Philadelphia.

### History

- 1977 - THE TRABUCCO HERNIA INSTITUTE, one of the first institutions in the world designed exclusively for ambulatory hernia repair, opened in New York, USA.
- 1989-1997 - Tension-Free Mesh-Plug Repair was performed in 3422 patients. A round-shaped Mesh T1 was folded to form the cone-shaped plug and then inserted into the defect. Additionally, onlay mesh was placed on the posterior wall of the inguinal canal.
- 1997-1999 - Novel approach: In order to avoid plug-related complications, the three-dimensional plug was abandoned and instead:
  - For medium and large indirect inguinal hernias, the flat MESH T4 was placed in preperitoneal space surrounding the spermatic cord.
  - For small indirect hernias, a small defect was closed with a single suture instead of insertion of the plug.

Additionally in all cases, preshaped flat HERTRA mesh was placed on the posterior wall of the inguinal canal. This ready-to-use prosthesis replaced a piece of large rectangular mesh trimmed during the operation.

During this period, different types of polypropylene materials were clinically tested to optimize the structure, thickness, and rigidity of the mesh.

HERTRA 1 as a rigid mesh was optimal for obese patients with large defect. HERTRA 2 was semirigid and designed for the rest of the patients. Both prostheses have proper rigidity, minimal mass, and maximal porosity. They lie flat in a wound, do not curl, wrinkle and fold even without suture fixation.

- Since 1999, the principles of the Trabucco technique and meshes designed for the repair have remained unchanged.

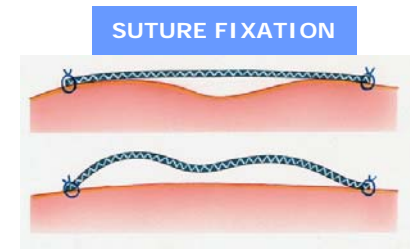
### Principles of the Trabucco Tension-Free Sutureless Inguinal Hernioplasty.

1. The first step is the same as for most hernia surgical techniques- hernia sac dissection and reduction into peritoneal cavity without opening, or in cases of incarcerated hernia the sac should be excised after revision.
2. Repair of the defect.
  - Use of a specially designed prosthesis according to type of hernia, size, patient BMI, and gender.
  - Sutureless technique- the proper prosthesis is placed without suture fixation to the surrounding tissue.

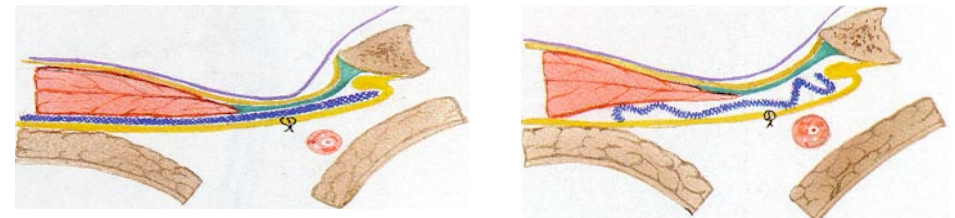
**SUTURELESS-** The prosthesis is placed without suture fixation to the surrounding tissue. Mesh should lie flat in the wound without curling or folding. It should therefore have proper rigidity, flat shape memory, and high porosity, allowing for fast tissue ingrowths. Such mesh better adapts to conditions when the patient moves after operation.

**TENSION-FREE** - Placing the mesh without suture fixation is critical to avoid tension, and to provide optimal conditions for wound healing.

In cases where sutures are applied, a maldistribution of the tension in the mesh-suture-tissue line results. This tension is responsible for a variety of postoperative complications: pain, mesh wrinkling, dead space formation, fluid collection, delayed healing, and increased risk of infection.



Mesh used for the Trabucco Sutureless Tension-Free Repair must have proper rigidity and flat shape memory; it is critical for the effectiveness of the technique!




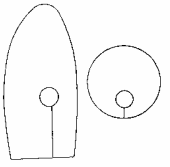
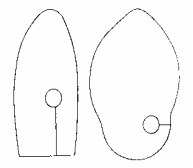


A prosthesis with proper rigidity (Hertra) (on left) placed without suture fixation lies flat and does not wrinkle or curl.

When mesh is too soft (on right), it wrinkles, curls, and creates dead space in the wound.



## CHOICE OF PROSTHESIS ACCORDING TO TYPE OF HERNIA

- For direct and small indirect inguinal hernias, it is sufficient to place flat HERTRA 1, 2, or 2a on the posterior wall of the inguinal canal without suture fixation. The external oblique aponeurosis is closed **under** the spermatic cord.  
**This is the simplest and the fastest inguinal hernia repair- no need for tissue repair, and no need for mesh fixation!**
- For all larger inguinal hernias, it is necessary to place an additional prosthesis (Mesh 4 or Mesh T5) in the preperitoneal space to prevent recurrence.
- For femoral or recurrent hernias, the defect has a cylindrical shape. Therefore, it should be filled with a special Plug T2 or T3. All plugs have a flat mesh basis, which protects from postoperative plug migration and reinforces the tissue around the defect.

Type of Hernia	Type of Prosthesis	Figure of the Prosthesis
Direct or Small Indirect	Hertra 1, 2 or 2a	
Medium or Large Indirect	Hertra (1,2,2a) plus Mesh T4 in Kits #7,8,11 or Kits# 12,13,14,15,16	
Scrotal or „Giant Hernia“- with defect of entire posterior wall of the inguinal canal	Hertra (1,2,2a) plus Mesh T5 in Kits #5 or 6	
Femoral	Plug T2	
Recurrent (inguinal)	Plug T2 or Plug T3	

## TRABUCCO TENSION-FREE SUTURELESS INGUINAL HERNIOPLASTY

### HERNIA SAC DISSECTION

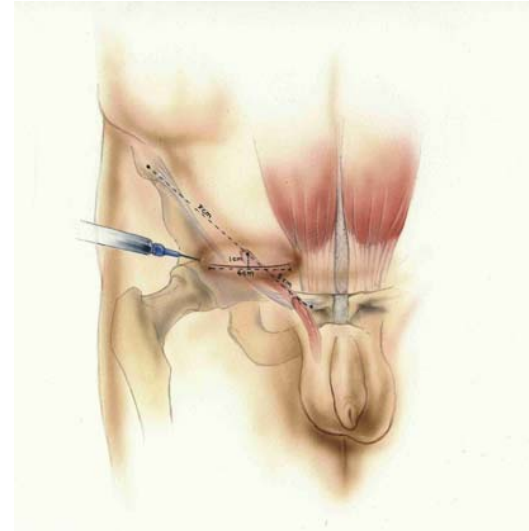


Fig 1. Subdermic and subcutaneous infiltration of an anesthetic solution. A transverse incision is made 1 cm below the internal inguinal ring. This heals better than an oblique incision and results in better cosmetic effect.

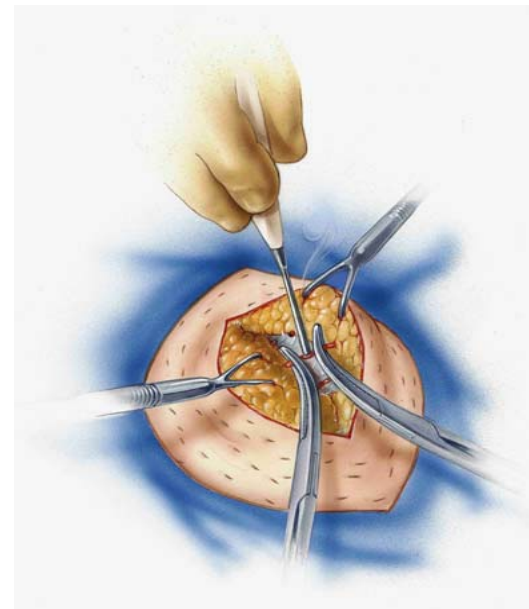


Fig 2. A double spring hook retractor does not slip when grasping the subcutaneous fatty tissue. It also facilitates exposure and hemostasis.

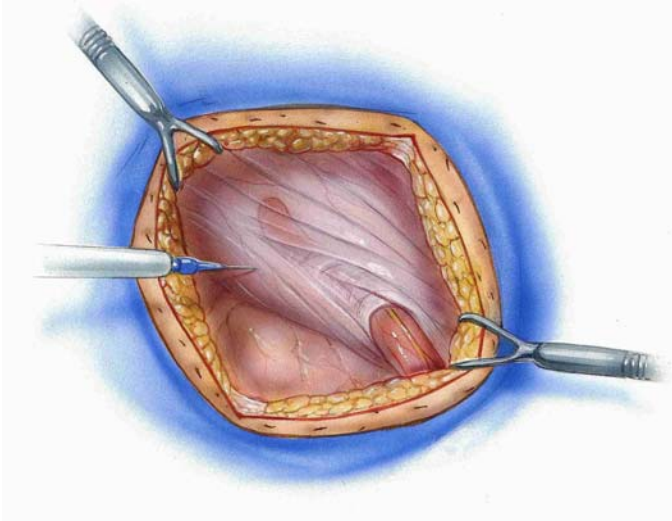


Fig 3. Anesthetic solution infiltrated under the external oblique aponeurosis acts on terminal sensorial branches of the inguinal nerves; therefore, a nerve block is not necessary.

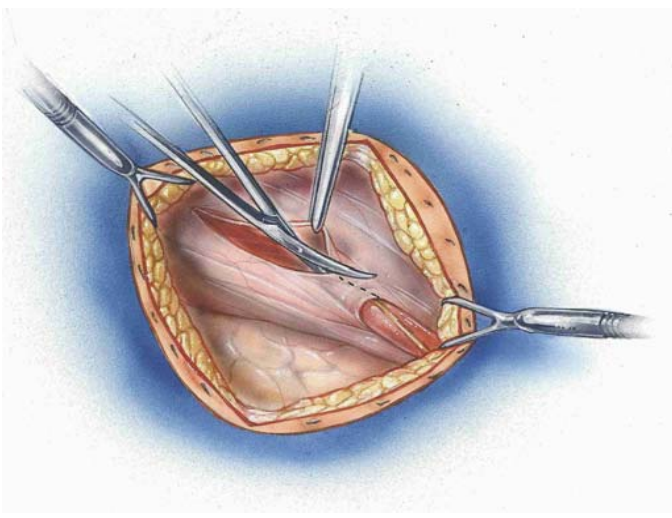


Fig 4. The external oblique aponeurosis is divided, preserving the inguinal nerves.

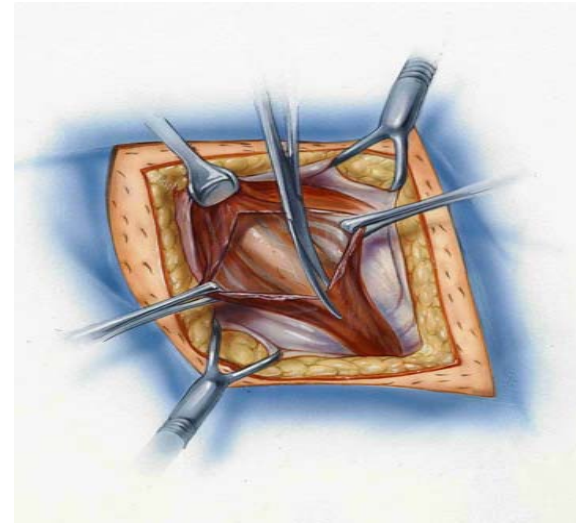


Fig 5. The cremaster is lifted with two Allis clamps and divided longitudinally, transected, and ligated.

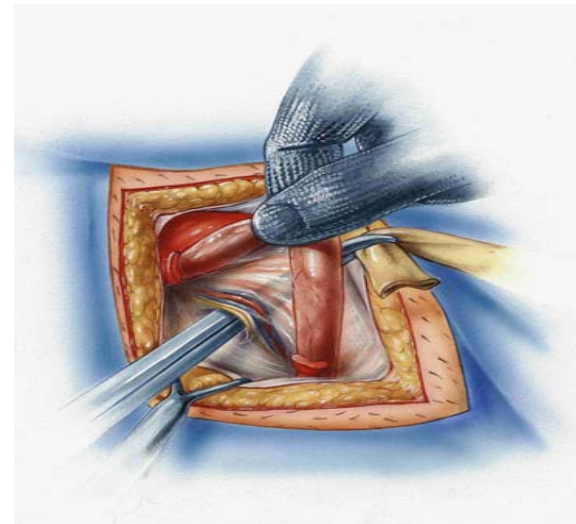


Fig 6. The spermatic cord is lifted, exposing its mesentery. A Kelly clamp is inserted under the mesentery, lifting the external spermatic vessels and the genital branch of the genitofemoral nerves. The neurovascular bundle and spermatic cord are encircled by a Penrose drain and pulled up, exposing the floor of the inguinal canal.



