



Primary Femoral Hernia: Open Anterior Treatment

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45.1 Introduction

A femoral hernia is an acquired hernia and is classified as a direct hernia; its path is constituted by the crural or femoral canal.

Nyhus [1] classifies it as an IIIc form, a special kind of defect of the posterior wall; in the EHS classification [2], it is classified as “F 1,2,3,x” depending on the size of the defect. It is an insidious hernia generally asymptomatic, where a small dimension inside the inguinal femoral area justifies a late diagnosis up to 30% of patients [3].

Even if this hernia is rarer than the inguinal hernia (1–2% repairs undertaken at the Shouldice Hospital in 1 year) [3], it has however a higher mortality rate, more than 25% [3, 4], because the diagnosis is often difficult (it is relatively small and harmless), and therefore there is a late, incorrect diagnosis which frequently occurs at the moment of complications [5].

Therefore, strangulation of a femoral hernia determines a misunderstood and delayed emergency, which could even put an expert surgeon on the wrong track [3–6].

Since the beginning of the last century, three main types of open approach have been used (Table 45.1).

The ideal treatment of a femoral hernia is up to today object of great discussion, and there is a lack of evidence: prospective trials are still not definite for strategy of early diagnosis, surgical techniques and mandatory prosthetic use, for the choice of approach and finally for outcomes, recurrences, pain, complications, etc.

The femoral access (low approach) represents the classical way undertaken in the past, as being simple and reliable, but in tissue repair techniques, this results in an unacceptable rate of recurrence [3], even if subsequent report showed a recurrence rate of 3.1%, at the Shouldice Hospital, in case of high approach, [7] selecting the use of low approach only after an inguinal intervention.

To be thorough, it is necessary to underline that between the preperitoneal access [8] and the laparoscopic one, the latter has gained considerably in its indication over the last two decades. In fact, it is a technique using the posterior approach, a total closure of the myopectineal orifice with a large prosthesis. It also represents a diagnostic technique by evaluating the type and dimension of the hernia defect and the type and vitality of the content after the

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Table 45.1 The main types of open approaches and techniques

<i>Anterior</i>	
• Femoral approach (low)	
– Bassini—inguinal ligament → pectineal sheet	
– Bassini-Kirschner—inguinal Thompson ligament→Cooper’s ligament	
– Lichtenstein—plug repair	
– Trabucco—plug T2	
– Gilbert “cone-shaped plug”	
– Rutkow—PerFix plug	
– Bendavid—femoral umbrella	
– Wantz—infrainguinal GPRVS	
• Inguinal approach (high)	
– Ruggi—Cooper to Poupart	
– Moschowitz—inguinal Thompson ligament→Cooper’s ligament	
– Lotheissen—McVay—transversus abdominis fascia→Cooper’s ligament (rectus fascia release)	
– Rives—preperitoneal prosthesis by anterior inguinal approach	
<i>Posterior</i>	
• Preperitoneal approach	
– Nyhus-McEvedy	
– Trabucco	
– Wantz	
– Rives	
– Stoppa	
– Ugahary	
– Kugel	

reduction. Even more, it allows a simultaneous evaluation of contralateral hernia or associated inguinal or abdominal wall ventral hernias, and it is indicated in atypical varieties [9–11]. However, a superiority in the results is uncertain in some recent studies [12, 13], although other ones show initial guidelines that recommend the use of laparoscopy in femoral hernias in election [14, 15].

Among the various methods used over the last 20 years, we have performed, after an initial experience with “rolled-plug” technique, an anterior approach using a technique called “mesh-plug” repair with several types of a double disc prosthesis (PHS, 3D patch, UPP, UHS—Ethicon).

In our opinion, this prosthetic repair is extremely adaptable to resolve the technical and

tactical problems of this particularly insidious hernia [16, 17].

45.2 Anatomic Characteristics of the Femoral Canal and the Femoral Fascia

The femoral canal is conical shaped, and his anatomy requires an appreciation of its three-dimensional characteristic [18]. There is a femoral ring (entrance to canal) and a femoral orifice (canal exit). In the typical variety, the femoral canal is located in the medial position with respect to the femoral vein (Fig. 45.1); there are also various atypical varieties (Fig. 45.2). The fossa ovalis, the opening for the great saphenous vein, is at its apex inferiorly. Thus, a femoral hernia may appear as a bulge of the skin over the fossa ovalis.

The characteristic rigidity of the osteo-fibrotic-fascial structures of this canal predis-

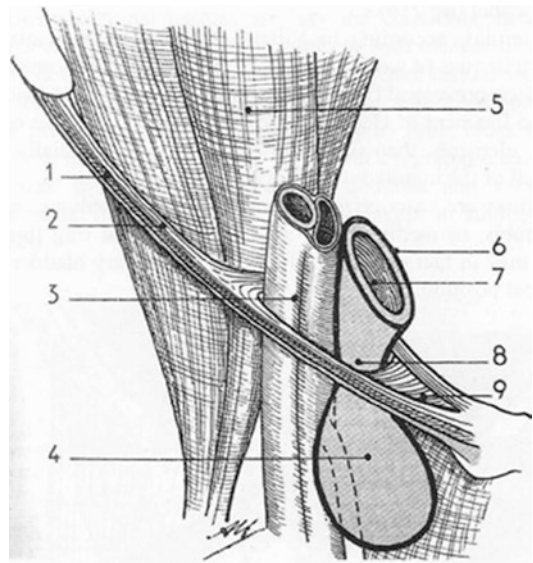


Fig. 45.1 Femoral hernia—typical variety (reproduced from *The Surgical Anatomy of Hernias of the Groin* by Henri Fruchaud—translated and edited by Robert Bendavid, 2006)

