PREVENTING MALE INFERTILITY FOLLOWING TENSION-FREE HERNIOPLASTY. CELL TRANSPLANTATION TECHNOLOGY IN ANDROLOGY

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Annotation. In recent years, there has been a growing number of reports implementing that hernioplasty can lead to the development of male infertility and pathozoospermia. At the moment surgery is the only treatment for inguinal hernias, therefore prevention of complications, such as azoospermia, oligozoospermia and male infertility is very relevant. Our research has shown that the choice of mesh materials in tension-free inguinal hernioplasty significantly affects spermatogenesis.

Standard polypropylene mesh is most frequently used in hernioplasty, nevertheless it affects spermatogenesis and reduces sperm count. Polyester mesh (Parietex™ ProGrip™) is an alternative option that does not affect spermatogenesis as much as polypropylene mesh does. Cell transplantation technology significantly reduces the number of abnormal forms and increases sperm motility in patients with pathozoospermia, normoastenoteratozoospermia, oligozoospermia gravis and azoospermia (I. D. Kirpatovskiy, Z. S. Kaitova, 1995-2000).

Key words: male infertility, inguinal hernia, azoospermia, hernioplasty, polyester and polypropylene mesh, Parietex, Parietex, ProGrip, cell transplant technology.

Introduction. Infertility is a disease of the reproductive system, defined as failure to achieve a clinical pregnancy after at least 1 year of regular unprotected sexual intercourse [1]. The prevalence of infertility ranges from 16 to 25% of all couples where the etiology of the male factor is determined in 30-50% of all cases [2]. Male infertility is often characterised by abnormalities of the sperm and semen analysis that is used as an indicator of male fertility. Male infertility can be caused by chronic diseases such as diabetes, cardiovascular diseases, congenital conditions (Klinefelter syndrome, hypogonadism) and other pathologies. Male infertility is a serious social and economic problem, which can lead to depression and suicide. Statistics of male infertility in the Russia Federation in 2016 showed that the main causes of infertility in men were: varicocele — 16%; ejaculatory duct obstruction — 14% and other male genital pathologies —13% [3].

Semen characteristics found in the WHO manual 2010

<table>
<thead>
<tr>
<th>Parameter</th>
<th>WHO 2010 lower reference limits (95% CI)</th>
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</thead>
<tbody>
<tr>
<td>Semen volume (ml)</td>
<td>1.5 (1.4-1.7)</td>
</tr>
<tr>
<td>Total sperm number (10⁶ per ejaculate)</td>
<td>39 (33-46)</td>
</tr>
<tr>
<td>Sperm concentration (10⁶ per ml)</td>
<td>15 (12-16)</td>
</tr>
<tr>
<td>Total motility (PR +NP, %)</td>
<td>40 (38-42)</td>
</tr>
<tr>
<td>Progressive motility (PR, %)</td>
<td>32 (31-34)</td>
</tr>
<tr>
<td>Sperm morphology (normal forms, %)</td>
<td>4 (3.0-4.0)</td>
</tr>
<tr>
<td>Vitality (live spermatozoa, %)</td>
<td>58 (55-63)</td>
</tr>
</tbody>
</table>

WHO – World Health Organization, CI – confidence interval, PR – progressive motility, NP – nonprogressive motility

Diagnosis begins with a detailed history (trauma, drugs, toxins and radiation, genital infections, etc.). During the physical examination a doctor must pay attention to the patient's weight (distribution of subcutaneous fat), the size and consistency of testes, scrotum and epididymis. Laboratory diagnosis of male infertility is based on blood and semen analyses (Table 1), that are taken from the ejaculate, the testis and the epididymis [4].

Additional semen analyses include: 1) measurement of the oxidative stress; 2) sperm DNA fragmentation (SCSA, TUNEL, comet test, SCD test); 3) sperm viability. If an individual had any disruptions to the blood testes barrier it is necessary to perform an anti-sperm antibody (ASA) testing. Other tests can include genetic testing (karyotype analysis), ultrasound and MRI (pelvis, perineum the pituitary gland).

Another cause of male infertility can be a surgical intervention, particularly inguinal hernia repair surgeries [5].

