

**ABSTRACT:** We have operated 250 patients for recurrent hernia. Most of recurrences occurred in patients previously operated without the use of prosthesis. Among them we have found that most of recurrences are located in the higher portion of the inguinal canal. We think that the inguinal triangle is a passive area that predisposes to hernia formation. We believe that this area of the inguinal canal is most stressed by the abdominal pressure following the Laplace law of physics. According to our point of view, we think that the deep inguinal orifice calibration is also an important technical aspect for hernia surgery. The technical aspects and the patient's predisposition to recurrence are here discussed.

**Our overall surgical experience**

Year	Hernias	Recurrent	Primary Inguinal hernias					Abdominal
			External Oblique	Direct	Mixed	Femoral		
1988	13	4	8	1	0	0	2	
1989	134	8	84	25	7	4	6	
1990	212	21	103	46	17	4	21	
1991	196	18	112	30	22	2	12	
1992	207	14	108	43	13	7	22	
1993	243	30	116	45	31	4	17	
1994	227	24	111	38	30	3	21	
1995	255	19	117	50	41	5	23	
1996	347	27	166	69	54	4	27	
1997	271	22	110	53	56	5	25	
1998	302	20	151	49	48	5	29	
1999	323	29	152	60	51	8	23	
2000	354	25	166	54	79	4	26	
2001	393	17	202	97	41	3	33	
2002	421	27	181	75	88	8	42	
2003	398	31	170	59	83	3	52	
2004	349	27	133	36	112	3	36	
2005	300	13	99	25	102	3	58	
2006	258	12	84	24	83	3	52	
2007	272	17	84	22	89	5	55	
2008	233	14	90	21	64	3	41	
2009	184	8	56	14	74	4	28	
<b>TOTAL</b>	<b>5892</b>	<b>427</b>	<b>2601</b>	<b>936</b>	<b>1185</b>	<b>90</b>	<b>653</b>	