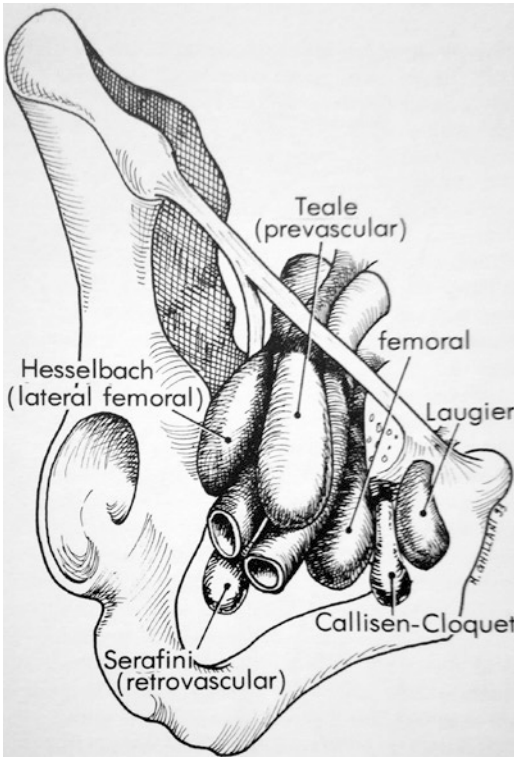


Fig. 45.2 Femoral hernia—atypical varieties (from Bocchi P, Paravascular hernias. In: Bendavid R, editor. *Prostheses and abdominal wall hernias*, Austin: R.G. Landes Company; 1994)

poses this one towards strangulation. The “less rigid” edge is the lateral one, consisting of the femoral vein and connective tissue. The posterior border is Cooper’s ligament. The inguinal ligament and ileo-pubic tract form the anterior limit. The transversalis fascia and aponeurotic insertion of the transversus abdominis muscle and, principally, the lateral edge of the lacunar ligament constitute the medial border. The importance of the femoral ring is equal to the internal inguinal ring; the former represents a second weakness in the lower part of the myopectineal orifice, which is covered only by the transversalis fascia. This assumes a particular disposition in the femoral canal (Figs. 45.3 and 45.4).

It is very important to underline the limits of transversalis fascia funnel:

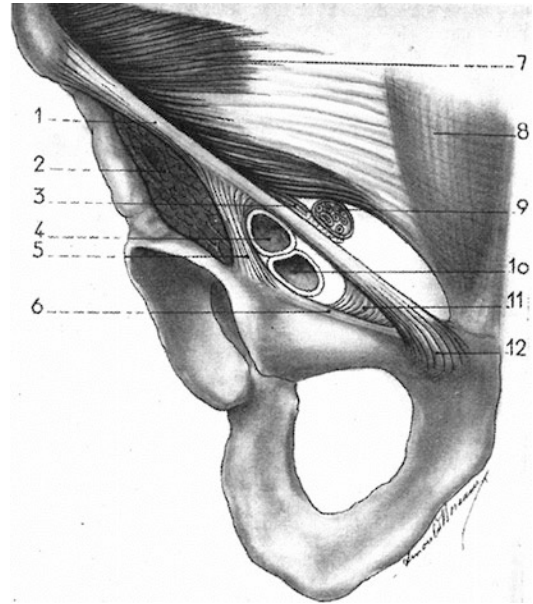


Fig. 45.3 Myopectineal orifice of Fruchaud (reproduced from George Wantz’s *Atlas of Hernia Surgery*, Raven Press, 1991, NY)

The anterior limit is the fascia lata, the posterior limit is the pectineus fascia medially and the fascia lata laterally, the medial limit is the lacunar ligament, and the lateral limit is the femoral vein.

The difficulty in closing the femoral ring without tension is due to the lack of elasticity of anatomical structures; in fact, it is difficult to approximate the inguinal ligament to Cooper’s ligament.

For this reason, all the femoral hernia tissue repairs presented high recurrence rates, mainly in the cases of a very large femoral ring (> 2 cm) (Fig. 45.5) and after a surgical inguinal hernia repair [9, 19, 20].

A dilated femoral ring can be due to the repeated increase of intra-abdominal pressure (i.e. coughing, pregnancy in women, etc.) but also in the case of degenerative changes and weaknesses of the structures in the subinguinal region with the deterioration of the descending aponeurotic fibres of the transversus abdominis (elderly) [21].

Fig. 45.4 Transversalis fascia and myopectineal orifice of Fruchaud (reproduced from Francesco Ruotolo)

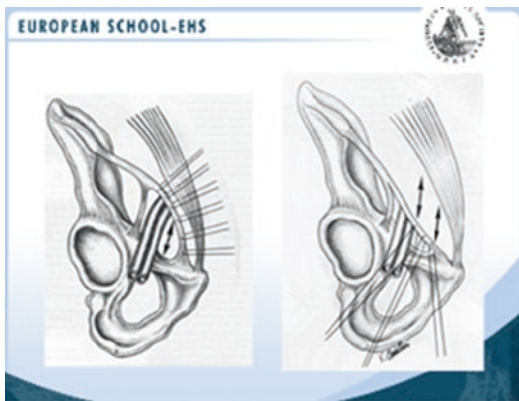
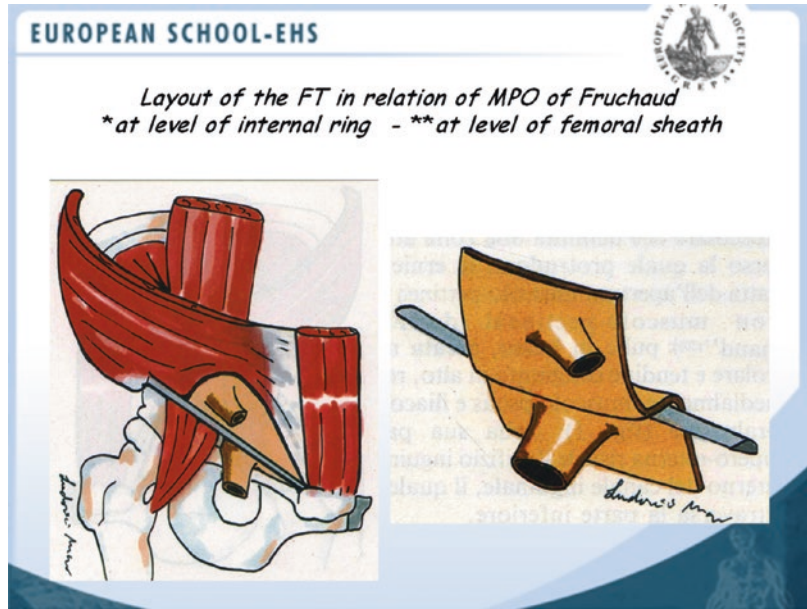


Fig. 45.5 Groin hernia tissue repairs: risk of femoral hernia after inguinal herniorrhaphy and vice versa (from Nocentini et al. Piccin Editore 1981)

45.3 Materials: Important Element for a Rational Use

At the end of the 1980s, on the base of several techniques and the results of dedicated surgeons, the plug technique has become widely used: Lichtenstein's "rolled plug" [22], Gilbert's "cone-shaped plug" [23], Trabucco's "dart-shaped plug" [24] and Rutkow's "PerFix plug" [25] (all made in polypropylene).