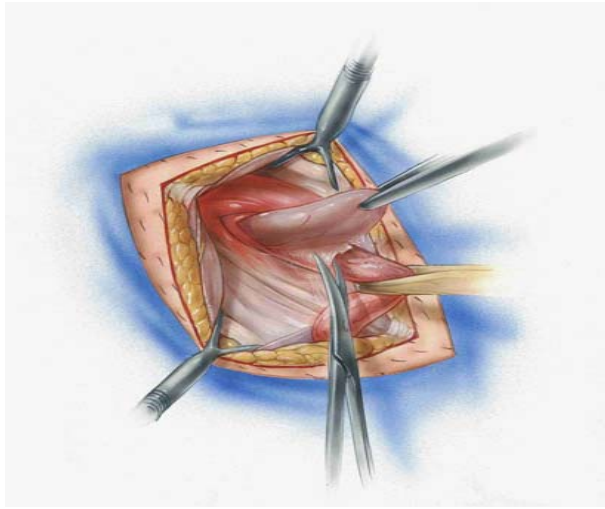


Fig 7. A sac of the indirect hernia is dissected from the spermatic cord, exposing the deep inguinal ring. The sac should not be cut or ligated in order to prevent postoperative pain due to local peritoneal trauma.

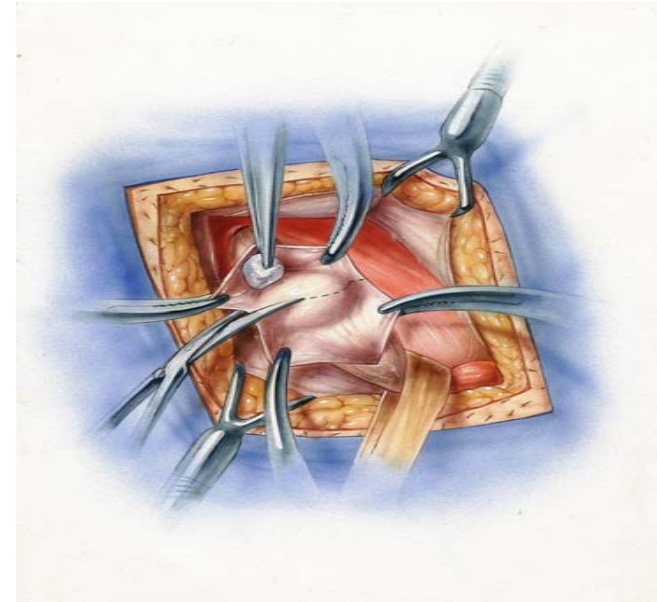


Fig 9. The distal part of the sac is left intact within the spermatic cord to prevent congestive orchitis.

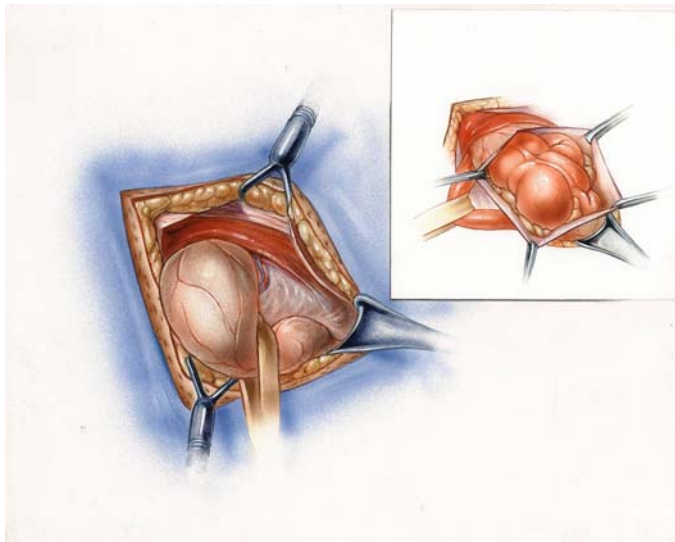


Fig 8. For large or scrotal hernia, however, the sac is additionally infiltrated with anesthetic solution and cut for revision.

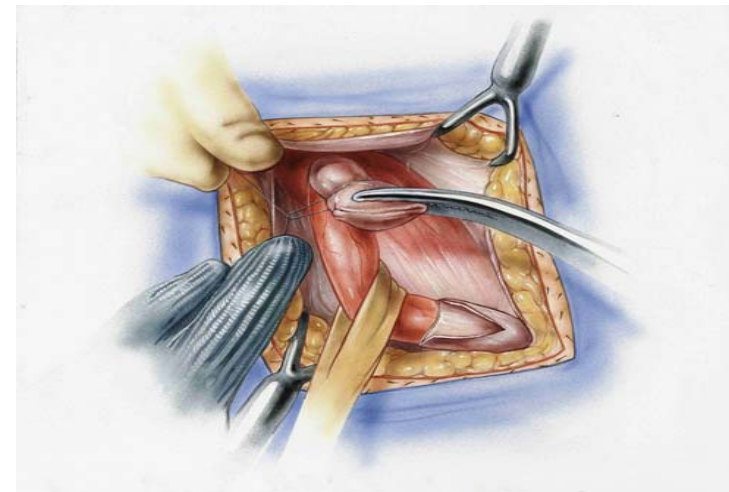


Fig 10. The proximal part is dissected, ligated, and reduced into the deep inguinal ring. The distal part of the sac is incised longitudinally and left open to prevent hydrocele, or fluid collection.

**DIRECT OR SMALL INDIRECT HERNIA REPAIR-  
IMPLANTATION OF HERTRA 1, 2, or 2a**

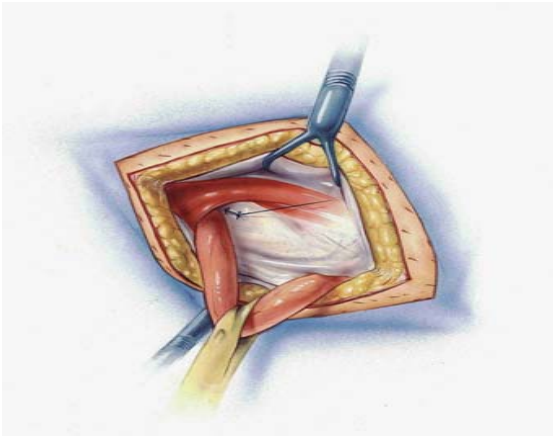


Fig 11. For small indirect hernia (defect <2cm), narrowing of the deep inguinal ring is preferred over implantation of the three-dimensional plug.

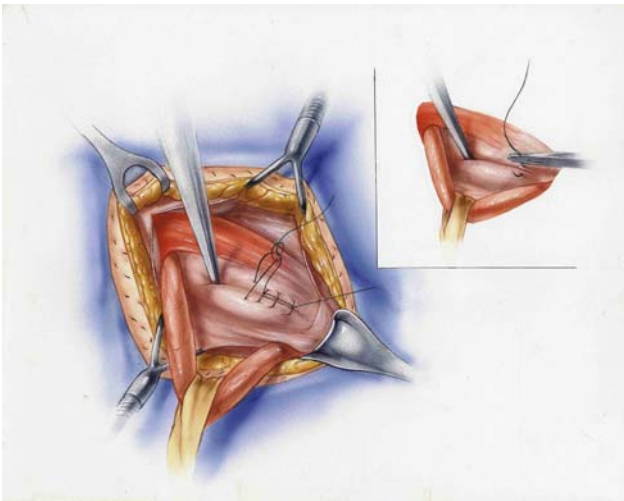


Fig 12. For direct hernia, the sac is reduced into the peritoneal cavity, and the posterior wall is flattened with the running, locking suture. Two rows of sutures may be necessary.

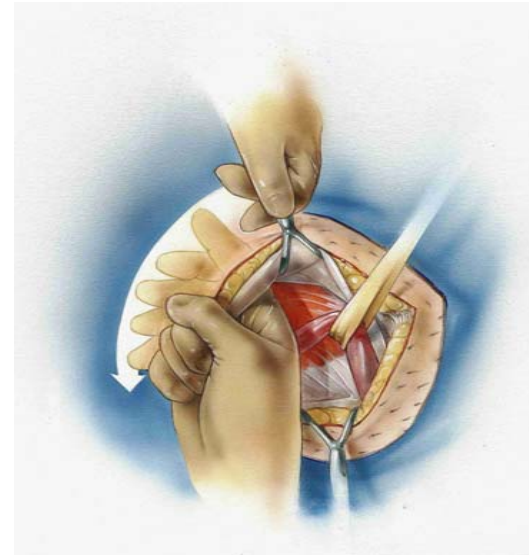


Fig 13. Next, blunt dissection of the loose tissue under the aponeurosis of the external oblique muscle prepares an adequate space for the placement of the Hertra mesh.

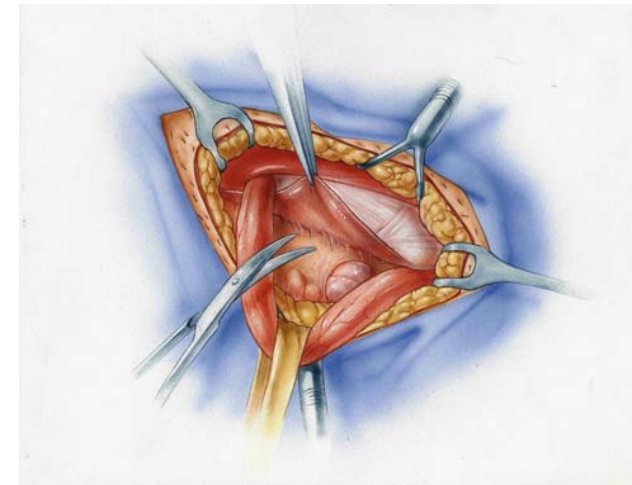


Fig 14. The inferior crus of the external oblique muscle is dissected from the cribriform fascia in order to lengthen the crus. This allows for closure of the external oblique aponeurosis without tension at the end of the operation and also permits easy exploration of the femoral canal.



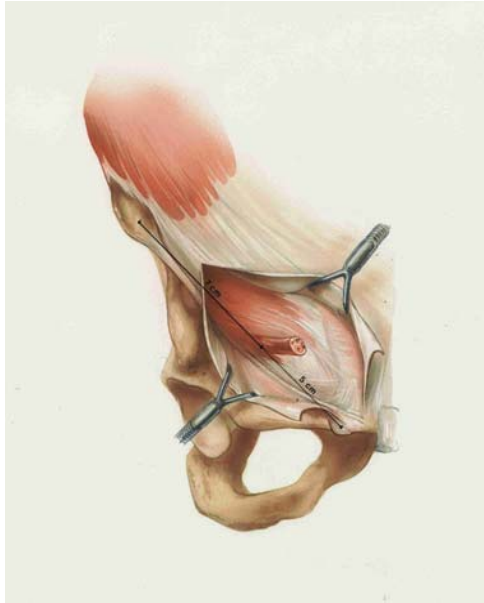


Fig 15. The floor of the inguinal canal has been flattened, and there are no direct or indirect protrusions. The anatomical space between the posterior wall and the external oblique aponeurosis is also referred as the "Inguinal Box". A mesh placed inside this space cannot move; thus it does not need to be sutured to the surrounding tissue.

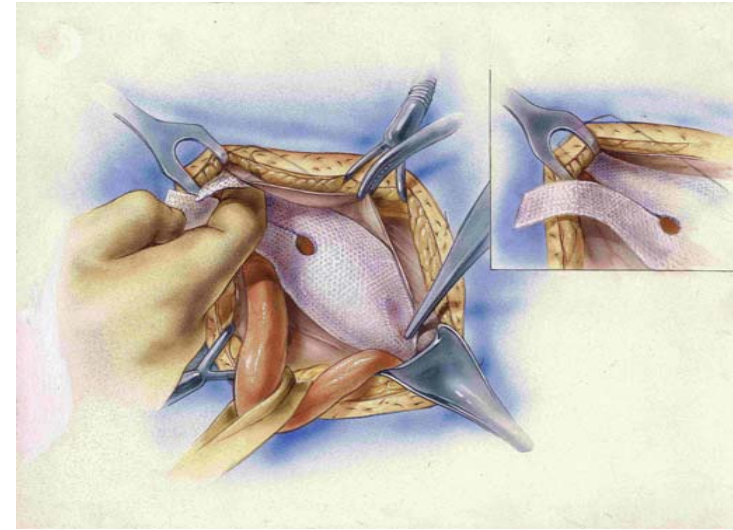


Fig 17. The lateral aspect of the pre-shaped rigid Hertra mesh is placed without wrinkling or curling in the lateral subaponeurotic space, which has already been dissected.