**Our hernia surgical experience published for the EHS on September 2009**

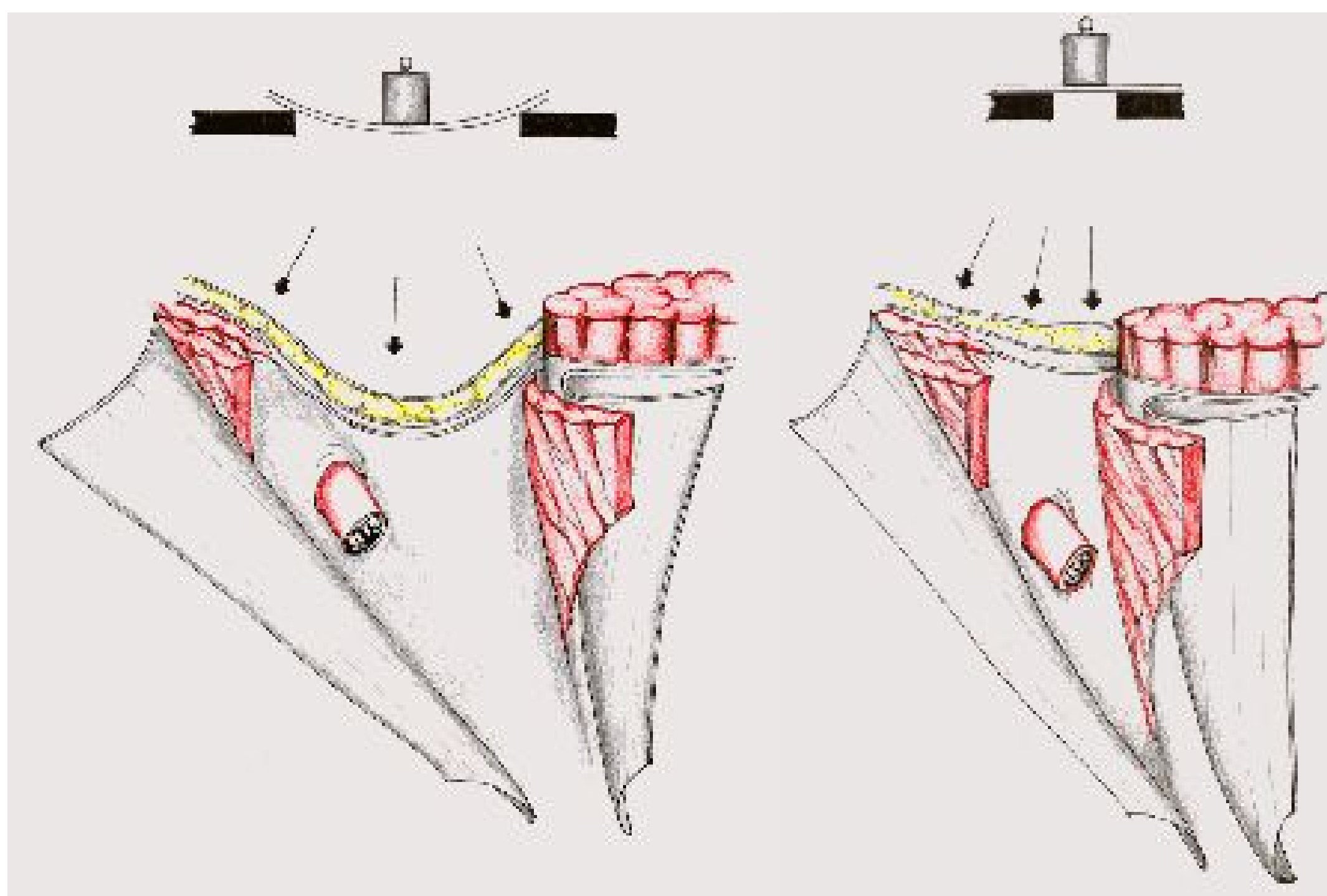
From December 1988 to September 2009 we have performed 5239 inguinal hernia operations: 427 were recurrent hernias always treated with mesh, with a recurrence rate of 5%, 4812 were primary with a recurrence rate of 0.6%. There were very few recurrences in patients treated for primary hernia with mesh. Recurrence rate is 0.7% in patients treated without mesh

YEAR	RECURRENT HERNIAS	HIGH	LOW	MIXED	M	F	PRIOR MESH	NO PRIOR MESH	TRAB/LICH
1998	20	10	5	5	20	0	0	20	0
1999	29	15	8	6	28	1	0	29	0
2000	25	14	4	7	25	0	1	24	0
2001	17	12	1	4	14	3	3	14	0
2002	28	15	7	6	27	1	1	27	0
2003	31	13	7	11	29	2	1	30	0
2004	27	14	6	7	26	1	3	24	2
2005	13	5	3	5	13	0	3	10	1
2006	12	4	1	7	12	0	2	10	1
2007	17	7	3	7	17	0	4	13	4
2008	14	7	3	4	12	2	3	11	3
2009	10	6	1	3	9	1	4	6	1
2010	4	2	2	0	4	0	2	2	2
<b>TOTAL</b>	<b>247</b>	<b>124</b>	<b>51</b>	<b>72</b>	<b>236</b>	<b>11</b>	<b>27</b>	<b>220</b>	<b>14</b>
		50,2%	20,6%	29,1%	95,5%	4,5%	10,9%	89,1%	5,7%
19-89 YEARS AVERAGE 63									

**Table 1:** Patients analyzed from January 1998 till February 2010

**Discussion**

**Causes of recurrences:** we have individuated 3 main causes related to the surgeon (and the technique used), to the patients and to external life factors. We think that the presence of multiple, misdiagnosed, subclinical hernia is an important cause of recurrence. We have previously reported that the omission to explore the femoral canal leads to an increase of 2.5% of pseudo femoral recurrences. The presence of an higher incidence of recurrences in the high portion of the inguinal canal (50,6% - Table 1) can be mostly related to technical errors regarding isolation or treatment of the sac, calibration of the internal ring (altered by the presence of hernia) or insufficient reinforcement. The presence of the cord, the presence of insufficient musculature on that area, and the presence of an higher distance between the rectus muscle and the inguinal ligaments, are factors related to the patient structure (see Fig n.1).