In fact, evidence showed and documented a large number of recurrences using the tissue repair techniques even in a dedicated hernia centre with a numerous amount of admissions for non-prosthetic treatment (Shouldice technique). For this reason, in that hospital in 1989, Bendavid proposed a prosthetic repair by positioning a preperitoneal umbrella [3, 26, 27] (Fig. 45.6). This enabled a reduction of the important number of recurrences sustained after the tissue repair technique [3, 28].

In 1995, our proposal was born. We have used the double disc polypropylene prosthesis, PHS mesh much used by Gilbert in United States [29], shaped into dimensions in order to fit the anatomical characteristics of the femoral canal. This technique has allowed us to achieve interesting and progressive results with an improvement of outcomes. These results, concerning especially the rate of recurrences and chronic pain, have been obtained thanks to the use of more modern prosthetic materials, partially absorbable and macroporous bilayer device, in recent years. These have different sizes and diameters and can be shaped according to the anatomical characteristics of the hernia and the femoral canal achieving a prosthetic tailored surgery:

Fig. 45.6 Femoral hernia: Bendavid's umbrella technique (reproduced from G. Valenti—*Le Ernie Inguinali*—Utet 1992 Milano)

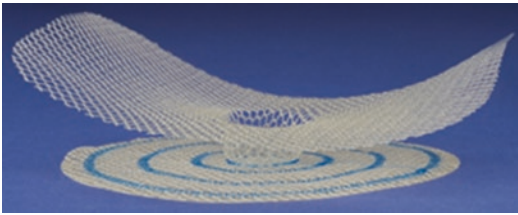
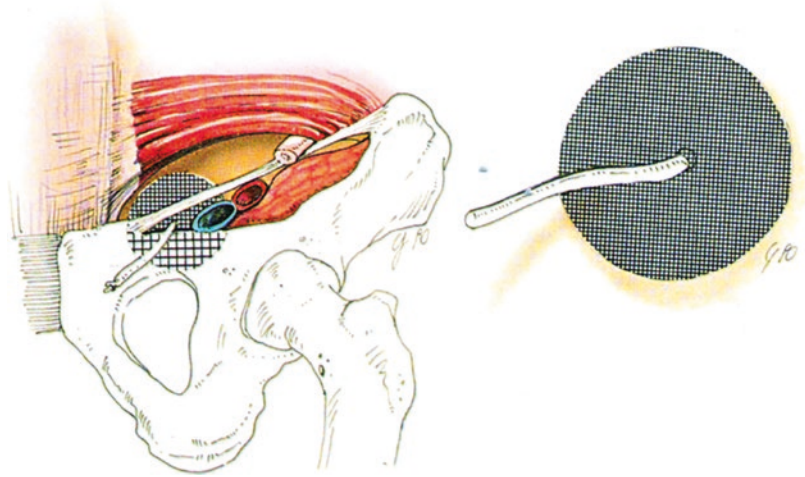


Fig. 45.7 UHS



Fig. 45.8 UPP

The rational use, as mentioned above, implies the positioning of a reduced amount of prosthetic material because:

- They are light meshes, principally containing less prosthetic material.
- They have a large amount of absorbable material.
- The inner disc of the prosthesis of different sizes lies deeply in the Bogros space, an indispensable condition for the optimal prevention of recurrences without an excessive separation of the space.
- A softer device fills the femoral canal by a mechanism of auto fixation of the two discs. This not only avoids recurrences but also discomfort, numbness and chronic pain. Fixation is limited to a few sutures in order to distend the prosthesis and to avoid migration.

- UHS: it represents the technological evolution of PHS (Fig. 45.7).
- UPP: the plug is soft and easy to handle, allowing an easy and fast positioning (Fig. 45.8).

Both are composed of Prolene (macroporous polypropylene) and Monocryl (poliglecaprone 25).

45.4 Anaesthesia

We perform, if possible, preferably a step-by-step local anaesthesia or an ultra-thin needle epidural anaesthesia (over recent years, the latter has been our preference).

The general anaesthesia is realized only if strictly necessary.

45.5 Surgical Techniques

Double disc mesh-plug technique—surgical steps (Table 45.2).

Table 45.2 Step-by-step technique

Step	Description
1	An anterior groin incision, in the shape of a golf club, retracted to expose the femoral region
2	Wide dissection of the femoral hole
3	The femoral sac is opened to assess the content
4	The sac is cut and narrowed, but, if it is possible, it is better to put it back without excision (to avoid pain)
5	The double disc prosthesis is tailored using a personal technique reducing the anterior sheet to a small border
6	Cleavage of the Bogros space using the finger for inner prosthesis
7	The prosthesis is made as a mesh plug
8	The double disc prosthesis is inserted into the femoral canal with a long clamp until the connector fills the canal, and the circular internal sheet of the prosthesis spreads open like Bendavid's umbrella prosthesis
9	The mesh is secured to the femoral canal with only three sutures (Prolene n2-0)
10	The first suture at the level of inguinal ligament
11	The second suture between the prosthetic connector and the Gimbernat ligament
12	The third suture at the level of the pectineal sheet
13	Other sutures are made to extend the anterior edge of the prosthesis in the pectineal fascia

45.5.1 UHS: Ultrapro Hernia System

(Figs. 45.9, 45.10, 45.11, 45.12, 45.13, 45.14, 45.15, 45.16, 45.17 and 45.18)

45.5.2 PHS: Prolene Hernia System

(Figs. 45.19, 45.20, 45.21, 45.22 and 45.23)



Fig. 45.9 Anatomic landmarks

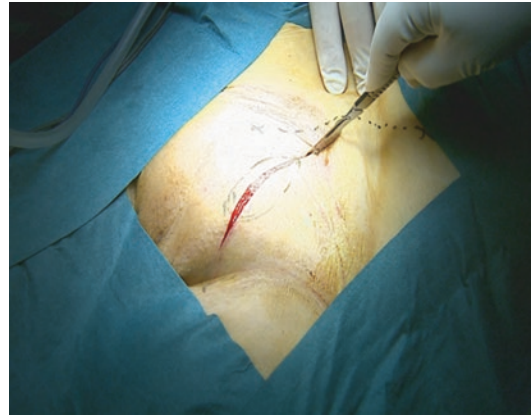


Fig. 45.10 An anterior groin incision, in the shape of a golf club, retracted to expose the femoral region