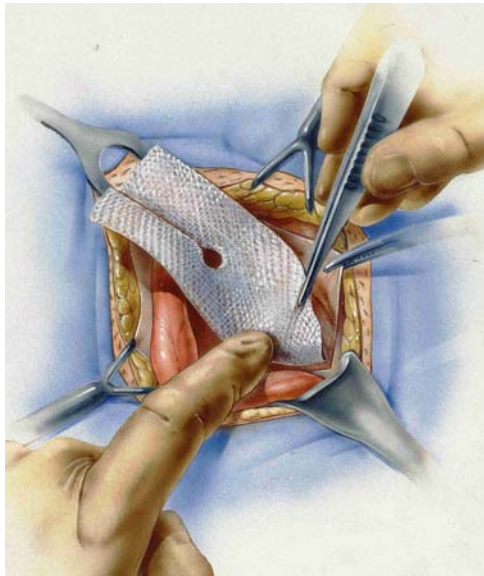


Fig 16. A preshaped Hertra mesh is placed on the flattened floor of the inguinal canal; its medial aspect must overlap the pubic tubercle by at least 1cm.

-  HERTRA 1-  
Rigid, for obese
-  HERTRA 2  
Semirigid
-  HERTRA 2A-  
for women

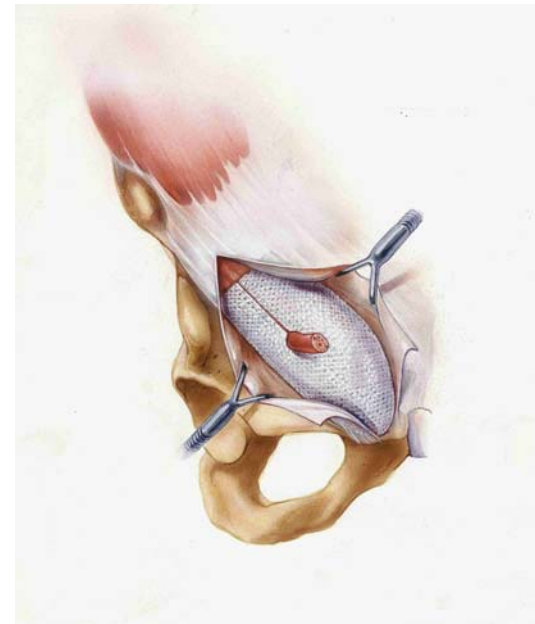


Fig 18. Preshaped Hertra mesh covers the posterior wall of the inguinal canal. This mesh has a flat shape memory and proper rigidity, so it lies flat and does not wrinkle or curl, even when placed without suture fixation. Nor will it migrate if it is lying without tension in a closed anatomical space, or "Inguinal Box," covered by the sutured external oblique aponeurosis.

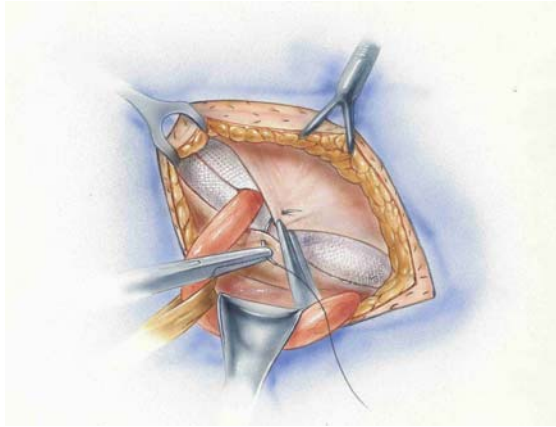


Fig 19. The aponeurosis of the external oblique muscle is reapproximated over the Hertra mesh but below the spermatic cord. The lengthened inferior crus enables a tension-free closure of the aponeurosis. During the postoperative period, tension-free, flat, and macroporous mesh situated in interfacial space is easily infiltrated by connective tissue and constitutes a uniform barrier preventing recurrence. Moreover, the spermatic cord is separated from the mesh-related scar formation, decreasing the risk of spermatic vascular and nerve damage.

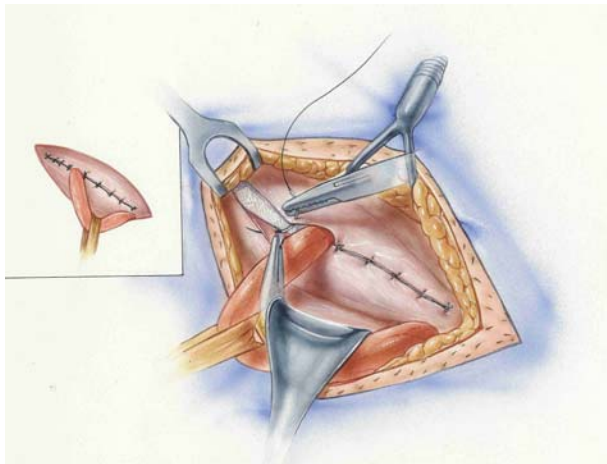


Fig 20. Closure of the external oblique aponeurosis.

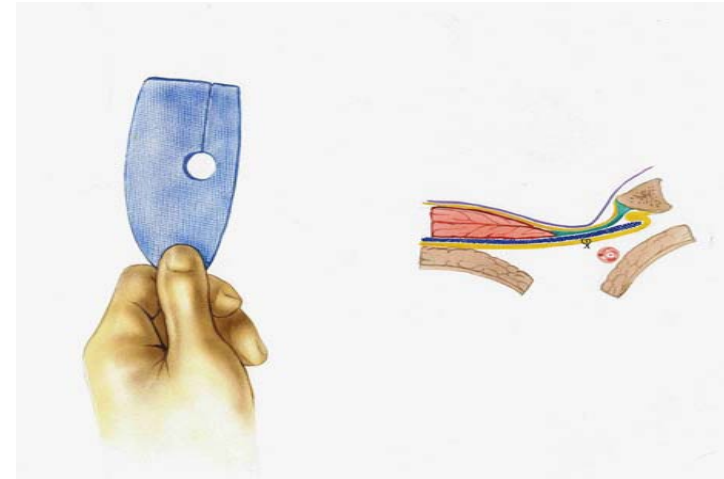


Fig 21. Hertra was designed especially for sutureless repair. It has proper flat shape memory and rigidity, which makes it easy to place flat in the interfacial space. No dead space is created, enhancing the engraftment. Hertra held in vertical position does not bend.

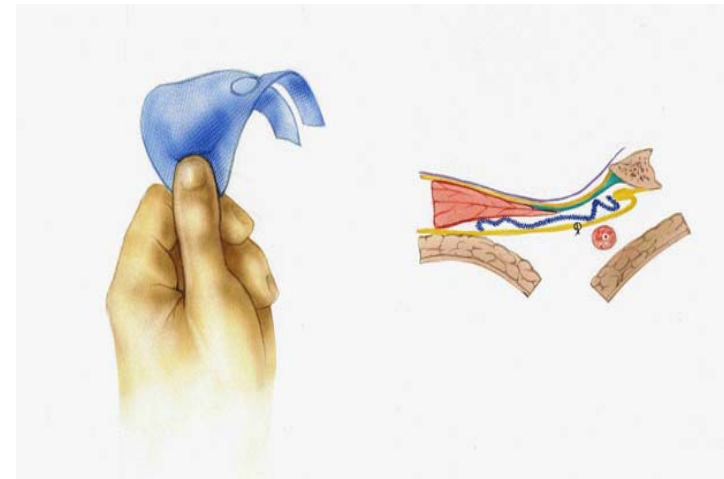


Fig 22. Other preshaped meshes are too soft for sutureless repair. If placed without sutures, they tend to curl, wrinkle, and create dead space, leading to postoperative complications. Mesh that is too soft bends when held in vertical position.

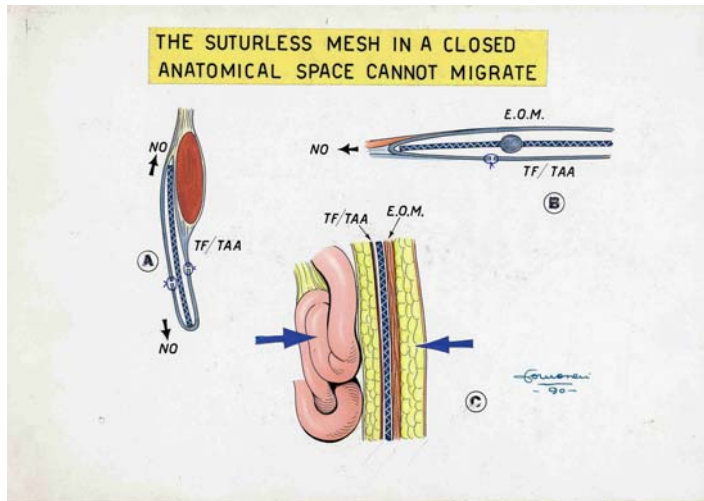


Fig 33. Closed anatomical boundaries lock the Hertra mesh in place after implantation. Intrabdominal pressure and tissue resistance also hold the mesh in proper position.

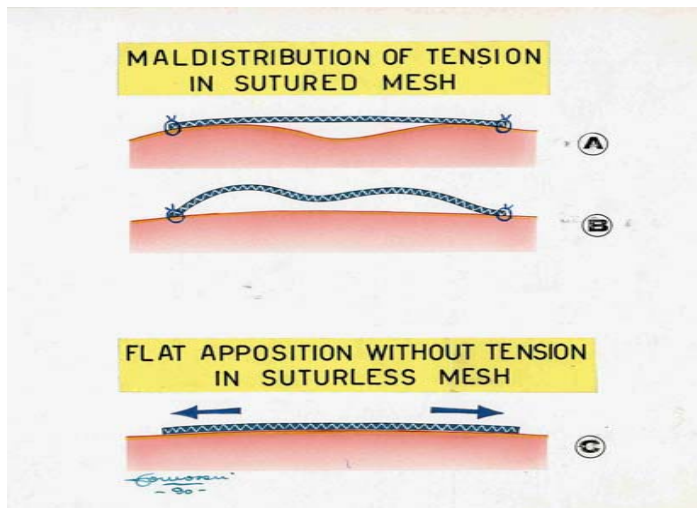


Fig 34. Whenever sutures are applied to the mesh, maldistribution of the tension may result. Additionally in such cases, dead space appears around sutured mesh (A,B). In contrast, rigid mesh placed without sutures lies flat without tension, and no dead space is created (C).

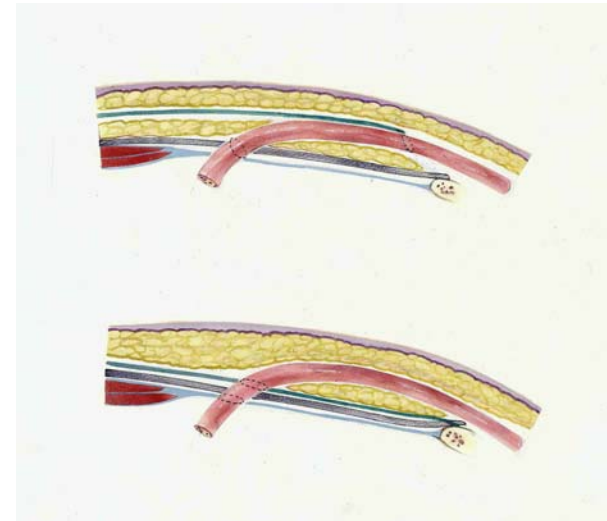


Fig 35. If the external oblique is closed **over** the spermatic cord (as in other techniques), the medial aspect of the posterior wall is protected only by the transversalis fascia and the mesh.

In Trabucco repair, however, the external oblique is closed **below** the spermatic cord (as in Halsted I operations). Therefore, the most frequent recurrence area-between the internal inguinal ring and pubic tubercle- is protected by triple-layer transversalis fascia, mesh, and the external oblique.

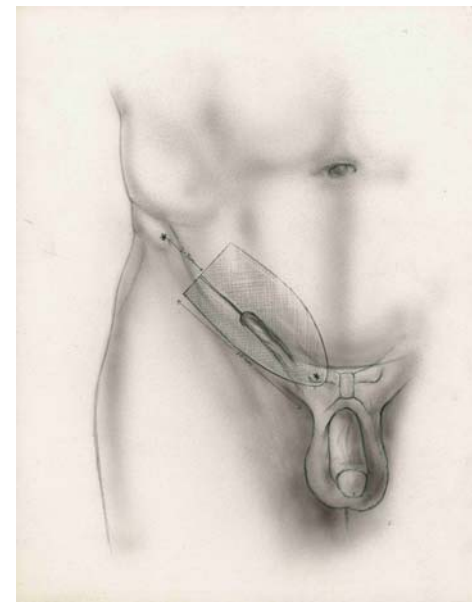


Fig 36. Projection of the Hertra mesh on the anterior abdominal wall. Postoperative pain is limited in sutureless repair, because there is no tension or nerve injury that may result from sutures.

