ABDOMINAL HERNIAS AND SURGICAL MESHES
Hernia

**Definition:** "Hernia is a protrusion of intra-abdominal organ (bowel...) through the abdominal wall defect. This is the result of a disproportion between the size of intra-abdominal pressure and resistance of weak point in the abdominal wall."

(Lichtenstein, 1986)
Hernia - the incidence of disease

During the life the inguinal hernia develops in 25% of men and 2% of women.
Types of hernia

- Inguinal (groin hernias)
- Umbilical
- Femoral
- Incisional
Umbilical hernia
Inguinal, femoral, scrotal hernia
Anatomy of groin hernia

Nepřímá tříselná kýla
Open groin hernia repair - Lichtenstein
Laparoscopic groin hernia repair
Incisional hernia
Position of surgical mesh in incisional hernia repair

- Onlay
- Inlay
- Sublay
Incisional hernia repair – retromuscular (sublay mesh)
There are more than 100 modifications of surgical meshes on the market...
Modern synthetic materials

a) Polyester (PE)
b) Polypropylene (PP)
c) Expanded polytetrafluoroethylene (ePTFE)
Ideal properties of surgical mesh

Ideal properties of synthetic biomaterials have been established in the 50’s of the last century, the material should ideally be:

- Physically stable after implantation
- Chemically inert
- Non allergic
- Non carcinogenic
- Mechanically resistant
- Sterilizable
- Cheap
Properties of the surgical meshes

- Relative Weight of Meshes
- Shrinkage
- Porosity, Bridging
- Elasticity of Abdominal Wall and Mesh Elasticity
- Stability of Mesh. Laplace´s Law
A. Relative Weight of Meshes

- Density of material (grammage) - g/m²
- 18 g/m² up to 180 g/m²

36 g/m²

105 g/m²
B. Shrinkage

- The mesh is not a biologically inert material – after implantation each mesh suffers shrinkage – depending on type, from 40 to 60%!

- Presently, the shrinkage of the mesh has had to be taken into account as a norm, which explains the reason for recurrence.

- The reason for the reduction in size of the mesh is not because of shrinkage of material itself, but in fact due to retraction of fibrotic tissue which grows over the mesh’s filaments.

Heavy weight mesh (95 g/m²)
After 8 years in place
That means 60% shrinkage…
C. Porosity, Bridging

- Pores smaller than 0.8 mm cause the so-called 'bridging effect'

- Meshes with smaller pores create a stiff scar plate possibly leading to a larger amount of shrinkage
D. Elasticity of Abdominal Wall and Mesh Elasticity

Under physiological conditions an expansion of the abdominal wall could be measured in the range of **11 - 32 % (cca 20 %)**.

Textile analysis of classic (heavy weight) shows that their **elasticity is only 4-16 % over 16N/cm.**

_A reduction in the elasticity of the abdominal wall after surgery_ is one of the consequences of mesh implantation.

E. Stability of Mesh. Laplace’s Law

- Using Laplace’s Law it is possible to calculate the desired stability of the material used for the repairing of the abdominal wall.
- 16 N/cm is necessary for the sublay technique.
- 32 N/cm is required for the inlay placement of the mesh (= ‘substitution of the abdominal wall’).

Stability of Meshes: All Meshes Securely Withstood the Forces and Tension Placed Upon them which Would Ordinarily Rupture the Muscles and Aponeuroses of a Healthy Abdominal Wall.
Dynamometry. Modified Stamp Test.

Series of mesh testing undertaken by The Brno Institute of Textile Testing. Used test – modified stamp strain test, diameter of tested mesh, 45 mm.
PP MESH standard 50 g/m2 – Polypropylene surgical mesh

Product description
Universal PP mesh of lightweight structure reducing its relative weight provides excellent properties from the surgeon’s point of view:

advantageous shape memory of the material after placement of the mesh during laparoscopic hernioplasty

secure and comfortable fixation of the mesh with sutures during hernioplasty by Lichtenstein's method

Material of the lightweight mesh type (50 g/m2) with suitable pore size (1.5 mm)

The mesh is pliable but at the same time sufficiently mechanically resistant.

Fully transparent to allow secure fixation.

Advantageous properties of the mesh allow its use in inguinal hernioplasty (both Lichtenstein and laparoscopic TAPP/TEP repairs) and in incisional hernioplasty (sublay and onlay).

Indications
Inguinal hernioplasty by Lichtenstein’s method
Laparoscopic inguinal hernioplasty TEP/TAPP
Incisional hernias (sublay/onlay)
PP MESH large pore – polypropylene mesh with large pores

**Product description**
- 66.9 g/m², pore size 3.0x1.5 mm
- PP mesh of medium weight structure (middleweight mesh) with large pores for better biocompatibility of material (reduction of the inflammatory reaction of organism – foreign body reaction). PP MESH large pore is suitable for laparoscopic inguinal hernioplasties:
  - excellent shape memory of the material facilitates the preperitoneal placement of the mesh
  - the mesh sides have different surface roughness – thanks to the „autofixation“ of the material to the inguinal tissues the rougher side helps in correct placement and spreading of the mesh
  - The mesh has sufficient mechanical resistance.
  - Fully transparent to allow secure fixation.
  - Advantageous properties of the mesh allow its use in inguinal hernioplasty (both Lichtenstein and laparoscopic TAPP/TEP repairs) and in incisional hernioplasty (sublay and onlay).

**Indications**
- Laparoscopic inguinal hernioplasty TEP/TAPP
- Inguinal hernioplasty by Lichtenstein’s method
- Incisional hernias (sublay/onlay)
PP MESH extra large pore – polypropylene mesh with extra large pores

- **Product description**
- 47.7 g/m²) pore size 3.5x3.0 mm
- PP mesh of light structure with extra large pores provides excellent material biocompatibility (reduction of the inflammatory reaction of organism – foreign body reaction) and in experiment it shows a markedly lower shrinkage rate (postoperative shrinkage of the mesh) as compared with classic heavyweight meshes.
- The mesh is pliable but at the same time sufficiently mechanically resistant.
- Fully transparent to allow secure fixation.
- Advantageous properties of the mesh predestine PP MESH extra large pore for use in incisional hernioplasties (sublay/onlay) and allow its use also in inguinal hernioplasties (both Lichtenstein and laparoscopic TAPP/TEP repairs).

- **Indications**
- Incisional hernias (sublay/onlay)
- Laparoscopic inguinal hernioplasty TEP/TAPP (glue)
**MESH light 40 g/m2 – Polypropylene surgical mesh**

- **Product description**
  - PP mesh of maximally lightened structure - lightweight mesh (40g/m2)
  - In spite of the smaller amount of its material the mesh shows sufficient strength safely exceeding the strength of aponeurotic structures of human body.
  - Light and flexible material for the patient's maximum comfort – elasticity of the material corresponds to the natural elasticity of aponeurotic tissues of the abdominal wall.
  - Advantageous properties of the mesh allow its use in most hernioplasties, preferably it is recommended for Lichtenstein surgery: easy handling during positioning and fixation of the mesh in groin, fully transparent for secure fixation to the inguinal ligament and the posterior wall of the inguinal canal.

- **Indications**
  - Inguinal hernioplasty by Lichtenstein’s method