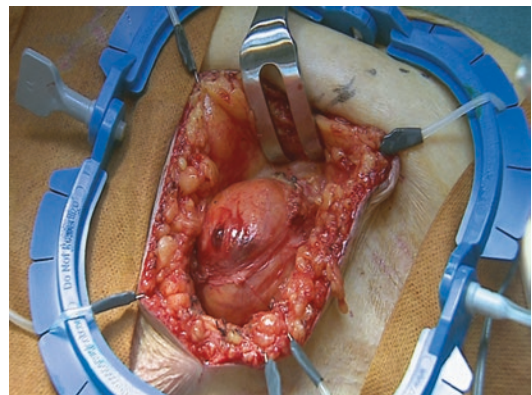


Fig. 45.11 Wide dissection of the femoral sac and hole

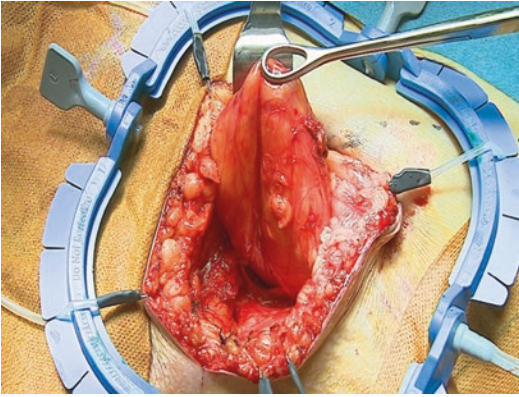


Fig. 45.12 Wide dissection of the femoral sac and hole



Fig. 45.15 UHS prosthesis is tailored reducing the anterior sheet to a small border

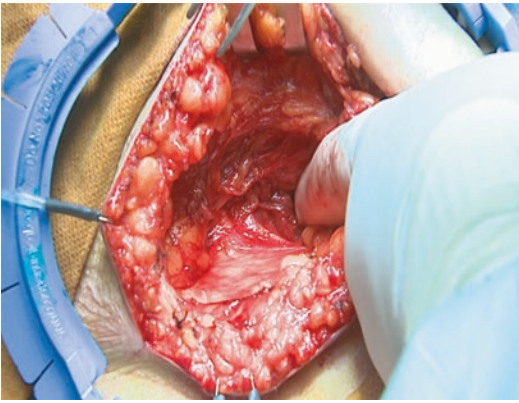


Fig. 45.13 Digital evaluation of crural orifice after hernia sac reduction (without excision)



Fig. 45.16 UHS prosthesis is made as a mesh-plug

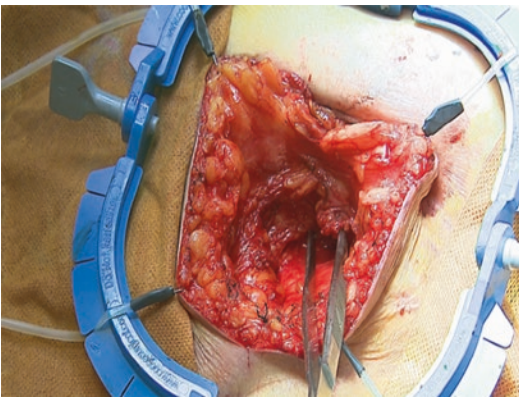


Fig. 45.14 The clamp holds inside the reduced hernia sac

45.5.3 UPP: Ultrapro Plug

(Figs. 45.24, 45.25, 45.26, 45.27, 45.28, 45.29, 45.30, 45.31, 45.32 and 45.33)

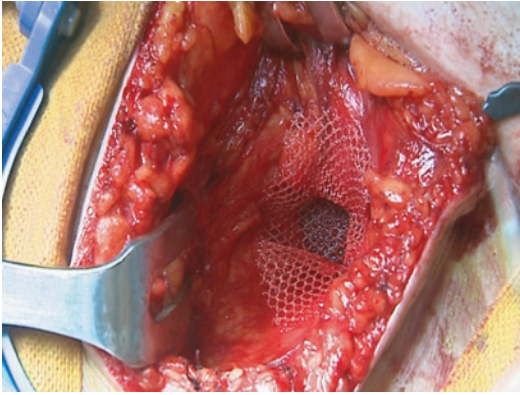


Fig. 45.17 Final position of UHS mesh plug; we can see the small ring of the anterior sheet

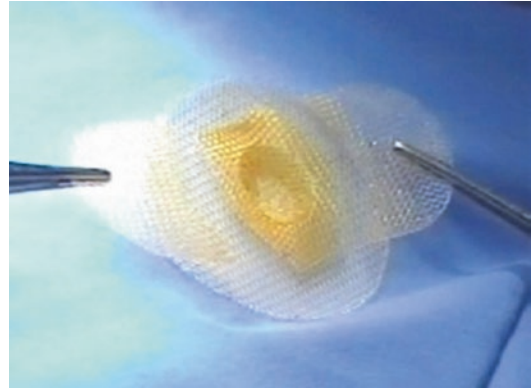


Fig. 45.20 PHS prosthesis used for femoral hernia

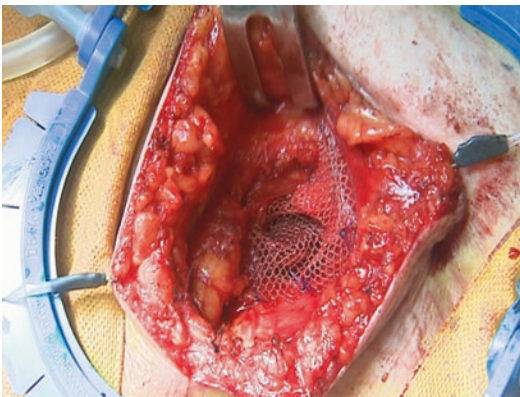


Fig. 45.18 Final view with three cardinal points and a few sutures to extend the anterior edge of the prosthesis in the pectineal fascia