**Fig. n.1:** The greater is the distance between the rectus muscle and the inguinal ligament, the greater is the tension that develops on the wall (Laplace law), which explains the higher incidence of recurrence at the higher portion of the inguinal canal

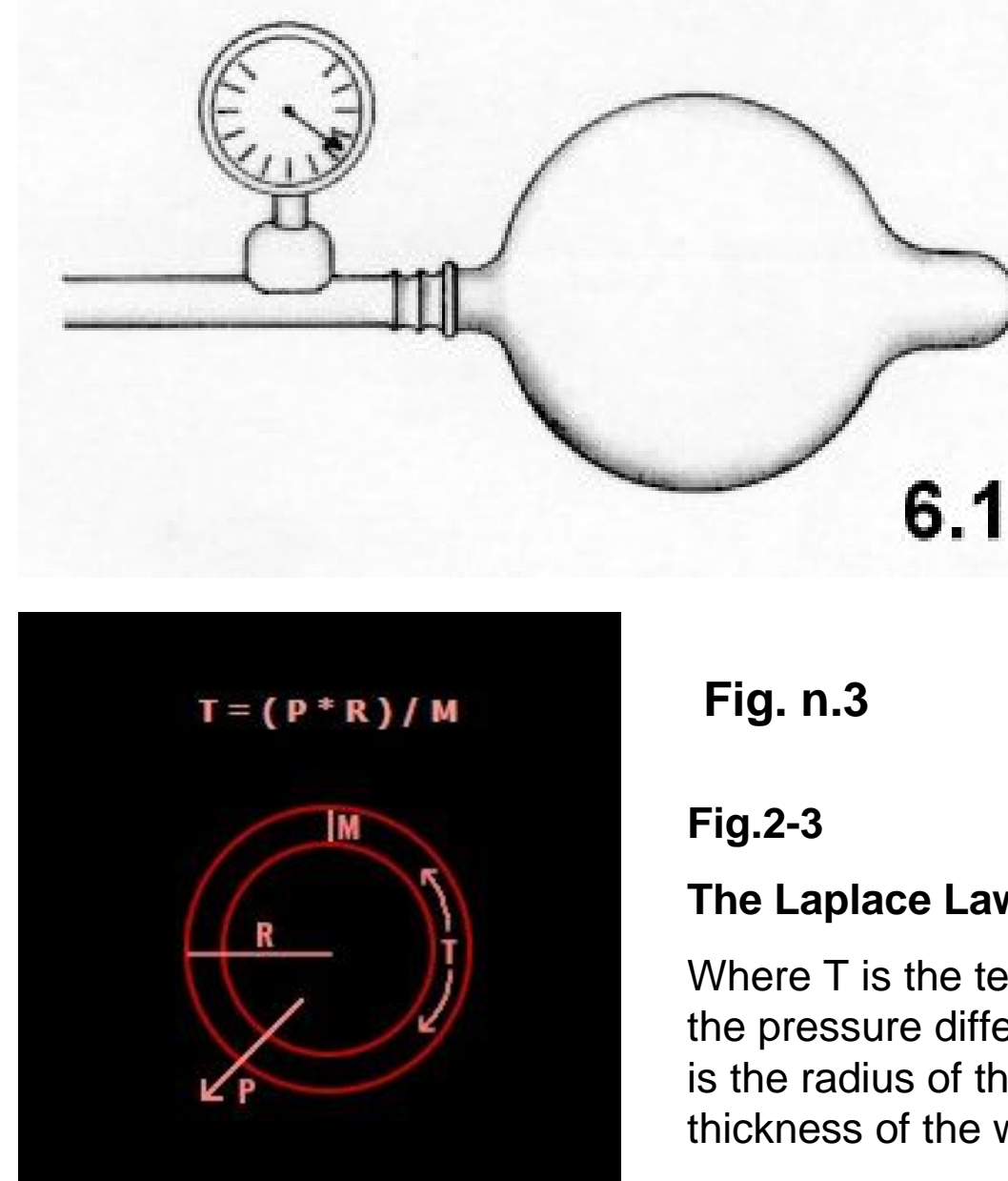
Suture traction, and suture type are also important risk factors for recurrences. We have found 3 multiple recurrent hernias in patients previously operated with Mersilene sutures with the Bassini's technique. Suture traction is an important factor related to recurrence, it mostly derives from the imbalance between active muscularized areas and the extension of passive areas without musculature (see Fig. 1). This phenomenon is better explained by the Laplace law of physics (see fig. 2-3). The full-thickness sutures over the muscles (fixing them to the inguinal ligament) further contribute to the development of recurrence (see fig. 4).