Trabucco sutureless hernioplasty is simple, effective, and easy to learn. It is performed under local anesthesia as an ambulatory surgery, and the patient is able to resume sedentary work the day after the procedure. Results published by several authors show a very low incidence of recurrence- lower than 0.2%.



**MEDIUM AND LARGE INDIRECT INGUINAL HERNIA**

**HERTRA 1, 2 or 2a plus MESH T4**



HERTRA 1- rigid mesh for obese patients



MESH T4

HERTRA 2- semirigid mesh, for the rest of patients



HERTRA 2A- for women

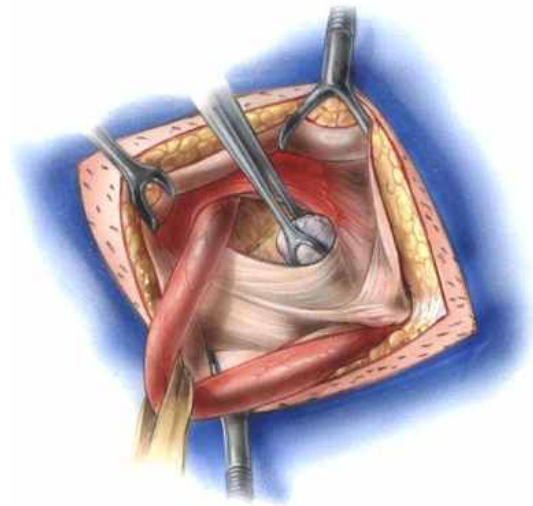


Fig 37. For medium and large indirect hernia (defect > 2cm), after reduction of the hernia sac, the preperitoneal space should be dissected for implantation of the Mesh T4.

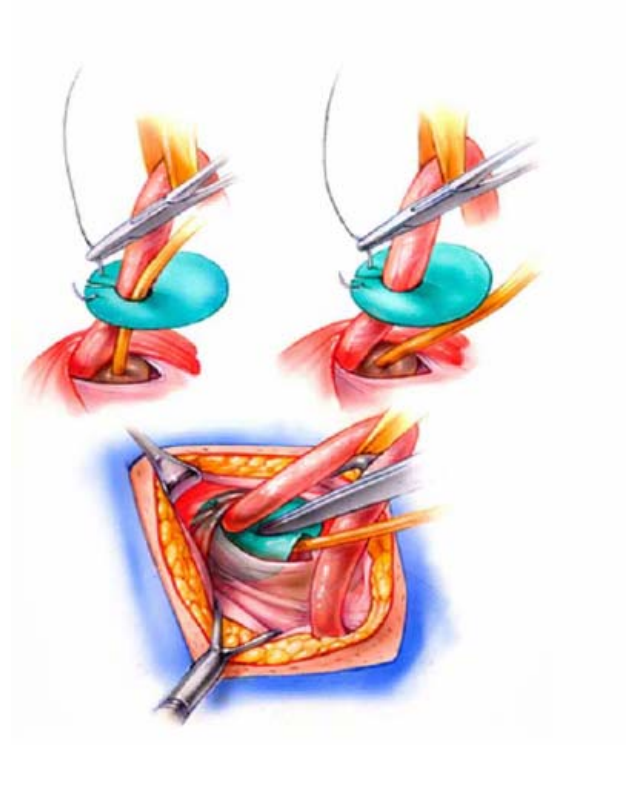


Fig 38. Mesh T4 can be placed around the spermatic cord above the wound and slid down to the preperitoneal space. An inflated Foley catheter balloon can help create the space for the mesh.

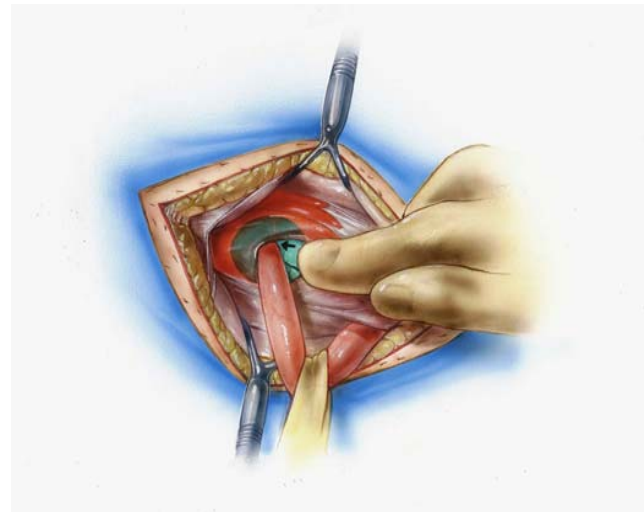


Fig 39. Flat Mesh T4 is placed in the preperitoneal space to block the internal inguinal ring and prevent recurrence.

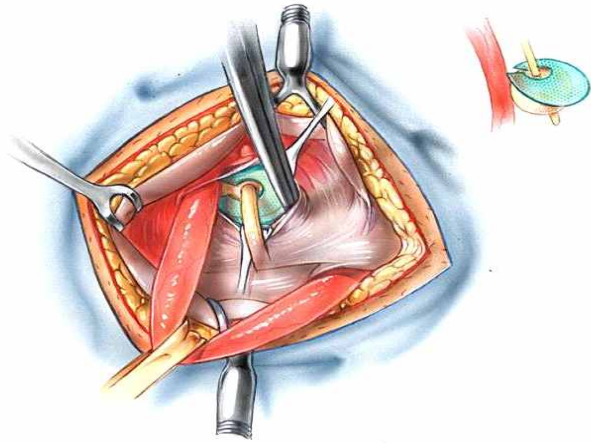


Fig 40. Alternative method of Mesh T4 placement. First the Foley catheter is inserted through the internal inguinal ring, and the balloon is inflated with 30ml air to create preperitoneal space. Then Mesh T4 can be inserted, allowing the spermatic cord to pass through the hole of the mesh.

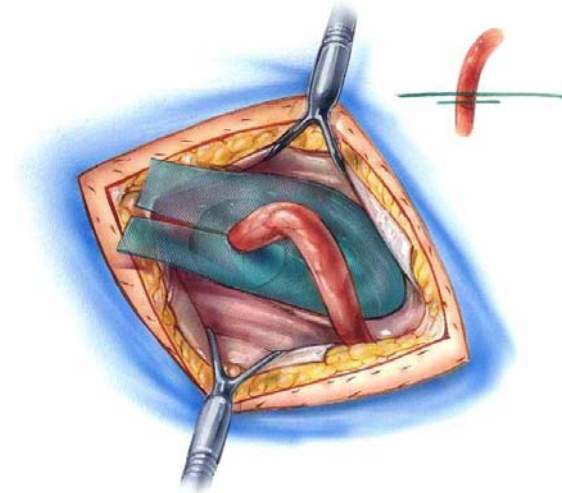


Fig 42. In the next step, Hertra mesh is placed without sutures on the posterior wall of the inguinal canal. External oblique aponeurosis is closed **below** the spermatic cord to directly cover the mesh in a closed anatomical interfacial space in the same fashion as it is performed for direct hernias. Mesh T4 helps to prevent indirect recurrence, and Hertra reinforces an entire posterior wall of the inguinal canal and prevents direct defects.

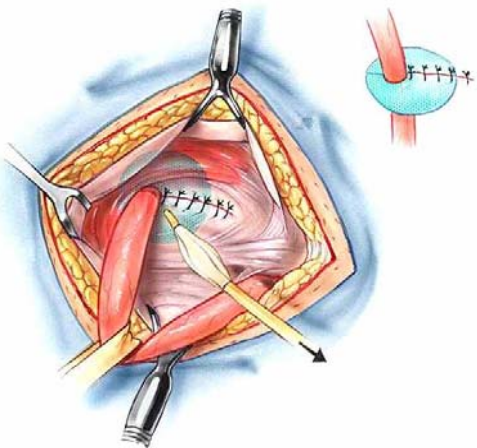


Fig 41. Next, the defect is closed with single sutures over the Mesh T4, and the Foley catheter is removed.

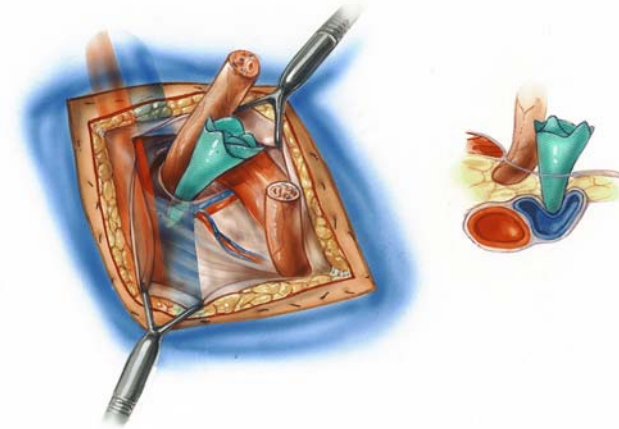


Fig 43. A flat Mesh T4 is preferred over three-dimensional plugs. Flat mesh is more suitable for flat preperitoneal space and for flat defects of the internal inguinal ring. The flat mesh lays flat without compression on surrounding tissue. Three-dimensional plugs, in comparison, can migrate, cause vessel injury (above), or chronic pain due to extensive pressure in the preperitoneal space, especially in young, thin patients.



**SCROTAL OR GIANT INGUINAL HERNIA WITH LOSS OF ENTIRE POSTERIOR WALL OF THE INGUINAL CANAL.**

**HERTRA 1, 2 or 2A plus MESH T5**

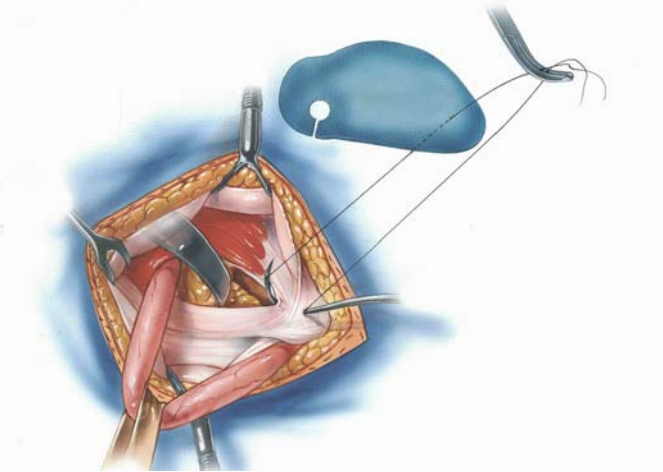


Fig 44. In cases of huge defects of the posterior wall of the inguinal canal, flat preshaped Mesh T5 is placed in the preperitoneal space. A Riverdin's needle facilitates the implantation and anchorage of the mesh. The first suture loop is passed through the tissue next to the pubic tubercle and then through the medial aspect of the mesh.

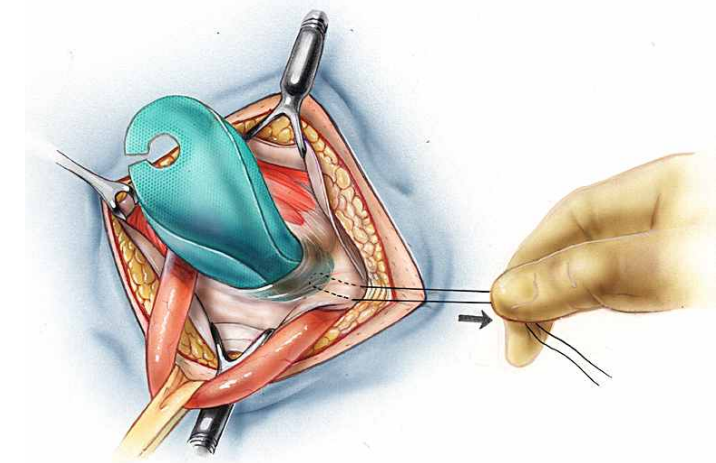


Fig 45. This suture loop is used to insert the medial part of the mesh T5 into the peritoneal space and tied to anchor the mesh.

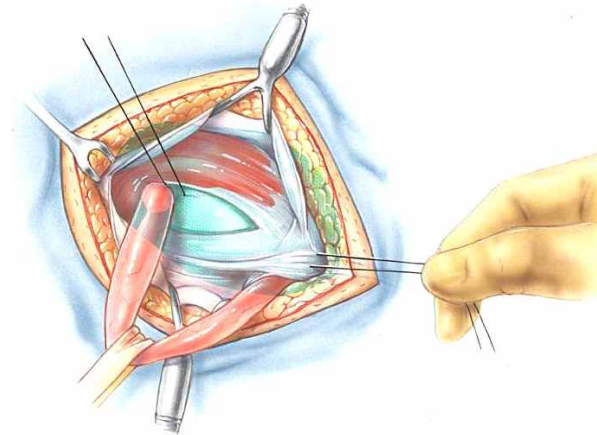


Fig 46. The second suture is passed through the lateral aspect of the Mesh T5. The prosthesis is placed in the preperitoneal space, passing the spermatic cord through the hole of the mesh.