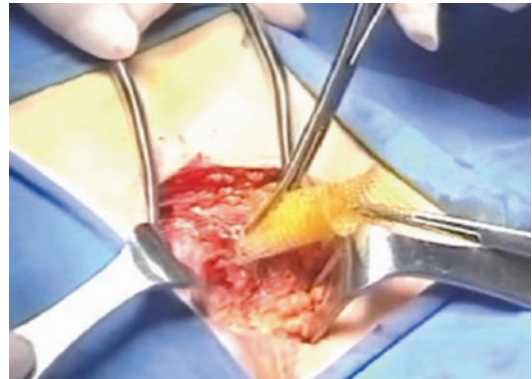


Fig. 45.21 PHS prosthesis before the positioning

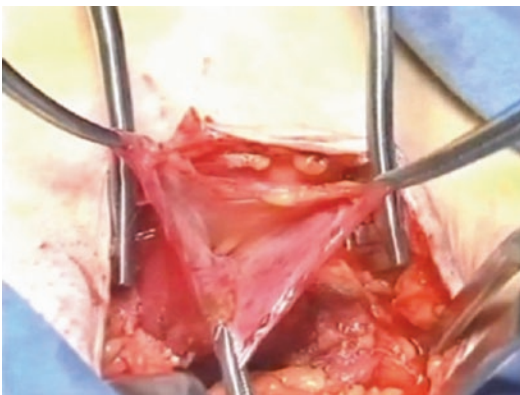


Fig. 45.19 The femoral sac is opened to assess the content

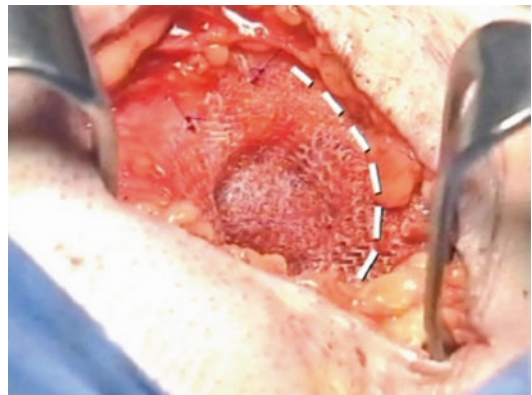


Fig. 45.22 The dotted line close to femoral vein

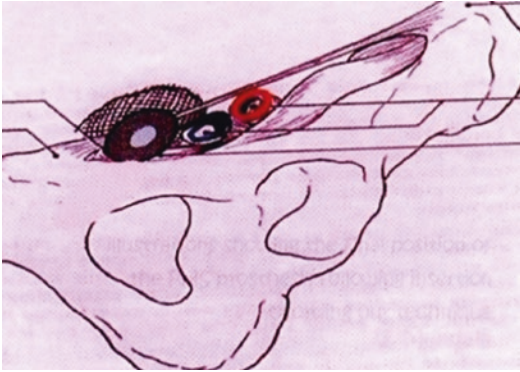


Fig. 45.23 Illustration of final position of the prosthesis

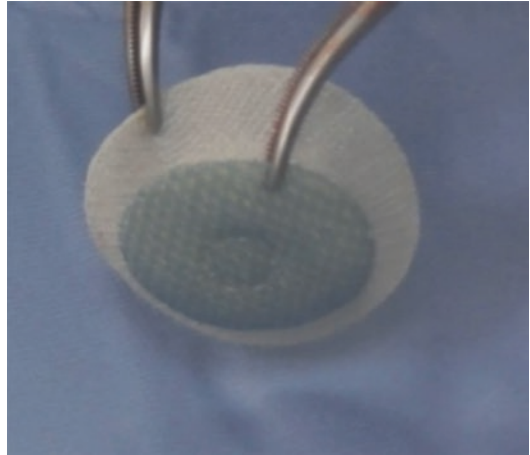


Fig. 45.27 The UPP Ultrapro prosthesis is a light mesh

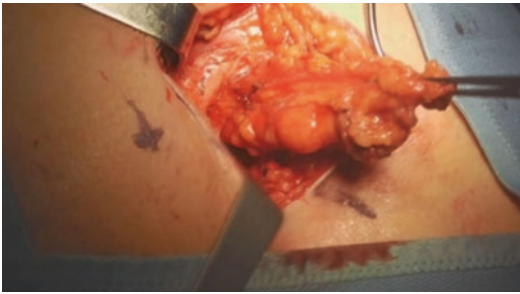


Fig. 45.24 Wide dissection of the femoral sac

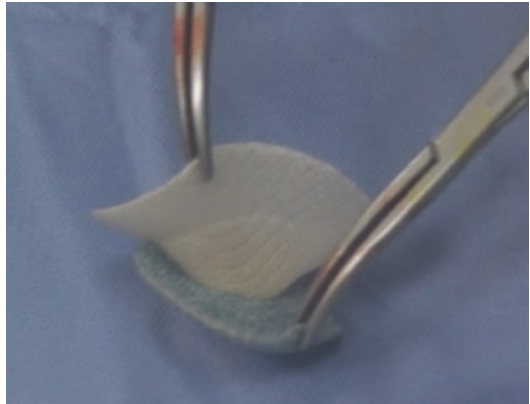


Fig. 45.28 The UPP Ultrapro prosthesis is partially re-absorbable



Fig. 45.25 The sac is not cut and it is put down without excision to avoid pain

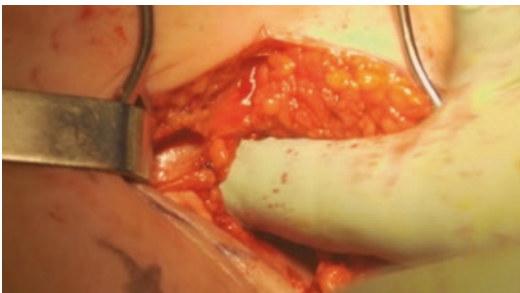


Fig. 45.26 Cleavage of the Bogros space by finger accomplished for inner prosthesis



Fig. 45.29 The UPP mesh plug is inserted into the femoral canal with a long clamp

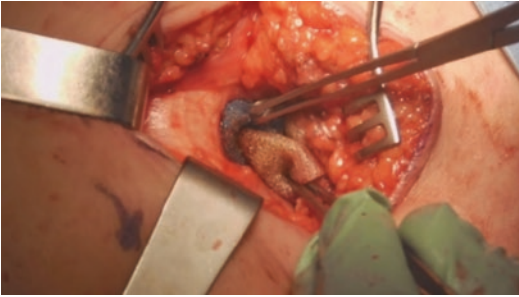


Fig. 45.30 The circular internal sheet of the prosthesis spreads open like Bendavid's umbrella prosthesis

