Introduction: The employment of a diversity of prosthetic materials and several types of mesh different in construction is opening a new chapter in hernia surgery and tension-free techniques are becoming a "golden standard" for repairing abdominal wall defects, whereas the conventional methods, i.e. the tension techniques are performed on young patients having small direct, indirect, or femoral hernias.

Aim: The aim of this retrospective study is to present the results of using Prolene Hernia System (PHS), Ultrapro Hernia System (UHS) and 3D Patch (3DP) devices in the treatment of inguinal, femoral, umbilical and small incisional hernias in outpatient surgery.

Material and methods: From January 2006 to January 2009, 70 patients were operated on for abdominal wall hernias (54 inguinal, 4 femoral, 8 umbilical and 4 small incisional hernias) using PHS, UHS and 3DP devices. All the patients underwent surgery under local infiltrative anaesthesia. All the surgical operations were performed by a single surgeon, 19 of them in the General Hospital and 51 in a private polyclinic.

Results: The mean size of the hernia defect in the inguinal, femoral and umbilical hernias was 2.5cm (1-4cm), while in the incisional hernias it was 4.5cm (3-6cm). The mean operating time was 2.4hrs (2-6hrs). There were no requirement for urinary drains. The mean follow-up was 18 months (0-36 months). The incidence of infection, chronic pain and recurrence was 0%. Three of the patients had complications: seroma in one patient with an incisional hernia and hematoma in two patients after inguinal hernia repair.

Conclusion: The employment of PHS, UHS and 3DP devices, which have not yet been widely accepted in our hospitals, has had outstanding results in outpatient surgery. In addition, the type of anaesthesia and the 3D mesh construction prepare the way for a short hospital stay, smooth recovery and a swift return to normal activity.

Key words: outpatient surgery; hernia; PHS; UHS; 3DP devices

INTRODUCTION

The anatomy of the inguinal area may still be unfamiliar to certain surgeons despite their considerable experience. The new chapter in surgery started with introduction of the laparascopy and the development of this techniques as well as laying greater stress on the posterior aspect of the area make substantial contributions to a further insight into its anatomy. In France, Fruchaud introduces the term MPO (myopectineal orifice), while Stoppa and Rives, two other Frenchmen, together with Wantz from the USA, emphasize its significance in inguinal hernia formation.

The MPO is an oval-shaped planar aperture in both side of the lower anterior wall at its junction with the pelvis. It is protected by transversal fascia and divided into superior (inguinal) and inferior (femoral) panes by the inguinal ligament. The inferior epigastric vessels divide its superior pane into the lateral part i.e internal inguinal ring (the site of indirect inguinal hernia occurrence) and the medial part, so called Haselbach’s triangle (the site of direct inguinal hernia formation). Its inferior pane is traversed laterally by the femoral vessels and is protected medially by the lacunar ligament.

Defect through this pane manifest as different type of femoral hernias. In the case of inguinal hernia repair, when we used different kind of the prosthetic device, the crucial step is to analyzed the weak tissues around hernia defect and made right choice.

The employment of mesh techniques (patch, plug) involves an anterior approach, whereas a posterior approach provides a unique opportunity for a full protection of the MPO against the formation of any hernia, including a femoral one.
Having taken into consideration the significance of the posterior wall of the inguinal canal, three-dimensional hernia systems have been devised ("3 in 1" as well as "2 in 1"), the employment of which, together with laparoscopic techniques, minimizes recurrence rates after herniorrhaphy. To be specific, this surgical technique, involving the employment of Prolene Hernia System to repair inguinal hernias, was first used by A.I. Gilbert, at the Hernia Institute of Florida in 1998.7,8-10

MATERIAL AND METHODS

Over a three-year period, a retrospective study of 70 patients was conducted, following inguinal, femoral, umbilical and small incisional hernia repairs. All the patients underwent surgical operations that employed a certain hernia system - Prolene Hernia System (PHS), Ultrapro Hernia System (UHS), or 3D patch (3DP) and local infiltrative anaesthesia.

All the surgical operations were performed by a single surgeon, 19 of them in the General Hospital and 51 in a private polyclinic, fulfilling the outpatient surgery criteria established and adopted by the Venezian local health authorities, Presidio Ospedaliere di Mestre, Venice, Italy, where the author was trained to perform these surgical operations.

The indications for surgical operations were as follows: primary and recurrent direct, in-direct inguinal, femoral, umbilical as well as small incisional hernias, the size of which did not exceed 7cm. Excluding criteria were: psychiatric reasons and refusal of operation under local anaesthesia, medical reasons (ASA IV, sometimes ASA III score) and anatomical reasons (incarcerated and strangulated hernias).

Detailed study data were collected by way of a thorough analysis of the preoperative procedures and the type of anaesthetic, the size of the hernia aperture, the operating time, and the length of the hospital stay in relation to demographic information and complications.