¹ Compare to all infertilities in men and women in 2016.
Modern approaches to inguinal hernia repair. Inguinal hernias make up to 75% of all abdominal wall hernias. Herniorrhaphy has changed significantly over the past 20 years, from open to laparoscopic, as well as through the use of mesh. However, hernia repair is still associated with various complications. In our study, we examined the effect of different types of meshes (polypropylene and polyester) on the characteristics of semen [6, 7].

Polypropylene is a non-polar, hydrophobic, electrically neutral and resistant to biodegradation polymer with high strength. However, the main drawback is its heavy fibres, which can stimulate inflammatory processes, formation of scars and due to polypropylene shrinking nature, it can lead to hernia recurrence (30 to 50%) [9].

Polyester has high strength as it is made of polyethylene and linear heterochain aromatic polymers with repeating units of the ester group. The polymer is weakly polar and more hydrophilic; it stimulates the conformability and tissue in-growth with the abdominal wall [10]. Although there have been reports that it degrades over time, especially during infections.

Cell transplantation technology was designed for various forms of defective spermatogenesis in men of a reproductive age, the effectiveness of which was examined in this study [11].

The aim of this study is to investigate the correlation between different approaches in inguinal tension-free hernioplasty and semen characteristics.

Methods and materials. Tension-free inguinal hernioplasty. The study included 60 patients with inguinal hernia (hernial protrusions was no more than 5 cm). Patients were divided into a control group – 20 healthy males (with a standard semen analysis and hormone levels) and an experimental group - 40 patients. The experimental group was divided into two groups of 20 patients: in group I patients underwent hernioplasty with the use of polypropylene implant Parietene™ ProGrip™; group II patients underwent hernioplasty with the use of polyester implant Parietex™ ProGrip™. Spermatogenesis analysis were performed after 1 month, 3 months and 12 months after inguinal hernioplasty. Cell transplantation technology as an optional treatment for various forms of defective spermatogenesis. The study included 40 men of a reproductive age with severe forms of defective spermatogenesis and hormonal imbalance. The patients’ mean age was 35 years ± 8.13, who were initially diagnosed with pathozoospermia 5 to 7 years prior to the experiment. The patients were separated into three groups according to the severity of their conditions: group 1 - 20 patients with normozoospermia; group 2 - 10 patients with oligozoospermia gravis; group 3 - 10 patients with azoospermia. Semen analysis was performed after 1 month, 3 months and 12 months after inguinal hernioplasty.

Results. Tension-free inguinal hernioplasty. The results indicate that after 6 months in group I the quality of the ejaculate was reduced dramatically: the sperm number decreased by 41.1% and total motility decreased by 12.1% (although the volume of ejaculate remained normal).

In group II the sperm number was 80.2% of the main group, and the motility has even increased compared to the preoperative period by 9.1%. 3 months after the surgery there was a significant decrease in the content of blood testosterone in patients who underwent hernioplasty. 6 months after the surgery hormonal parameters corresponded to the preoperative level. The level of testosterone was 68.6% and 83.9% of the level of the main group. In the operated patients FSH and LH levels were close to normal, compared to 3 months after the surgery. In group II the levels of hormones were reduced to their initial values much faster compared to group I; LH has even surpassed its level by 30% by the third month, and by 1.5% by the sixth month.

Cell transplantation technology as an optional treatment for various forms of defective spermatogenesis. Immunological studies conducted immediately after each surgery and a few months later, showed no rejection of cell transplants throughout the observation period. During the observation period all patients from group 1 showed normalization of spermatogenesis. The number of morphologically abnormal sperms of group 1 patients was reduced to 10 % compared with the preoperative values (preoperative number of pathologically changed sperm was 80 ±15% and after the surgery 7 ±4%). In group 2 there was an increase in the total number of motile sperm forms (active and partially-active) up to 40 % compared to the original values. In group 3 there were isolated motile and morphologically normal forms of spermatozoa (in 4 out of 10 patients).

Conclusions: our analysis showed a clear advantage of using polyester mesh in inguinal hernioplasty in men of a reproductive age. Cell transplantation technology can be recommended as a promising rehabilitation treatment of some forms of male infertility.

REFERENCES