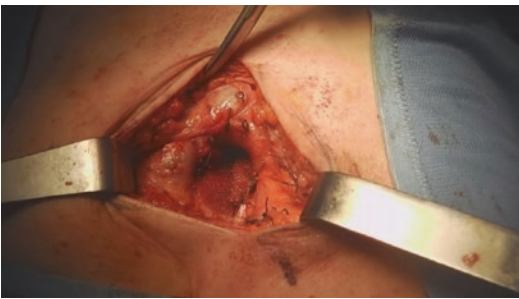


Fig. 45.31 Final position of the UPP mesh plug; we can see the small ring of the anterior sheet



Fig. 45.32 Final appearance of sutured skin

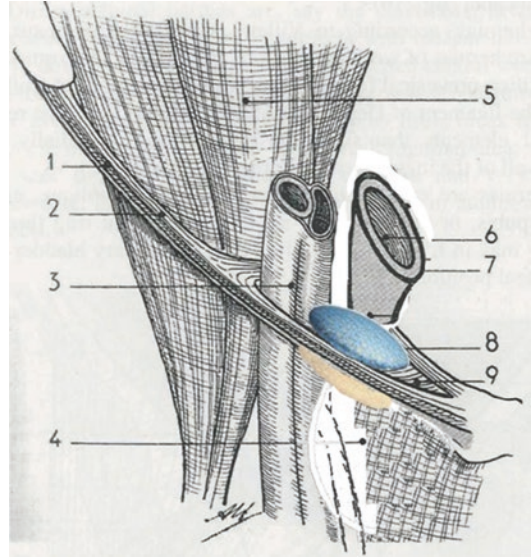


Fig. 45.33 Diagram showing the position of the UPP double disc prosthesis according to our technique (From Fruchaud modified)

45.6 Emergency Femoral Hernias: The Surgical Technique

“..... Are the most treacherous of all hernias. When incarcerated, they outnumber all other forms of incarcerated abdominal hernias combined”. (R. Bendavid).

Groin examination must always be part of an abdominal examination.

In many cases, in emergency, the reduction of an incarcerated femoral hernia is impossible without incising the lacunar ligament and the medial femoral sheath to widen the defect (Fig. 45.34).

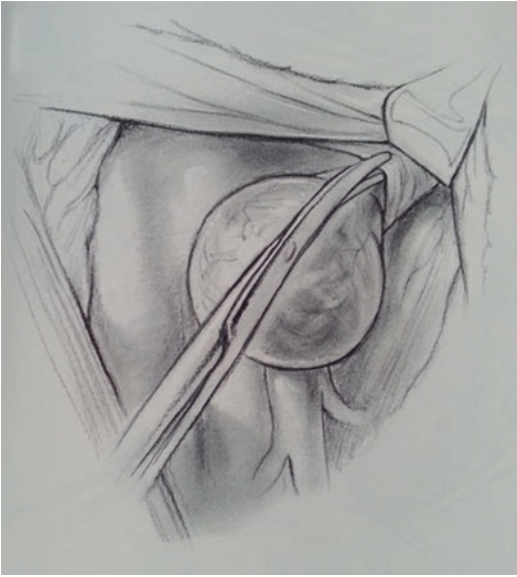


Fig. 45.34 (reproduced from George Wantz's *Atlas of Hernia Surgery*, Raven Press, 1991, NY)



Fig. 45.35 Strangulated Richter's hernia

45.7 Personal Technique in Emergency

CASE I Richter hernia (Figs. 45.35, 45.36, and 45.37).

CASE II Femoral epiploic strangulated hernia – Combined repair (Figs. 45.38, 45.39, 45.40, 45.41, 45.42, 45.43, 45.44, and 45.45).

CASE III Strangulated small bowel femoral hernia – Combined repair (Figs. 45.46, 45.47, 45.48, and 45.49).

In several cases, (12 cases), there was an indication to carry out our technique in a combined procedure (open/laparoscopic approaches) [17].

In our opinion, this technique is indicated in selected cases of complicated femoral hernias, e.g. the elderly and the frail patients with other comorbidities thanks to the collaboration with the anaesthesiologists, for different reasons:

- A “short” general anaesthesia.
- A rapid low-pressure pneumoperitoneum (a few minutes).
- Diagnostic aim of laparoscopy: only to explore the type and vitality of the contents after reduction and the evaluation of the size of the femoral ring.

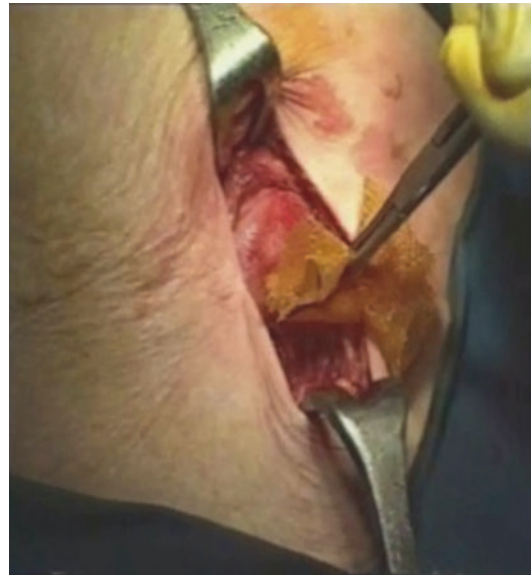


Fig. 45.36 Prosthesis insertion



Fig. 45.37 Final position

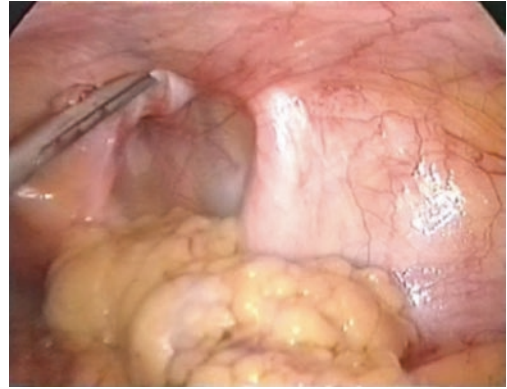


Fig. 45.39 Femoral epiploic strangulated hernia. The internal femoral ring after epiploic reduction