**The Laplace law**

$$T = (P \cdot R) / M$$

$P = \text{PRESSURE}$   
 $R = \text{RADIUS}$   
 $M = \text{THICKNESS}$   
 $T = \text{TENSION}$

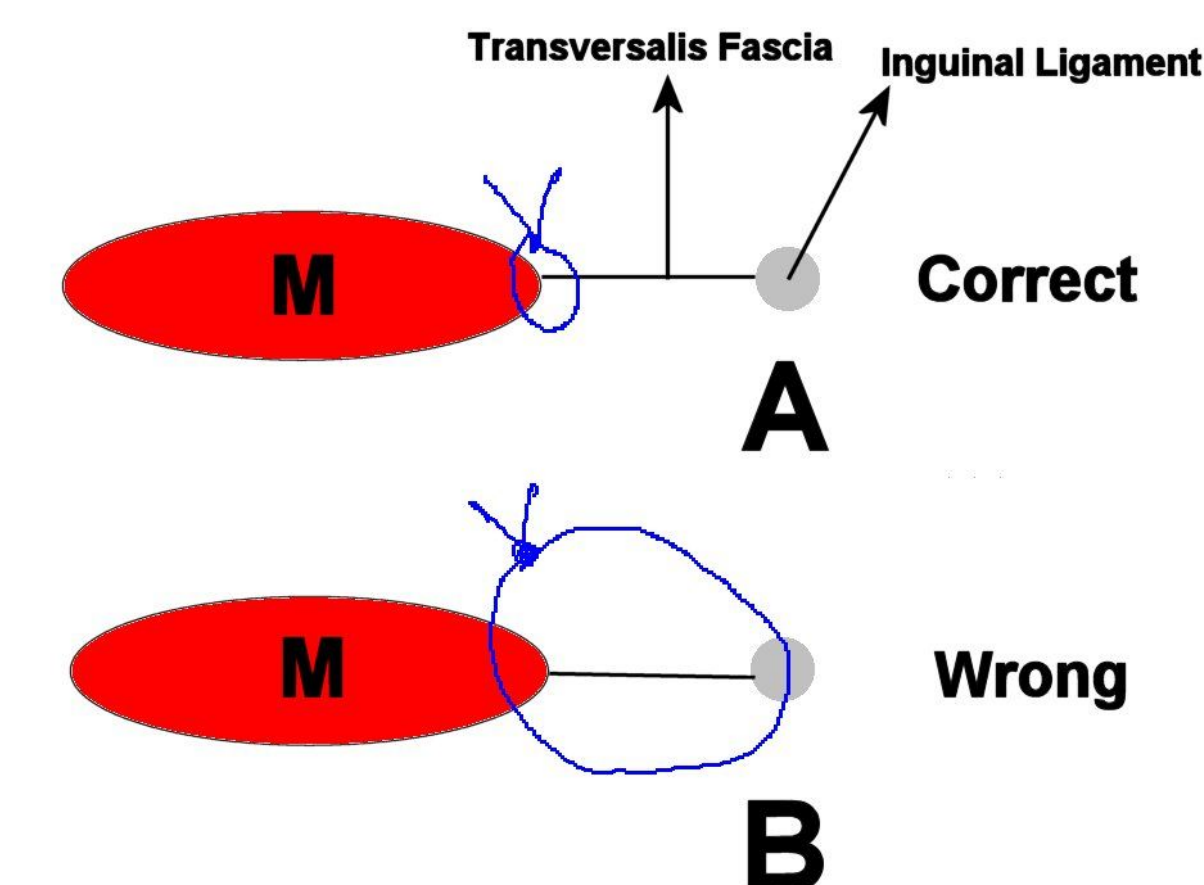
**Fig. 2** The Laplace Law can be applied to the hernia sac and to the inguinal triangle



