Modified Lichtenshtein hernioplasty prevents male infertility

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INTRODUCTION: *Lichtenstein hernia repair made revolutionary progress in hernia treatment. Since that a lot of modifications have been proposed. In a few of them attention is drawn to spermatic cord isolation from a mesh for prevention of spermatic cord involvement into inflammatory process which may lead to disturbances in ejaculation act and spermatogenesis itself.*
AIM OF THE STUDY: To *compare morphological parameters of sperm prior and after hernia surgery in those groups of patients who underwent Lichtenstein and modified Lichtenstein (with spermatic cord isolation from a mesh by Gvenetadze) hernia repairs.*
CONCLUSION: *Our experience showed that modified Lichtenstein hernioplasty which involves spermatic cord complete isolation from the mesh prevents male infertility especially in the case of bilateral hernia repair.*

KEY WORDS: Modified Lichtenstein hernia repair, Morphology and cytology of sperm.

Introduction

The true tension- free hernioplasty using mesh and no suture closure of the hernia defect was introduced in 1984 by Irving Lichtenstein and colleagues [21].
Rutkow and Robbins report a modification of the tension-free hernioplasty using a plug to block the defect in the posterior inguinal wall supplemented by sutureless swatch or patch as an overlay on the posterior inguinal wall [22].
It is well documented that all kind of mesh material initiates fibroblastic proliferation and fibrosis. Lichtenstein hernioplasty utilizes the technique in accordance to that spermatic cord lays on a mesh. Although limited direct contact of a patch with spermatic cord doesn't completely avoid spermatic cord encasement in fibrosis during mentioned Rutkow procedure either.
The mentioned involvement of spermatic cord in massive fibrotic process appears as a main drawback for both techniques. There are a few reports about morphological changes in spermatic cord structures [4,11,14,16,20,23] after Lichtenstein hernia repair but no data exists regarding to morphological and functional changes of sperm after this type of repair.
The above described problem served as a stimulus to introduce the technique which would incorporate not only tension-free element but also prevents close contact of spermatic cord to mesh.

Materials and methods

In 2002 we've worked out modified hernia repair for inguinal hernia (Gvenetadze's method of hernia repair –Certificate No. 2117 issued by Georgian Society of Authors and Performers GESAP– member of International Confederation of Societies of Authors and Composers CISAC).
The methodology of proposed so called modified hernia repair which prevents close contact of the spermatic cord to a mesh is described below.
Anesthesia: Local or general may be employed. For local anesthesia –mixture of anesthetics: 0.25% bupivocaine, 0.5 % Novocaine with adrenaline 1:400 000– total 150 ml of solution.
Positioning: supine position. The head of the operating table is tilted downward by about 15 degrees.

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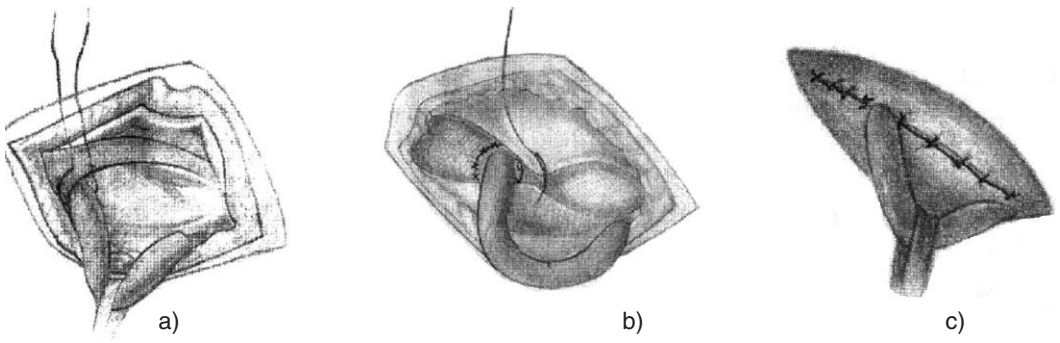


Fig. 1: Gvenetadze's technique for the isolation of the spermatic cord from a mesh. A) The deep inguinal ring is narrowed by purse -string suture with the transversalis fascia around the spermatic cord. B) The mesh is tailored so that the window in it for the spermatic cord is 0.5 cm wider than the diameter of spermatic cord. This approach avoids close contact of mesh window edges with proximal part of spermatic cord. C) The medial and lateral layers of external oblique muscle are approximated and sutured with interrupted or continuous suture under the spermatic cord.