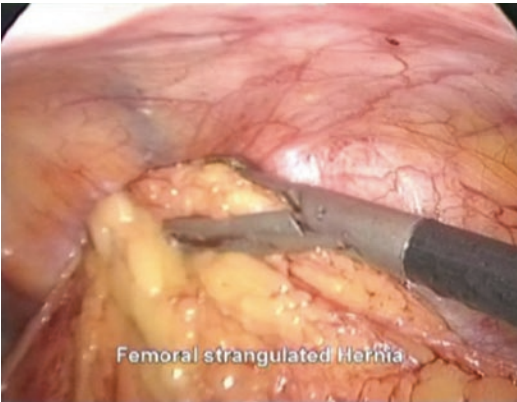


Fig. 45.38 Femoral epiploic strangulated hernia

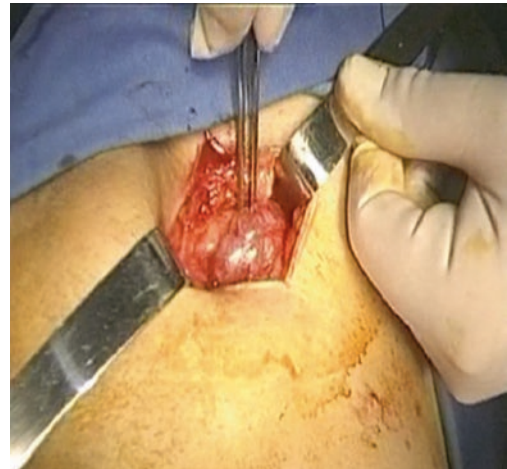


Fig. 45.40 The femoral sac is dissected and reduced into the abdomen by anterior approach ...

- The combined technique (laparoscopy and a simple infrainguinal low approach) permits the reduction of the sac into the peritoneal cavity, and it represents a great advantage in avoiding contact between the prosthesis and the hernia content (infections) as well as the intraperitoneal fixation of the sac and, most importantly, the late evaluation of the viability and possible ischemic troubles of the contents.
- The combined technique avoids a negative prognostic factor: an associated laparotomy [30, 31], the latter was carried out in 11 patients, in our case series.



Fig. 45.41 ... under laparoscopic control

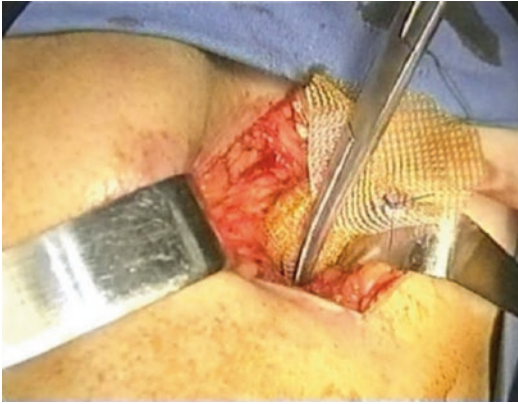


Fig. 45.42 The 3D patch mesh plug is inserted into the femoral canal with a long clamp

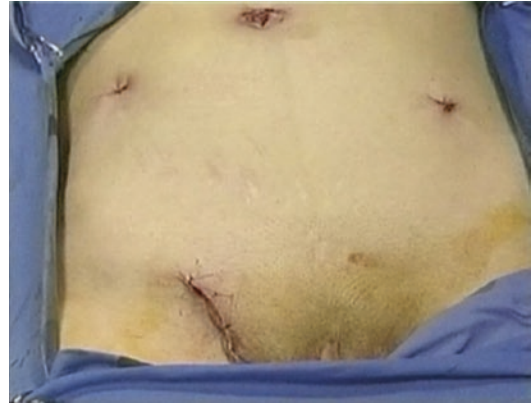


Fig. 45.45 Final view of the abdomen with incisions

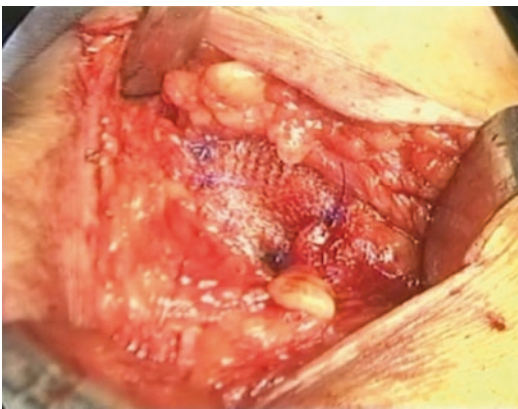


Fig. 45.43 Superficial disc is anchored with three cardinal sutures



Fig. 45.46 Strangulated small bowel in femoral hernia. Laparoscopic view



Fig. 45.44 The femoral sac inverted is anchored to the peritoneum



Fig. 45.47 Reduction of the content into the abdomen by laparoscopic approach

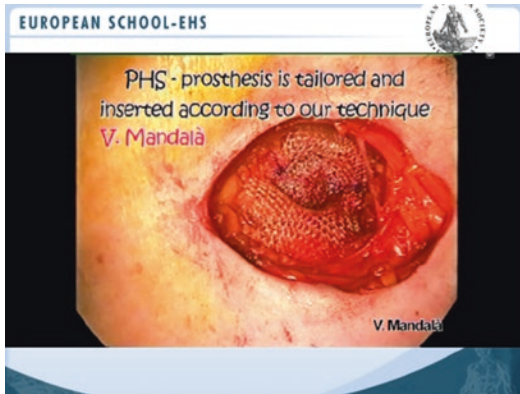


Fig. 45.48 PHS prosthesis is shaped and inserted, according to our technique, by anterior approach

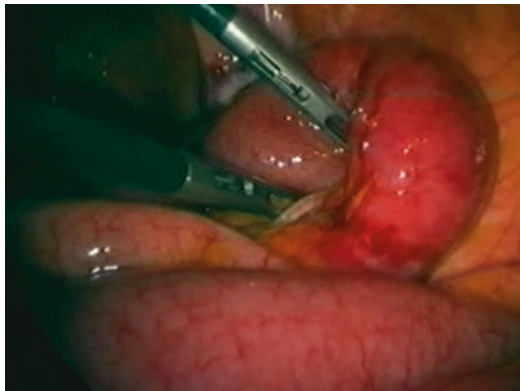


Fig. 45.49 Final view for late evaluation of the bowel integrity

- An alternative technique is the hernioscopy (hernia sac endoscopy) [32, 33]; moreover it is achievable in case of inguinal strangulated hernia, and, in our opinion, it is not possible in femoral one, in consideration of the femoral canal anatomy.