**Fig. n.3**

**Fig.2-3**  
The Laplace Law:  $T = (P \cdot R) / M$

Where T is the tension in the walls, P is the pressure difference across the wall, R is the radius of the cylinder, and M is the thickness of the wall



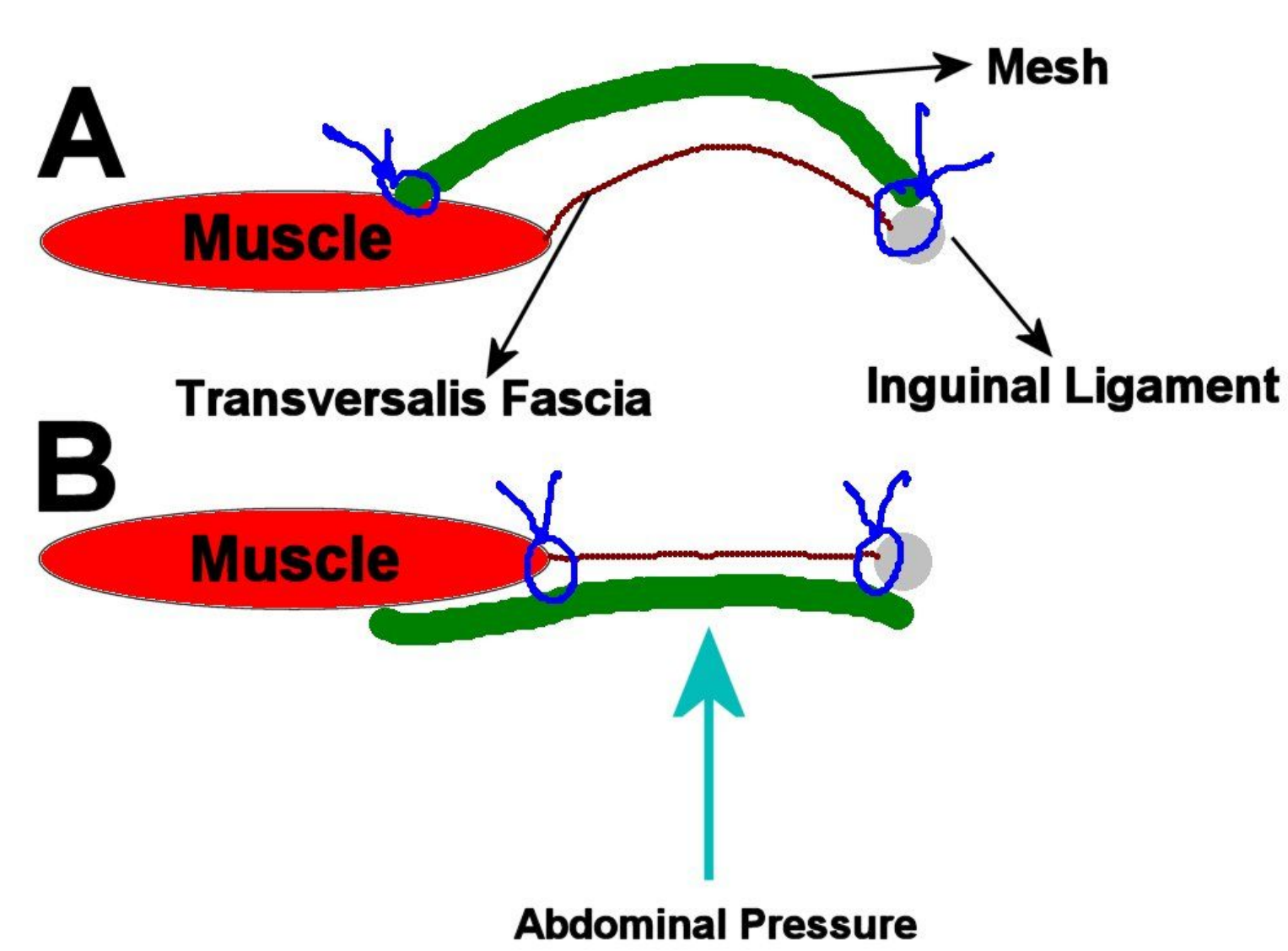
**Fig. n. 4** Sutures must be between muscular fascia and fascia, never full-thickness or immobilizing and incapacitating muscular structures. It is suggested to make small holds to avoid suture traction and realize a tension free hernioplasty. It is not advisable to fix muscular structures (M) to the inguinal ligament.