The incision: 1-1.5 cm above and parallel to the inguinal ligament. The external oblique aponeurosis is opened in the long axis of the inguinal canal.

The cremaster is clamped divided and ligated at its origin and similarly dealt with distally at the level of the pubic tubercle. Herniotomy is performed as usual and the hernia sac is inverted or excised.

The deep inguinal ring is narrowed by purse -string suture with the transversalis fascia around the spermatic cord.

The mesh is tailored so that the window in it for the spermatic cord is 0,3-0,5 cm wider than the diameter of spermatic cord. This approach avoids close contact of mesh window edges with proximal part of spermatic cord. The mesh is fixed to the inguinal ligament, internal oblique and transverse muscle and pubic tubercle (Prolene2-0) routinely, completely closing the posterior wall of the inguinal canal with the crossing of the tails of the mesh behind the spermatic cord.

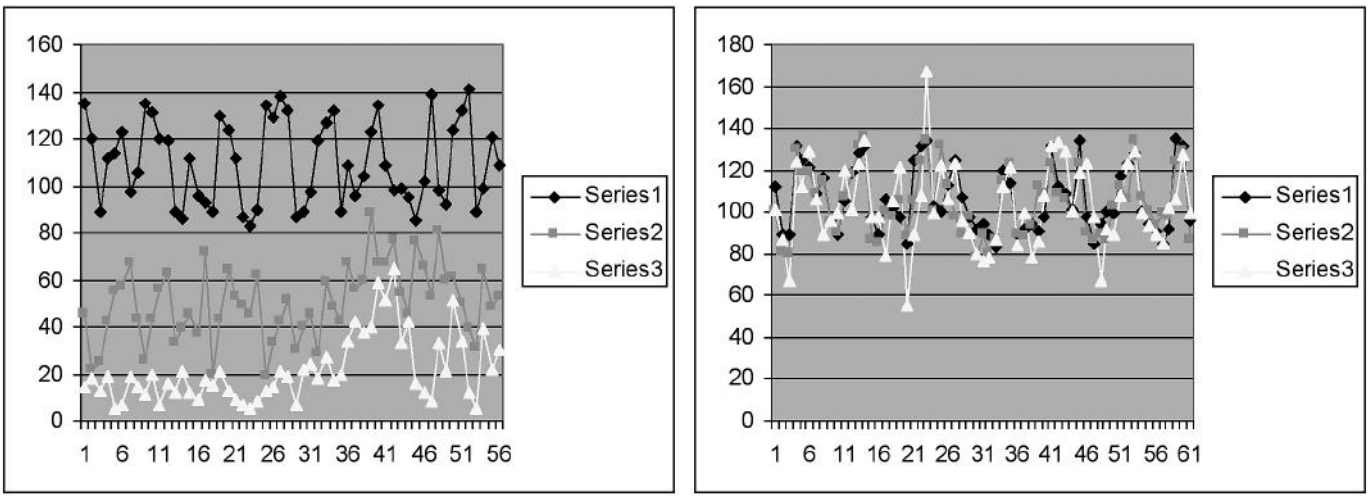
The medial and lateral layers of external oblique muscle are approximated and sutured with interrupted or continuous suture (Prolene 2-0) under the spermatic cord. Thus close contact of the spermatic cord with the mesh is completely avoided (Fig. 1).

117 male patients (mean age 44.8.) with maintained reproduction functions (prior to surgery) have been chosen from all patients who underwent tension free hernia repair in the period of 2002-2006. Complete spermomorphocitological investigations prior and after hernia repair have been performed. The total number was allocated into 2 groups. The I group contained those 56 patients who underwent bilateral Lichtenshtein hernia repair. The II group – 61 patients on whom bilateral modified hernia repair has been utilized.