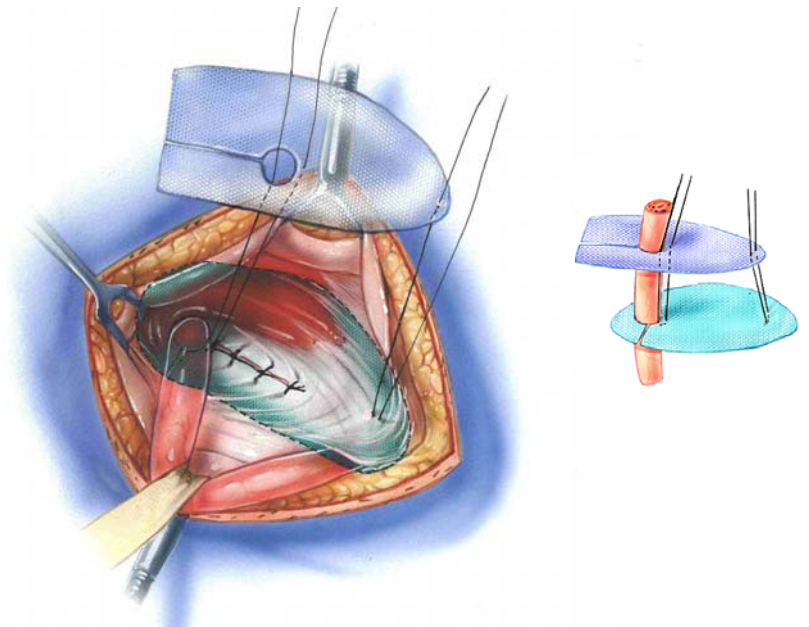


Fig 47. A defect of the posterior wall is closed with running or single sutures just to cover the Mesh T5 with the tissue. Next, the preshaped Hertra mesh is placed over the closed defect, and sutures from the Mesh T5 are passed through the medial and lateral part of the prosthesis. The sutures are tied over the Hertra to complete mutual anchorage of the meshes. The external oblique aponeurosis is closed below the spermatic cord and over the mesh Hertra as for other types of inguinal hernia.

## THREE-DIMENSIONAL PLUGS

### PLUG T2 and PLUG T3

Three-dimensional plugs are generally proposed for tunnel-shaped defects, such as femoral or recurrent inguinal hernias. They fill the lumen of the defect, preventing recurrence. However, most plugs do not have a base and also have free space inside. This structure allows mesh shrinkage over time, leading to plug collapse, and ultimately recurrence.

The proposed three-dimensional plugs are designed to prevent shrinkage and migration. These are the only plugs that have a mesh base and compressed rigid mesh tips to avoid injuring the tissue. The base is made from softer mesh to reinforce the tissue around the edges of the defect and enables easy plug anchoring.

The base varies in size from 3cm in diameter to size of 10x 14cm.

In plug repairs, the prosthesis fills the defect instead of closing it with sutures; it is therefore a tension-free technique.



Fig 48. Plug T2 has a small base and is designed for oval tunnel defects. It is produced in small, medium, and large sizes.

Plug T3 has a tip and large base. It is designed to fill the canal of the defect and simultaneously reinforce the surrounding tissue. For example, it can be used for weakened transversalis fascia or laparoscopic repair.

## TENSION-FREE FEMORAL HERNIOPLASTY

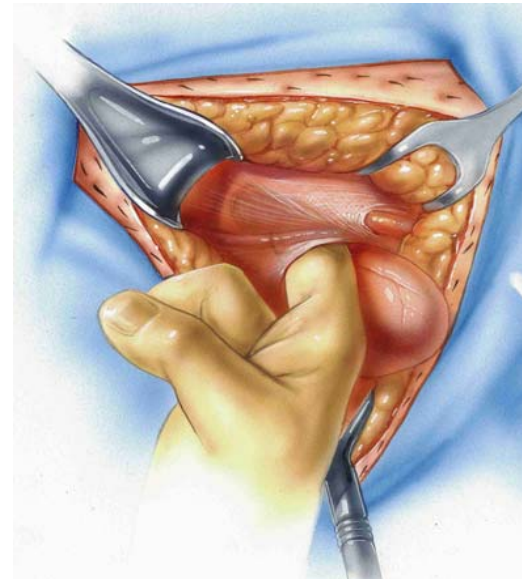


Fig 49. First the femoral canal is inspected and dilated with a finger. Then the hernia sac is reduced into the abdomen.

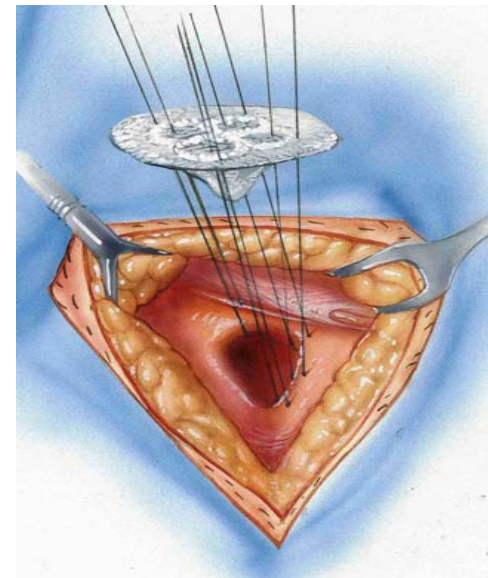


Fig 50. Loop sutures are placed from the inguinal ligament, falciform ligament, and pectineal fascia through the wall of the femoral canal. The ends of these sutures are then inserted through the base of the plug and tied. The tip of the plug slides into the lumen of the femoral canal when the sutures are tied.



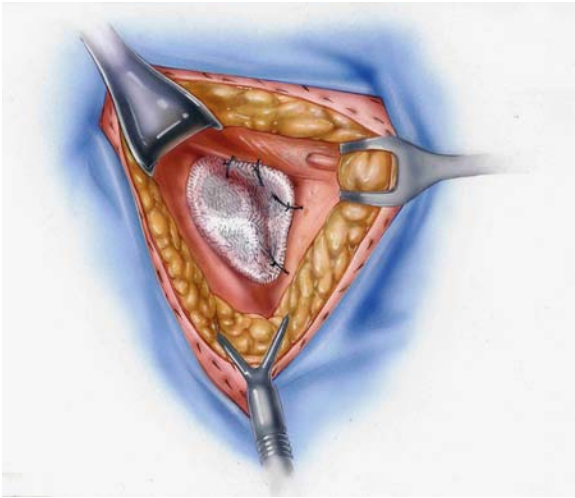


Fig 51. The sutures are tied, and the tip of the plug rests inside the femoral canal. Additional sutures can be placed into the base of the plug if necessary.

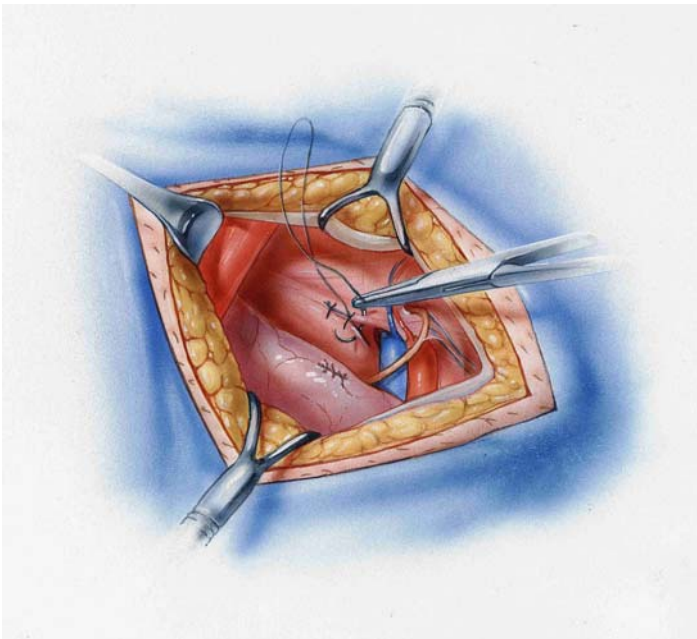


Fig 52. This posterior approach is preferred when the hernia is strangulated. The dilated femoral canal is narrowed by suturing the ileo-pubic tract to Cooper's ligament, or Plug T2 is inserted into the internal orifice of the femoral canal.

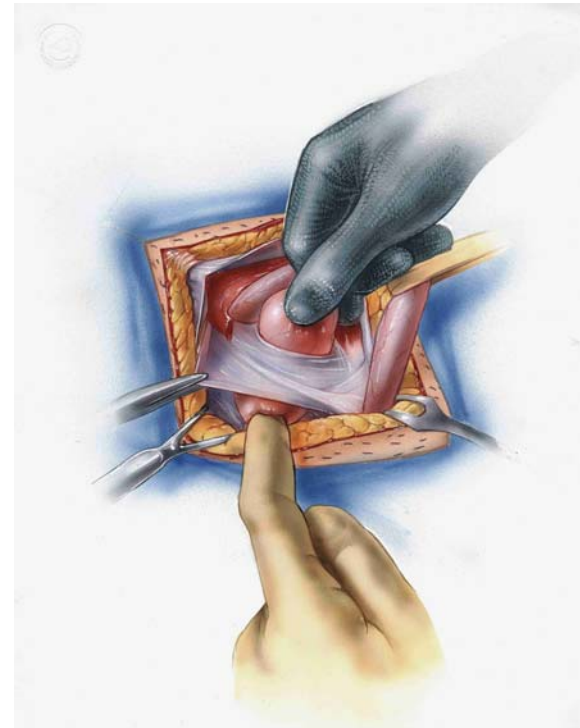


Fig 53. In the inguinal approach, the posterior wall of the inguinal canal is opened. The femoral hernia is reduced by pushing the sac on the side of the opened posterior wall of the inguinal canal. The femoral ring is then repaired using Plug T2.

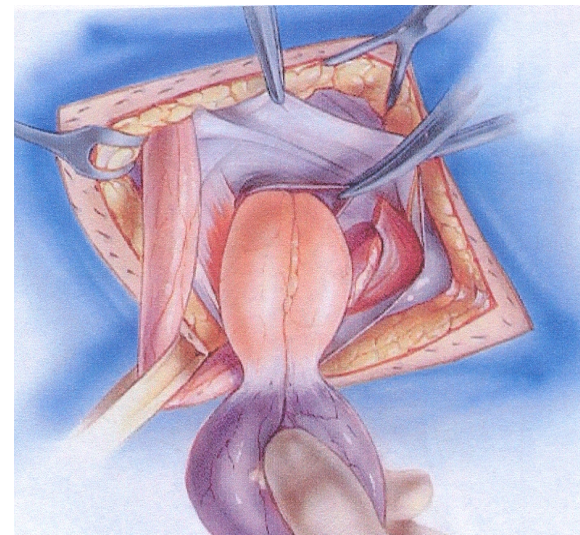


Fig 54. A strangulated femoral hernia is repaired by the inguinal approach. The posterior wall of the inguinal canal is opened. The strangulated loop of the bowel is pulled up, and an intestinal resection is performed. The femoral canal is then repaired with Plug T2, which is placed in the internal or external orifice of the canal.

## TENSION-FREE RECURRENT INGUINAL HERNIA REPAIR

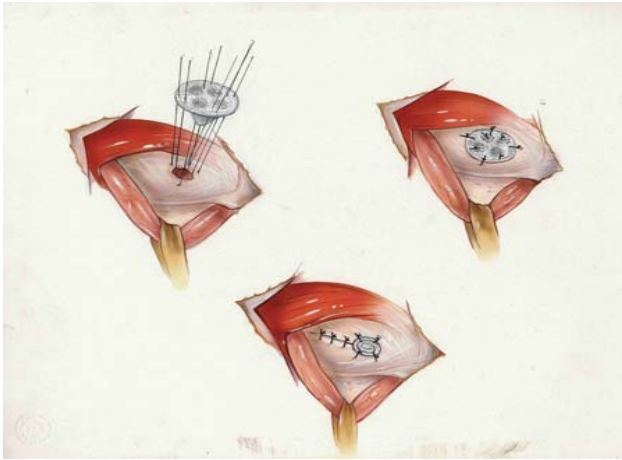


Fig 55. Recurrent inguinal hernias with small defects can be repaired through the anterior approach. After hernia sac dissection and reduction, Plug T2 is inserted into the defect and sutured to its edge. Dissection should be minimal in order to decrease the risk of spermatic cord damage. Plug T2, because of its base, produces a greater containment than the cigarette, cylinder, or umbrella type plugs and lowers the risk of plug migration and shrinkage.