There are recurrences also among patients previously operated with mesh (10,9%). This phenomenon is increasing but is not statistically relevant according to our analysis. Most of these recurrences occurs in patients operated with plugs (plug displacement). We have also found 14 recurrences in patients previously operated with the so called tension free hernioplasty (8 Type A, 3 Type B, 3 Type M see table 3): most of them had a recurrent external oblique hernia due to mesh dislocation and only two developed a single low direct hernia, 7 patient had mesh expulsion (6 Type A and one Type M), 2 a lesion of vas deferens for mesh decubitus, one a testicular atrophy. This means that the mesh material and the mesh placement play an important role. Mesh dislocation is explained by the pulling out of the prosthesis at the level of one of its borders. It is the same effect that happens to a sail when the wind (the abdominal pressure) is very strong. This effect can be explained by the Laplace law (fig. 2). In other words what we call tension free hernioplasty under rest is not the same under stress: the wider is the area not covered by musculature (the passive area fig. 6) the greater is the risk to encounter a recurrence even in presence of a mesh (Fig. 5 and 6).

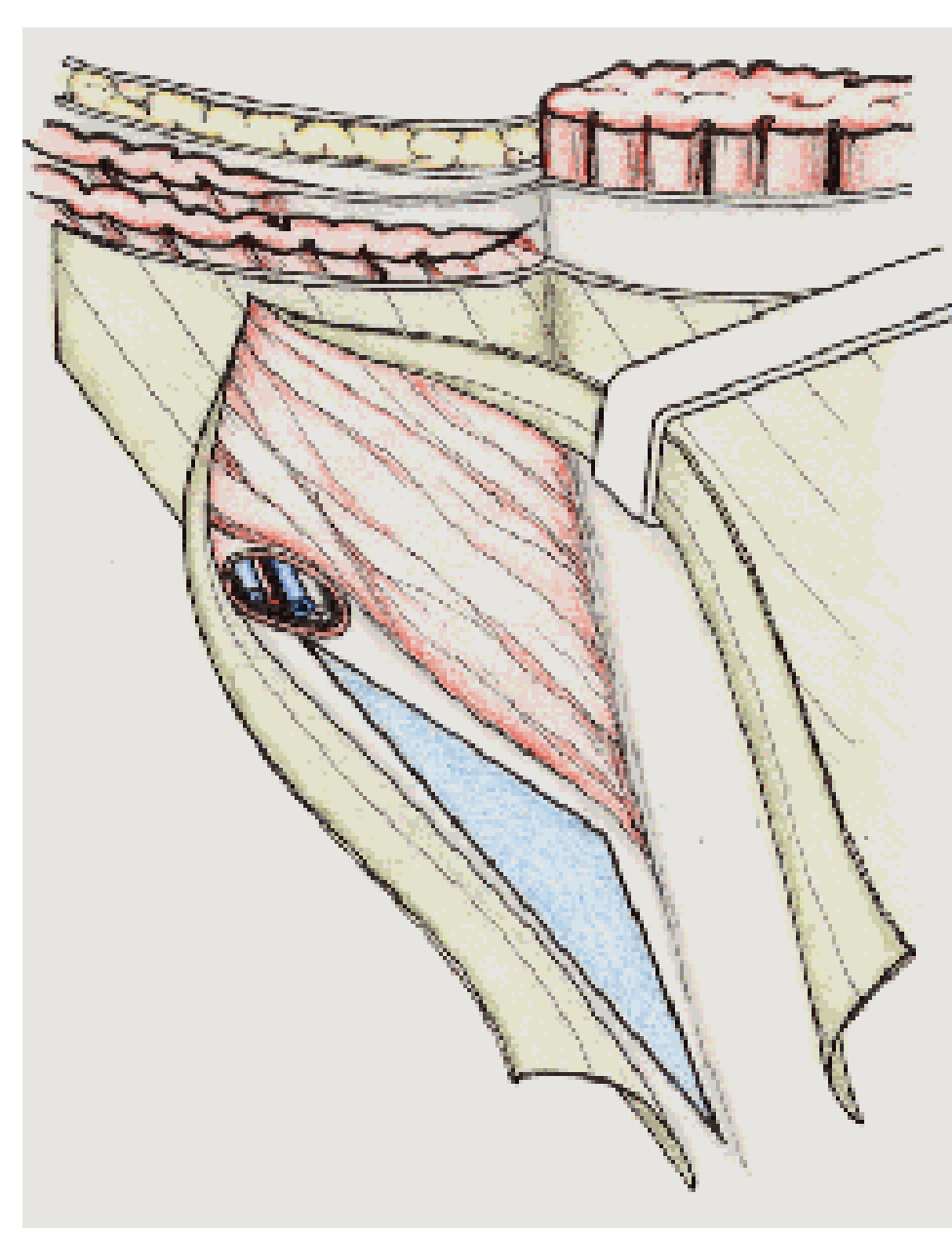