Complete spermomorphocitological investigation included study of the following parameters of sperm: volume of sperm, pH, viscosity and stretching capacity of sperm; spermatozoid total count and count per 1 ml of sperm; spermatozoid morphology, spermatozoid moving capacity, type and coefficient of spermatozoid movement; sper-

TABLE I - *The standard protocol which has been used for evaluation of the sperm main parameters.*

Diagnosis	**Normozoospermia**	
Sperm Evaluation		**Norm**
Volume	3.0 ml	2-5ml
Colour whitish	whitish	whitish
Smell	specific	specific
Ph	7.8	7.2-7.8
Time of loosing Viscosity	25 min	25 min
Streching capacity	0.2 CM	0.1-0.5 cm
Spermatozoids per 1ml.	$45x10^6$	≥ $40x10^6$
Cryptozoospermia mobile		
immobile		
Spermatozoids total	$135x10^6$	$>80X10^6$
Capacity of Movement		a + b ≥ 50%
	%	
	c + d	
Coefficient of motion		3 3-4
Life Capacity	a + b	a + b
	%	≥ 50%
	c + d	
Morphology		
Normal	60%	≥ 50%
spermatozoids Pathologic	40%	≤ 50%
Tusoleman Bodies		NO
Spermolisis	High 10%	10-15%
Immature forms	No	≤ 2%
Leucoagregation	No	NO
Spermatophages	1	1-2
Leucocytes	2-5 in visible area	UP TO 4 x 10^6
Erythrocytes	No	NO
Epithelial cells	No	1-4
Lecitin granules	Large Amount	Large Amount
Amyloid	No	No
Spermaggregation	No	No
Micro flora-bacteria	No	No
Spermaglutination	No	No
Crystals of batcher	No	No
Mucin	No	No
Sperm resorbtion	No	No
A.S.A.	?	No
Calcinate	No	No
Mar-test-ar	%	< 10-40 %



a) b)

Fig. 2: A) Spermatozoid total count in the 1st group of the patient: Series 1 - represent spermatozoid total count 2 days prior to surgery, series 2 -30 days after operation and Series 3 -6 months after surgery correspondingly. Statistically significant difference ($p<0.01$) of the parameters between the series 1 and series 2 and 3 has been stated. B) In the 2nd group of patients there was no statistically significant difference between the Series 1 and the other series 2 and 3.

matozoid life capacity; morphology; leucoaggregation; sperm aggregation etc. have been carried out in all groups 2 days prior to surgery, 30 days and 6 month after surgery. Sperm was obtained (masturbation or vibroejaculation) from all the volunteer patients after their written agreement (Tab. I).

Results

Statistically significant differences between main sperm morphological parameters: volume of sperm; spermatozoid total count and count per 1 ml of sperm; spermatozoid morphology, spermatozoid moving capacity 2 days prior to surgery, 30 days and 6 month after surgery have been reported in the I ($p<0.01$) group. In the II group no significant differences among mentioned sperm parameters have been observed (Fig. 2).

Conclusion

Modified Lichtenshtein hernioplasty (by Gvenetadze) especially for bilateral hernia repair which involves spermatic cord complete isolation from the mesh prevents male infertility. The new posterior wall after this hernioplasty is more solid than after classical Lichtenshtein hernioplasty.

Discussion

As it is mentioned above we haven't found any publication in English speaking literature regarding sperm morphofunctional changes in humans after inguinal hernia mesh repair but we can point out to this fact not only by our data but also on the basis of different articles published in recent years in which rough fibrotic changes around spermatic ducts and vessels after mesh implantation are observed.

The effects of the long-term implantation of a mesh bioprosthesis on the surrounding soft tissue during hernia repair are numerous. In the recipient tissues even years after implantation, a persisting inflammatory proliferative foreign-body reaction with increased cell turnover is described [4] .Typical signs are inflammatory cells and numerous macrophages at the interface, also even after years [12] .This inflammatory response to the mesh implantation is reported not only after incisional hernia repair, but also following bioprosthesis implantation during inguinal -ernia operation. Trabucchi reported about similar findings in human biopsies 7 days to 9 years after inguinal dacron mesh implantation. He observed a foreign-body giant cell layer around the fibers and the presence of macrophages in an intermediate layer [13].