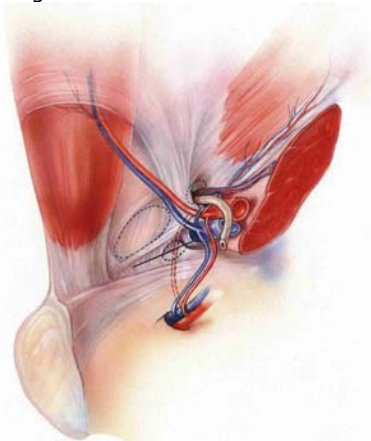


Fig 56. For larger recurrent hernia, the posterior approach is recommended. The view of the inguinal region in the posterior, preperitoneal approach is similar to that in laparoscopic view. The main advantage of this approach is that dissection and repair are usually done in "virgin territory," making it safer and more convenient.

## POSTERIOR PREPERITONEAL APPROACH

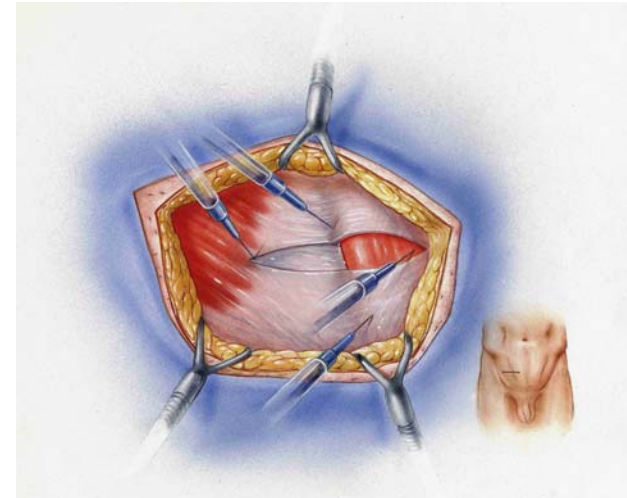


Fig 57. A transverse incision is made 2 cm above the internal inguinal ring. The lateral abdominal muscles and the anterior sheath of the rectus muscle are incised. The rectus muscle is retracted medially, and the transversalis fascia is opened to visualize the preperitoneal space.

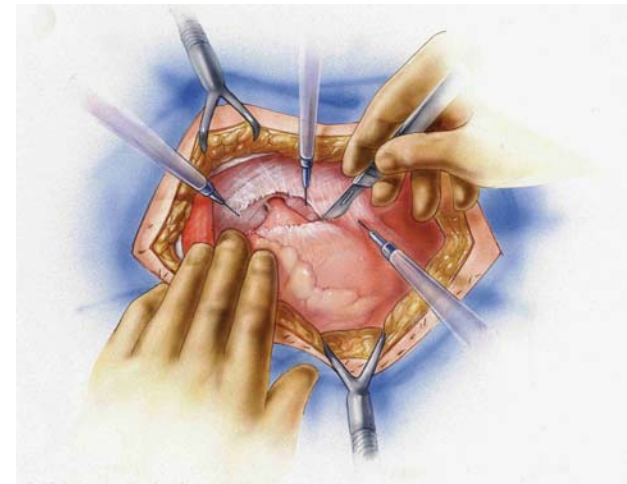


Fig 58. Adhesions around the hernia sac are dissected to visualize the edges of the hernia defect.

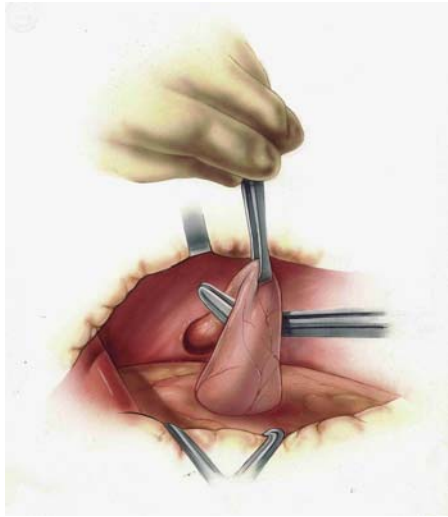


Fig 59. A Kelly clamp is used to free the sac in preperitoneal space.

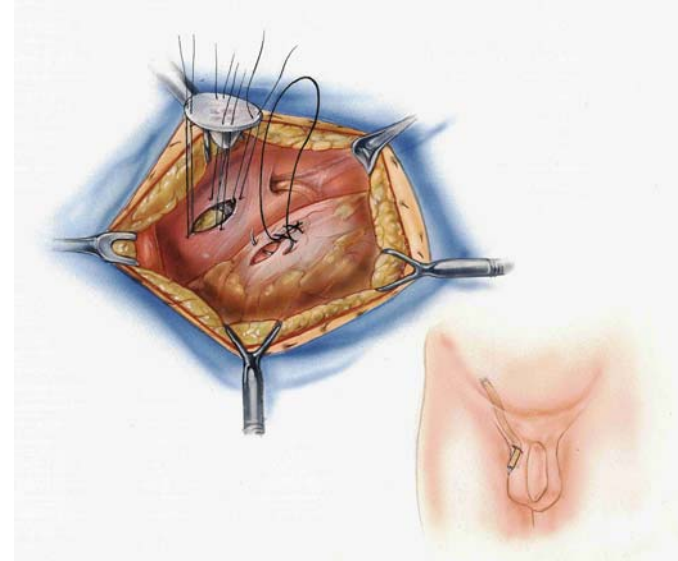


Fig 61. After the sac excision, the peritoneum is closed with running sutures, and the defect is closed with Plug T2. The distal part of the hernia sac, which remains in the canal, can be drained through the skin, low in the groin.

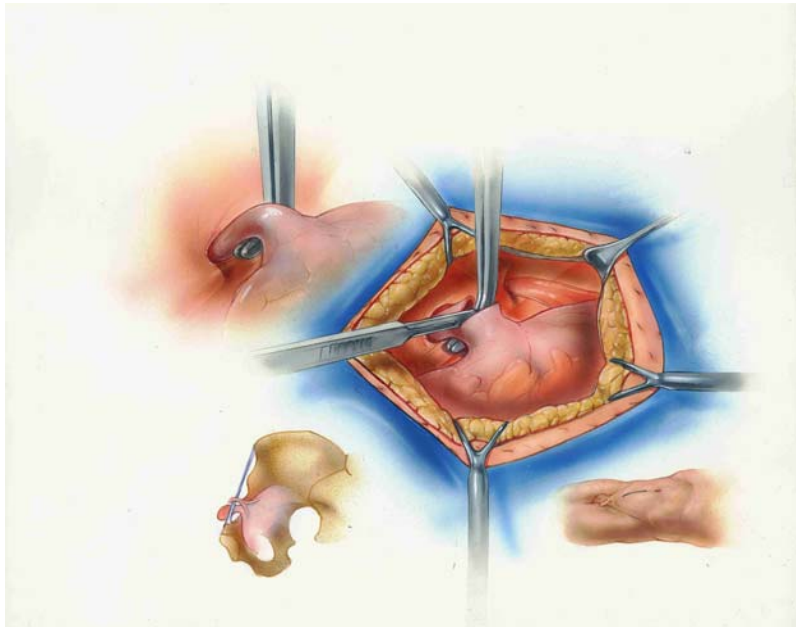


Fig 60. The sac is cut, leaving its distal part in the inguinal canal.

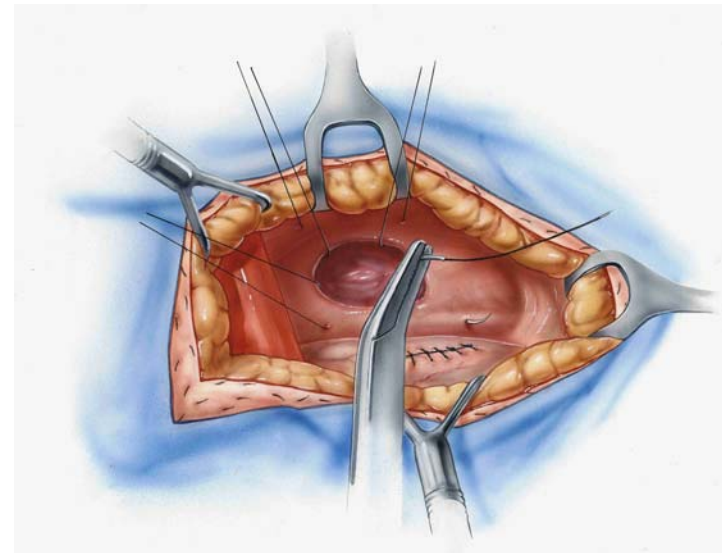


Fig 62. Four sutures around the edge, from the inside of the defect outward, are used to secure Plug T2.



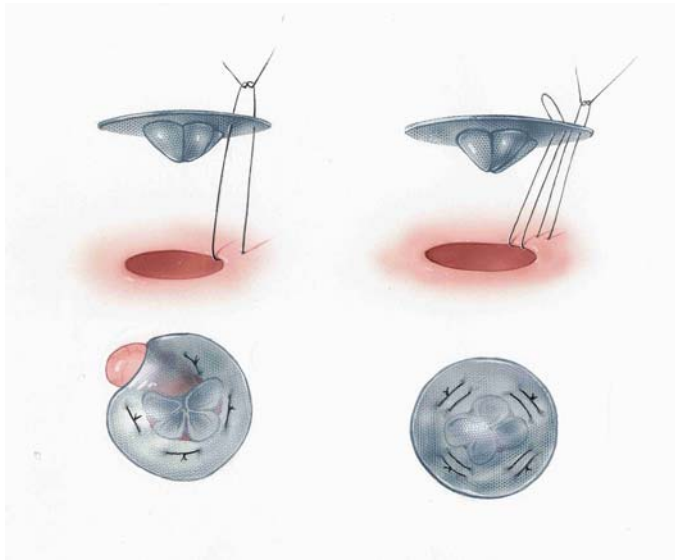


Fig 63. Two methods of anchoring Plug T2 to the edges of the defect.

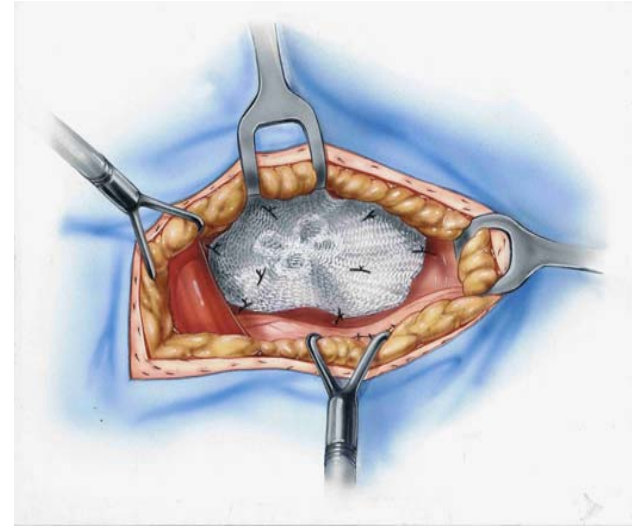


Fig 65. After the plug is inserted, additional sutures can be used to secure it.

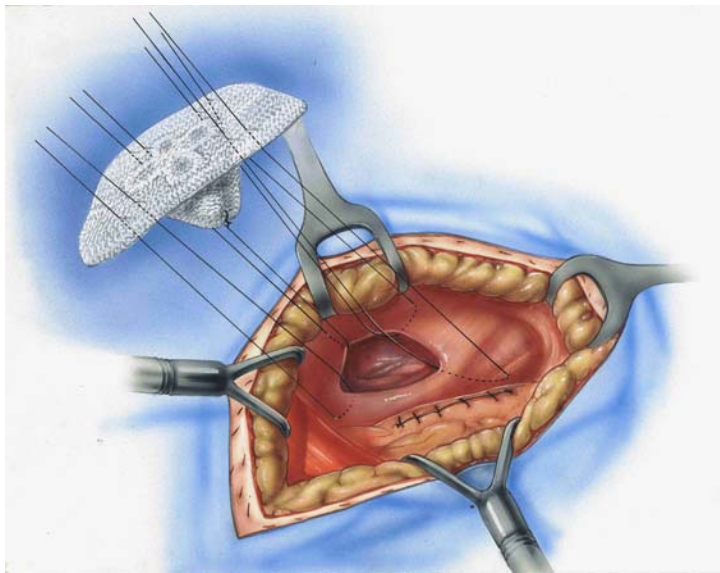


Fig 64. Plug T2 is inserted into the defect, and sutures are tied.