**Patients and results**

This results have been incorporated with our overall series from December 1988 till September 2009

COMPLICATION	POSTOPERATIVE COMPLICATIONS	
	PRIMARY HERNIA	RECURRENT HERNIA
Subcutaneous Seroma	288 6,00%	59 14,00%
Temporary Testicular Edema	4 0,10%	8 2,00%
Hematomas	19 0,40%	8 2,00%
Wound Infections	4 0,10%	3 0,80%
Testicular Atrophy	9 0,20%	6 1,50%
<b>PATIENTS</b>	<b>4812</b>	<b>427</b>
<b>PATIENTS</b>	<b>HERNIA OPERATIONS</b>	<b>AGE MAX AGE MIN AGE AVG</b>
PRIMARY HERNIAS	4812	99 1 54 13:1
RECURRENT HERNIAS	427	91 19 61 22:1
ABDOMINAL HERNIAS	653	- - - NR
<b>RECURRENCES % REC</b>		
PRIMARY	75%	15%
RECURRENT	60%	25%



**Fig. 5:** Case A seems more "tension free" than case B. This is not true. Under rest, case A is without tension. Under stress, with the increasing of the abdominal pressure, case B seems to respond better. Recurrence most likely appears in case A.



**Fig. 6** The inguinal triangle is a passive area that is unprotected by the abdominal pressure

**Conclusions**

Many are the factors that contribute to recurrent hernia development. We have here analyzed some common surgical errors.

Our conclusion is that most recurrent hernias are developed in the higher portion of the inguinal canal because of its weakness, according with the Laplace law of physics. All the so called "tension free" techniques should be revisited under this point of view.