45.8 Personal Experience (1996–2015)

Over a period of 20 years, we have performed 244 surgical procedures using the plug technique, 68 on men and 176 on women; 129 (52.9%) patients underwent emergency surgery and 115 (47.1%) were elective cases. We have performed only 11 laparotomies and the recurrence rate was 2%. This percentage can be underestimated because a great number of elderly patients have been operated on

having complications in an emergency setting (dedicated emergency department, patients lost in follow-up). The overall mortality rate was 2% (five patients). The mortality (3.9%) occurred only in strangulated femoral hernias, associated with a bowel resection (three cases) and laparotomy (three cases). Therefore, there was no mortality in elective cases.

45.9 Consideration on Personal Case Studies from 1996 to 2015

45.9.1 Type of Prosthesis

- Rolled plug *n* 56 (22.9%)
- Umbrella plug *n* 45 (18.4%)
- Mesh and plug *n* 11 (4.5%)
- PHS *n* 62 (25.4%)
- 3D plug *n* 22 (9.1%)
- UPP *n* 21 (8.6%)
- UHS *n* 27 (11.1%)

45.9.2 Anaesthesia

- Local: 123 cases
- Local + neuroleptanalgesia: 24 cases
- General 18: cases
- General (conversion): 20 cases
- Epidural: 59 cases

45.9.3 Local Complications *n*. 41 (16.8%)

- | | |
|-----------------------------|--------------------|
| • Serohaematomas | 20 |
| • Wall's oedema | 4 |
| • Lymphorrhoea | 2 |
| • Infection | 5 |
| • Recurrence | 5 |
| • Pain discomfort | 5 |
| • Deep vein thrombosis | 0 |
| • Major vascular injury | 0 |
| • Major vascular bleeding | 0 |
| • Retroperitoneal haematoma | 1 |
| • Removal prosthesis | 4 (pain—infection) |
| – Rolled plug | 2 |
| – 3D patch | 1 |
| – PHS | 1 |

45.9.4 Abdominal Complications

- Adynamic ileus 3 (NOM—nonoperative management)
- Obstructive ileus 2 (redo laparoscopic surgery)
 - Littrè hernia (ileal resection)
 - Single adhesion by plug (adhesiolysis)
- Upper digestive bleeding 1 (NOM—nonoperative management)

There is a great difference of pathway in election (preventive surgery in young people) and in emergency (mandatory therapeutic surgery in elderly patients), as in our case studies that report an acceptance of patients in an emergency surgical department of a third-level hospital. In these complicated cases, a quick and easy intervention, if possible, is the first choice for these elderly patients.

As referred by other surgeons [31], there are several limitations (bias) also in our experience:

- Retrospective design
- Lack of randomization and blinding
- Single-centre experience
- Inconsistency in follow-up schedule
- A lot of patients lost
- Many patients with early mortality (elderly patients with several comorbidities)
- Lack of standardized hernia surgery database, in the past
- With underestimating:
 - Late hernia recurrence
 - Late chronic pain
 - Long-term complication rate

Also in our experience, this disease is correlated by age (elderly people).

“...The older the patient, and the longer the delay in diagnosis, the higher the mortality rate...”. (R. Bendavid) (Fig. 45.50).

45.10 Tactical Considerations: Tips and Tricks

45.10.1 The Choice of Materials and Shape: UHS Mesh and UPP Plug

- Does not expand the preperitoneal space (flat disc prosthesis)
 - Three-dimensional characteristic shape:
 - Little fixation
 - No plug migration
 - Lightweight prosthesis:
 - Large pore and partially absorbable
 - Increased flexibility
 - Reduction in foreign body sensation
- Low rate of recurrence
 - Low rate of chronic pain
- The rational use of double disc prosthetic device according to our technique:
 - Crural orifice <2 cm → UPP Plug—3D Patch
 - Crural orifice >2 cm → PHS—UHS meshes

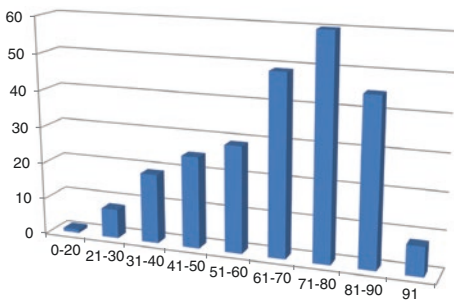


Fig. 45.50 Femoral hernias - Incidence by age (V. Mandalà)

45.10.2 Advantages of the Infrainguinal Approach

- Can be performed under local or epidural anaesthesia (high-risk surgical patients)
- Has been proved to be convenient [34] (direct approach to femoral canal)
- Shorter operative time vs laparoscopic procedures
- Easy to learn and teach

45.10.3 What Does a More Minimally Invasive Approach Mean?

- A direct approach to the femoral canal.
- It is not necessary to dissect the inguinal canal.
- Spermatic cord and nerves within the inguinal region are protected.
- Decrease of chronic postoperative pain.

45.10.4 Infrainguinal Open Approach in Emergencies

- Incarceration and obstruction.
- Strangulation.
- Irreducible hernias.
- It is easier to partially cut the inguinal ligament using the infrainguinal approach rather than an inguinal one [34].

45.11 Conclusion: Low Approach Double Disc Prosthesis

- Rapid and straightforward execution
- Suitable for the elderly, frail and “complicated” patients
- Treats both the mechanical and biological problems (prosthetic use)
- Allows short hospitalization, even in emergency cases
- Low recurrence rate
- No increase in chronic postoperative pain
- Applicable in all presentation patterns

45.12 Femoral Hernias: General Key Points

- Lack of evidence.
- Need of multicentric RCT, international registers and consensus conferences.
- A thorough imaging analysis (CT scan) especially in an emergency is mandatory.
- Tailored surgical procedure according to anatomy.
- Several technical options and approaches sometimes combined.

- Mandatory use, if possible, of prosthesis.
- Surgeons should perform the technique they are most confident with.
- No delay surgery.

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