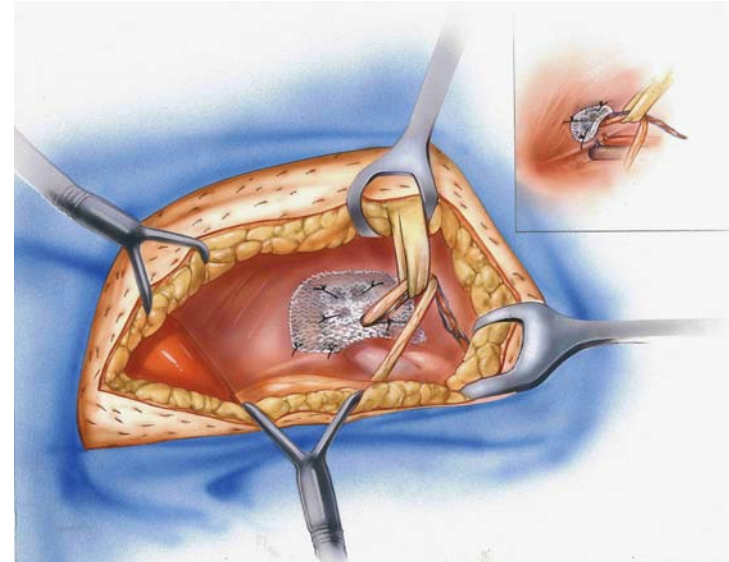


Fig 66. Plug T2 can also be used for repair of indirect recurrent defects.

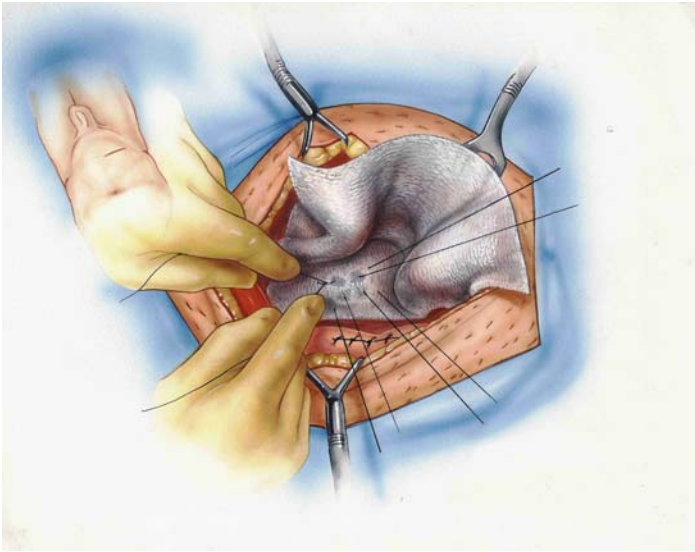


Fig 67. Plug T3, with a large mesh base, is used in recurrent hernias when the entire transversalis fascia is weakened. The plug is secured with sutures following the same method as for Plug T2.

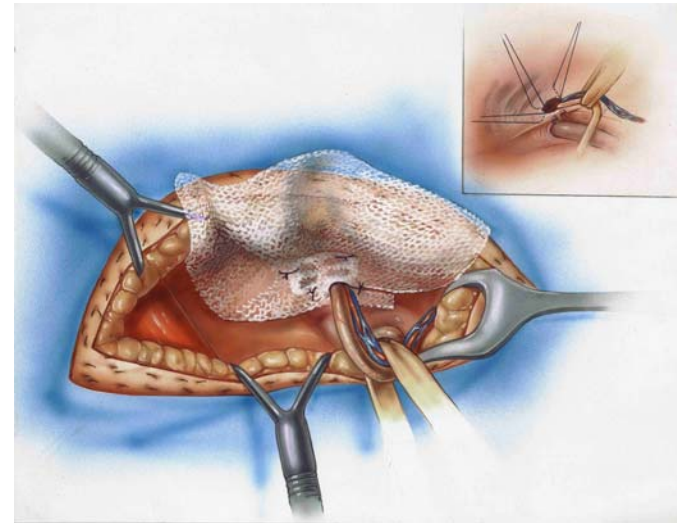


Fig 69. Plug T3 can also be used in cases of recurrent indirect hernias.

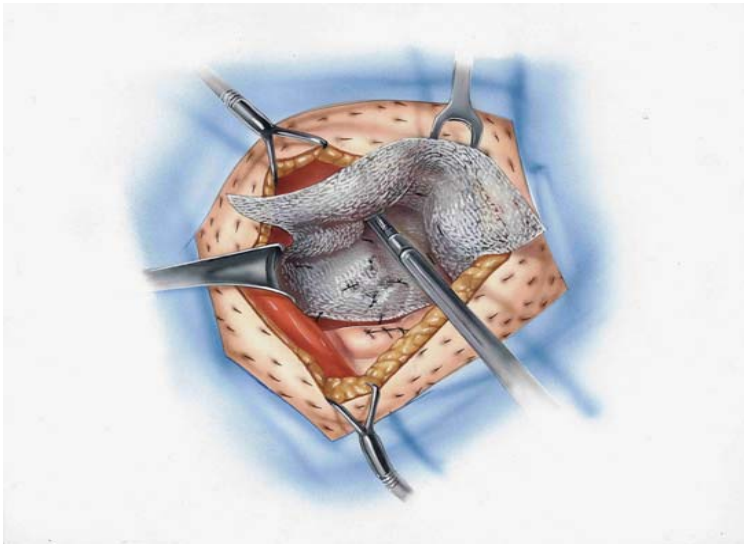


Fig 68. A stapler may be used to attach the mesh base of the plug to the posterior wall.

## TRABUCCO TENSION-FREE SUTURELESS VENTRAL HERNIOPLASTY

The Stoppa-Rives technique is known as the most efficient of all operations for abdominal hernia repairs. However, it requires sutures to keep the mesh in position and to prevent mesh migration, wrinkling, and curling. Suturing is time consuming, in many cases challenging, and can create tension in the mesh responsible for postoperative pain and complications.

The Sutureless Tension-Free Technique is based on Stoppa- Rives principles, but the mesh is implanted without suturing it to the surrounding tissue in order to avoid the problems mentioned above.

Preliminary results after a three-year follow up from Italy and a two-year follow up from the European Multicenter Study confirm the effectiveness of the procedure.

### Technique

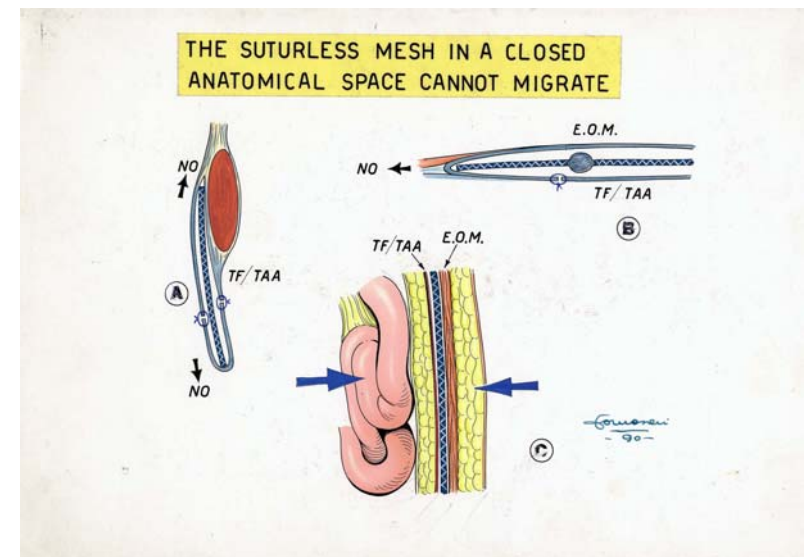
Sutureless Tension-Free Repair of abdominal hernias is based on the same principles as for inguinal hernias:

1. Utilization of the mesh with proper physical features\*
  - a. **proper material**- monofilament polypropylene
  - b. **proper rigidity and flat- shape memory**- protects from wrinkling and curling
  - c. **excellent adhesive property**- prevents migration immediately following the operation
  - d. **proper macroporosity**- allows fibroblast infiltration and macrophage protection from bacteria

\* There are three meshes especially designed for sutureless technique and manufactured by Herniamesh SRL, Italy:

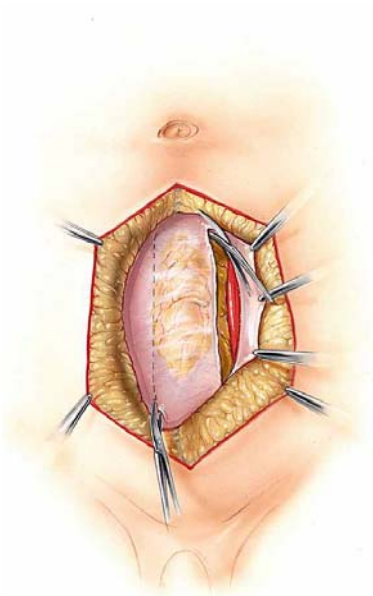
- o **Hertra O**- thickness 0.72mm, 242g/m<sup>2</sup>
- o **Oval Patch**- thickness 0.83mm, 223g/ m<sup>2</sup>
- o **Round Patch**- thickness 0.83mm, 223g/ m<sup>2</sup>

2. The mesh is implanted in a closed space, preferably between the posterior fascia and abdominal muscles or in preperitoneal space.
3. Immediately after the operation intrabdominal pressure compresses all the layers of the abdominal wall together with the mesh, preventing mesh migration and fluid collection. However, this mechanism is efficient only when mesh has proper rigidity and lies flat, adhering well to the surrounding tissue without wrinkling or curling.
4. A few days after the operation, a local fibroblast infiltration process takes place and develops over time, thus creating a uniform scar tissue layer, which indefinitely keeps the prosthesis in the proper position and prevents recurrence.

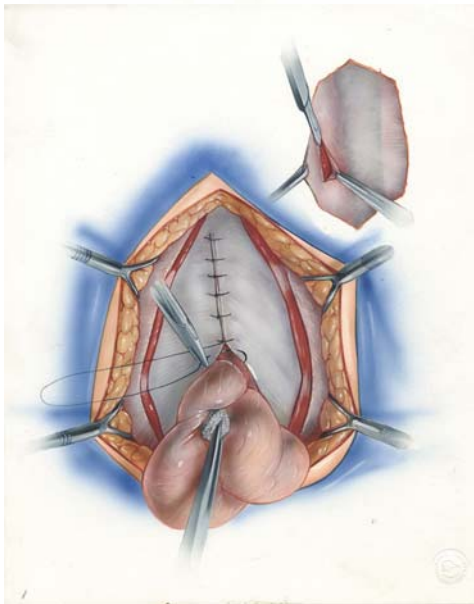




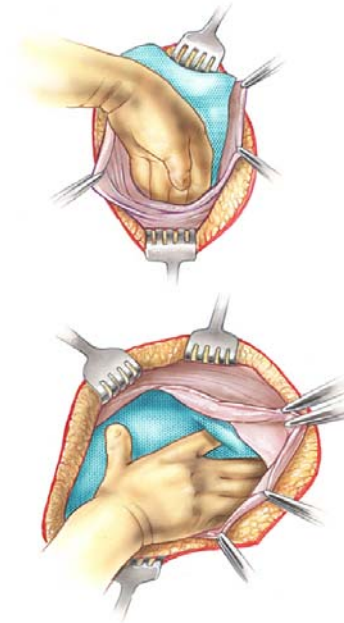
## SUTURELESS TENSION-FREE HERNIOPLASTY



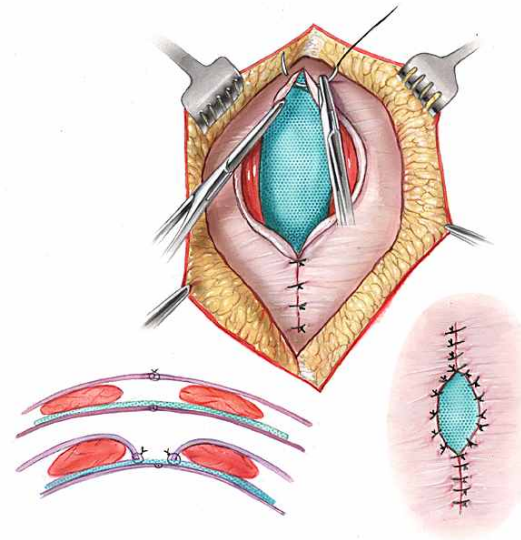
The hernia sac is dissected and opened for revision of the peritoneal cavity.