Similar changes have been found within the spermatic cord after mesh inguinal hernia repair in the animal model [14] Here the aforementioned changes together with a fibrotic formation were observed after 6-12 months. Beets et al. [15], found increasing foreign-body giant-cell reaction to polypropylene mesh in the preperitoneal position until the third week after implantation in the pig. Afterwards the response gradually decreased, until at 6 months, it persisted at half the maximal level at 3 weeks. Adhesions between the mesh and the structures of the spermatic cord were described by Fitzgibbons et al. [17]in the pig. They found adhesions between the mesh and structures of the spermatic cord even after intraperitoneal placement of the mesh. LeBlanc et al. [16] placed a heavy weight polypropylene mesh into the preperitoneal space and also observed severe adhesions to the sper-

matic cord, 30 days after implantation. Ninety days after operation, adhesions to the spermatic vessels and to the spermatic cord as well as venous congestion of the testis were described.

There are also reports about reactions of inguinal prosthetic mesh in man. Wingenbach et al. [18] reported long-lasting pain during copulation in 3.9% of all cases after laparoscopic hernia repair. Langenbach et al. [19] found painful ejaculation in 10%, 12 wee;s after laparoscopic repair, which correlated with the kind of mesh. Hetzer et al. [6] reported spermatoceles requiring operation after Lichtenstein repairs in 0.8%. Silich and McSherry [5] reported a case of a spermatic granuloma requiring operation, 2 years after mesh repair of an inguinal hernia.

Involvement of testicular veins is also already described in literature. LeBlanc found testicular venous congestion after mesh implantation in the pig [16]. Our results indirectly confirm this observation. Moreover venous thrombosis within the spermatic cord has been seen by Peiper C and co-authors.[23] This observation has not been described in literature before. Perhaps this spermatic thrombosis represents the cause for the inflammatory changes. More likely, however, is the explanation that the venous thrombosis is one of the results of the foreign body reaction. This observation can be considered as a direct confirmation for those changes in sperm count and quality characteristics as it shown by us. In addition to that Peiper C and colleagues have found a significant influence on testicular perfusion and function[23]. In the postoperative phase, testicular temperature and perfusion were reduced after any repair, with a stronger effect following the Lichtenstein operation. Spermatogenesis also showed a certain reaction on the mesh. The mesh repair reduced the amount of regular spermatogenesis classified as Johnsen [10] in comparison to the Shouldice repair and the controls. This difference, however, was without statistical significance. As abovementioned authors claimed "… the changes mentioned might by of no large clinical relevance in unilateral repair, but in bilateral cases, they must be brought under consideration, the influence on humoral conditions will be topic of further investigations". Moreover Shin et al. [20] reported a total of 14 cases of azoospermia secondary to inguinal vasal obstruction related to previous polypropylene mesh herniorrhaphy.

Thus our study should be considered as a further clinical prove for altered spermatogenesis after bilateral hernia mesh repair and the modification proposed is a way of its prevention. On the basis of our experience we conclude that modified lichtenshtein clinique is effective nethod of hernioplasty as for young as well for elderly patients.

Riassunto

INTRODUZIONE: L'ernioplastica con la tecnica di Lichtenstein ha introdotto un progresso rivoluzionario nel trattamento chirurgico dell'ernia inguinale. Prima di essa erano state proposte una serie di modifiche. In poche di esse era stata prestata attenzione all'isolamento del cordone spermatico dalla protesi per prevenirne il coinvolgimento nel processo flogistico di guarigione, che è in grado di provocare disturbi al momento dell'eiaculazione e della stessa spermatogenesi.

SCOPO DELLO STUDIO: Paragonare i parametric spermatici morfologici prima e dopo la riparazione chirurgica dell'ernia in quei gruppi di pazienti che erano stati trattati con la tecnica protesica di Lichtenstein, sia originale che modificata (con l'isolamento del funicolo spermatico dalla mesh secondo Gvenetadze.

CONCLUSIONI: La nostra esperienza ha dimostrato che l'ernioplastica eseguita secondo la Lichtentein modificata, che prevede il complete isolamento del cordone spermatico dalla mesh previene l'infertilità maschile, specie nel caso di riparazione spermatica bilaterale.

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