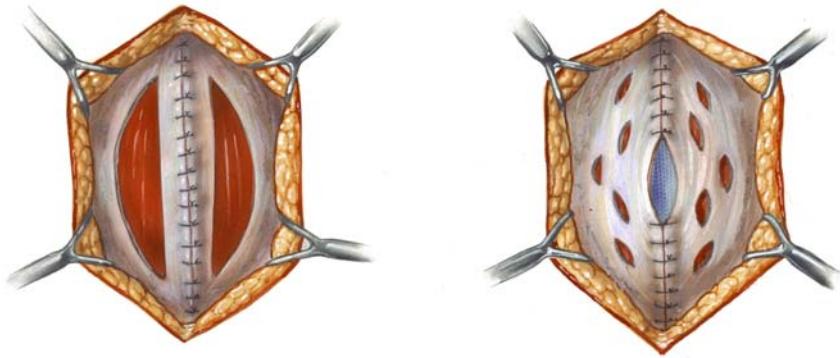
Then the hernia sac is excised, and the peritoneum and posterior fascia are closed with running sutures. Sometimes, in order to decrease the tension of the abdominal wall, it is necessary to use part of the hernia sac for closure and cover of bowels. In this case, the mesh is separated from the bowels and placed in retromuscular space.



Next, the mesh with flat shape memory is placed in retromuscular position- under the rectus muscles. There is no suture anchoring of the mesh. Alternatively, for lateral ventral hernias, mesh can be placed in preperitoneal space, under the lateral abdominal muscles.

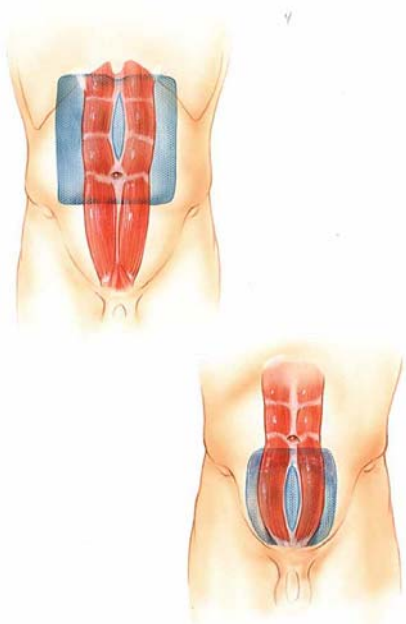


The anterior rectus sheath is closed with running sutures over the mesh and muscles. Sometimes, in order to decrease the tension, a part of the fascia can be sutured superficially to the posterior fascia, leaving a small fascial gap.



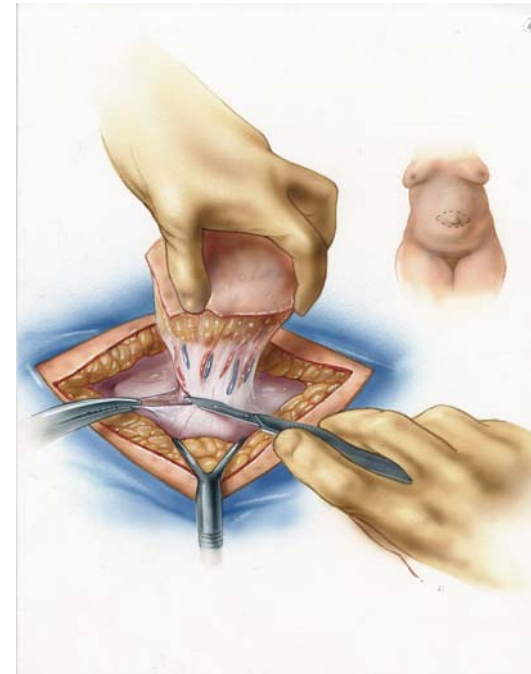
Small incisions of the anterior fascia can also help to decrease the tension in the wound, especially when repairing a huge abdominal hernia.

A suction drainage should be applied in all cases, just over the mesh, in the retromuscular or preperitoneal space. In obese patients, a second suction drainage is recommended in the subcutaneous space.



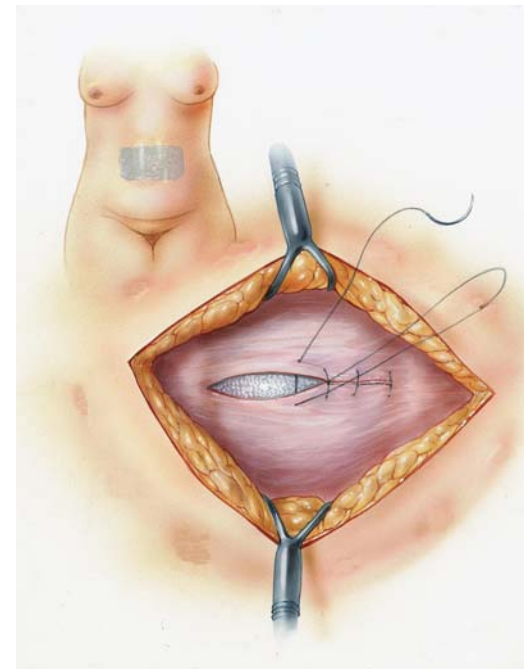
The size of the mesh should be much larger than the size of the defect. Implantation of adequately large mesh is critical for the effectiveness of the sutureless procedure.

## Sutureless Technique For Small Abdominal Hernia



There is still a high recurrence rate after suture repair for small abdominal hernias with defects less than 5cm. Therefore, the sutureless technique offers a great advantage, avoiding extended dissection and suturing. Placing a mesh without fixation to the surrounding tissue is easy, fast, and convenient.

Dissection and excision of the hernia sac in an umbilical hernia is performed in traditional fashion.

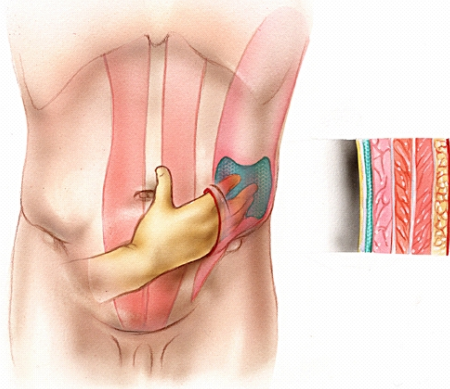


After closure of the peritoneum and posterior fascia, the mesh is placed under the rectus muscles. Next, the anterior fascia is closed with single or running sutures. Short term suction drainage over the mesh is recommended.



## THE SLIDING, LOCKING KNOT, RUNNING SUTURE

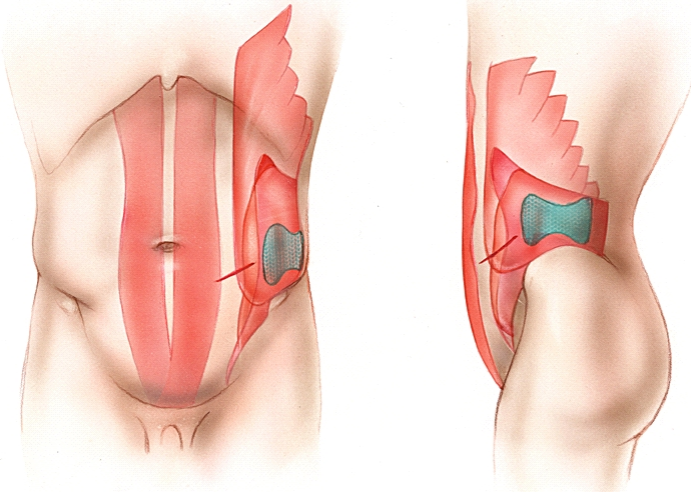
This type of suture can be very useful for abdominal wall surgery. It is applied for closure of the abdominal fascia. A smooth monofilament suture should be used, allowing for easy sliding. This suture type ensures a secure approximation, similar to that of an interrupted suture. It saves operating time, distributes the tension more evenly along the suture line, and is better for hemostasis.



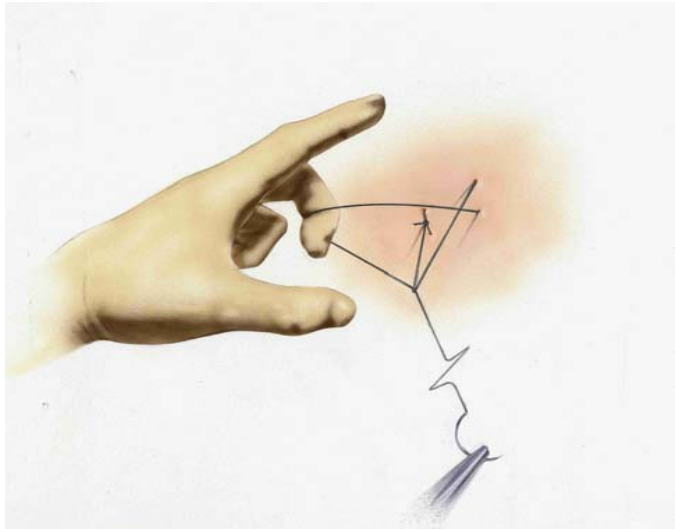
Specially designed meshes with flat shape memory can be implanted in any aspect of the abdominal wall.

For example, lumbar hernia following kidney removal can be easily repaired with the sutureless technique. Here the mesh is placed in the preperitoneal space.

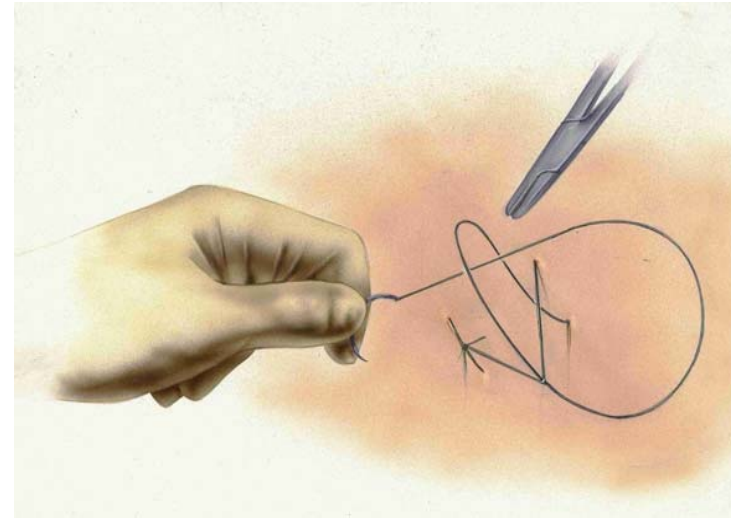
A loop is made in the suture line with the thumb and index finger.



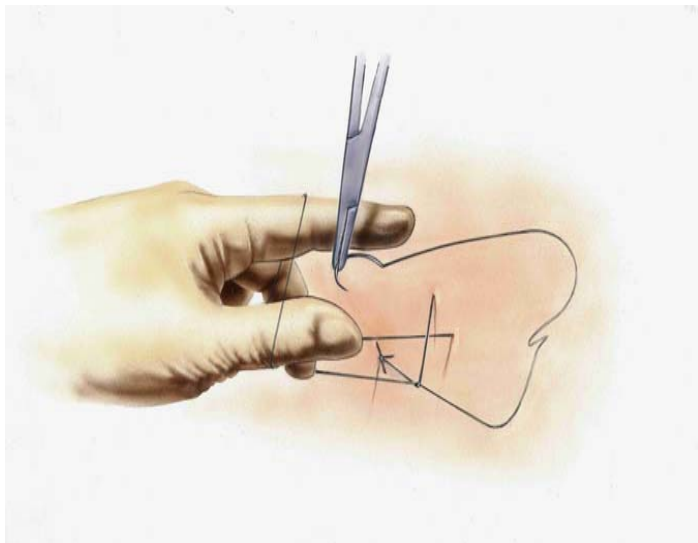
The middle finger makes a second loop in the needle line and then pulls it into the first loop.



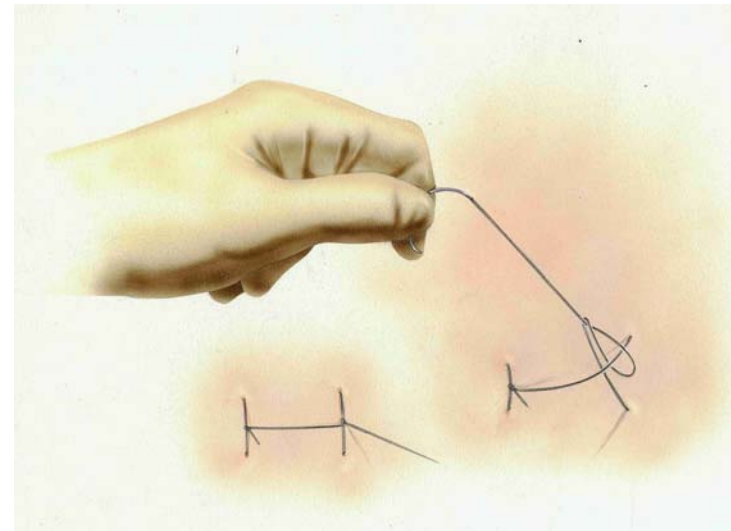
The thumb and index finger drop the first loop into the second loop, which is held by the middle finger.



The needle is pulled out of the loop.



The thumb and index finger take over the loop held by the middle finger and grasp the needle.



The hand holding the needle locks the sliding knot.

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### PLUG- RELATED COMPLICATIONS

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