Preoperative procedures involved an internist examination together with ECG and a blood count (all the patients were in the ASA I-II-III group). The prophylactic antibiotics, given 30 minutes preoperatively, included Cefazolin 2g i.v. and Cefuroxime 1.5g i.v. in 38 and 32 patients respectively. Additionally, 10-20 minutes preoperatively, the patients were given Atropine 0.3-0.5 ml i.m depending on the patient’s weight, as well as Midasolam 3mg i.m or Midasolam 7.5mg tablets, depending on the patient’s age and general health. As for the local infiltrative anaesthetics, 47 patients were given Bupivacaine 0.25% (20-40ml) and Lidocaine 1% (20ml), whereas 23 patients were given Levobuvicaine 0.25% (20ml) and Lidocaine 1% (20ml).

The anaesthetics were administered in the preoperating room or on the operating table 15 minutes preoperatively, following the procedures used in Presidio Ospedaliere di Mestre. The very important notice is that, the anaesthetist is not present in the day surgery theatre, but only in the main operating block.

SURGICAL TECHNIQUES

The surgical incision spot having been marked and the anaesthetics administered 15 minutes preoperatively, in inguinal hernias the inguinal canal is approached through a typical oblique incision approximately 5cm in length, in femoral hernias the incision ought to be level with the femoral aperture, in umbilical hernias a curved "smiley" incision is made under the navel, while in incisional hernias the surgical incision is made along the scar left after the previous surgical operation. According to the Rutkow-Robbins modification of the Gilbert hernia classification, different types of mesh both in construction and in size (PHS, UHS, 3DP) are used, depending on the size of the hernia aperture.2,7 (Table 1)

Following the incision into the skin and the external oblique aponeurosis, as well as the preparation of the medial and lateral aponeurotic flaps of the external lateral muscle to the inguinal ligament and pubic tubercle, together with a minimal section of the spermatic cord, the sac is dissected with no need to slit open previously. In case of lipomas being found, they are also dissected and together with the sac returned to the preperitoneal cavity. If the internal ring does not exceed 1cm in diameter, a 3DP mesh is used, while in case of the aperture exceeding 1cm, a PHS or UHS is used. PHS and UHS devices are available in three sizes - medium, large and extended. After a detailed digital exploration of the preperitoneal cavity, additional space has to be provided for the underlay component of the mesh to be positioned (the use of gauze or sponge is absolutely vital), the step being the key ele-

| TABLE 1 |
| USING DIFFERENT TYPES OF PROSTHETIC DEVICES ACCORDING TO RUTKOW-ROBBINS |
| MODIFICATION OF THE GILBERT HERNIA CLASSIFICATION |

<table>
<thead>
<tr>
<th>Hernia aperture</th>
<th>Hernia aperture</th>
<th>Hernia aperture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1 anulus prof</td>
<td>Type 5 focal hernia</td>
<td>Type 7 femoral hernia</td>
</tr>
<tr>
<td>&lt;1 cm (3DP)</td>
<td>(3DP)</td>
<td>(3DP)</td>
</tr>
<tr>
<td>Type 2 anulus prof</td>
<td>Type 6 double hernia</td>
<td>&gt;4 cm (UHS)</td>
</tr>
<tr>
<td>&lt;4 cm (UHS)</td>
<td>(UHS)</td>
<td></td>
</tr>
<tr>
<td>Type 3 anulus prof</td>
<td>Type 7 femoral hernia</td>
<td>&gt;2 cm (UHS)</td>
</tr>
<tr>
<td>&gt;4 cm (UHS)</td>
<td>(3DP)</td>
<td></td>
</tr>
<tr>
<td>Type 4 anulus prof</td>
<td>Type 8 double hernia</td>
<td>&lt;2 cm (UHS)</td>
</tr>
<tr>
<td>&gt;2 cm (UHS)</td>
<td>(UHS)</td>
<td></td>
</tr>
<tr>
<td>Type 5 anulus prof</td>
<td>Type 9 femoral hernia</td>
<td>&gt;2 cm (UHS)</td>
</tr>
<tr>
<td>&gt;4 cm (UHS)</td>
<td>(3DP)</td>
<td></td>
</tr>
</tbody>
</table>
ment to determine the success of the hernia repair. There are several methods for positioning the underlay component of a prosthetic device into the preperitoneal cavity. The surgeon ought to be familiar with all of them and decide which particular method is to be employed. Assiduous attention ought to be paid to the inferior epigastric vessels since it might be necessary to resection them and tie them off, particularly in case of "pantaloon" hernia. Following the placement of the underlay component, the moment of crucial importance for the success of the surgical operation is to spread it without its being creased or rolled. This having been done, the connector remains positioned in the interior orifice, while the onlay component is spread, thus providing protection of the anterior aspect of the inguinal canal. Thereafter, the lateral end of the onlay component is slit to provide a passage for the spermatic cord. The slit parts of the mesh are joined by a single prolene 2-0 stitch and fixed to the inguinal ligament while encircling the spermatic cord. In most cases it is necessary to add three stitches (vicryl 2-0, Ethicon) on the onlay component in order to spread the mesh properly as well as to prevent the recurrence. The fascia is fastened by an extended vicryl 2-0 stitch, while the skin is fastened by an intradermal vicryl rapid 3-0 stitch. When the internal aperture is less than 1cm in diameter (the Gilbert classification), the 3PD device is used and its under-lay component is positioned into the preperitoneal cavity through the internal aperture; thereafter, the string is pulled, thus providing an opportunity for the plug to be shaped and positioned properly in the preperitoneal cavity, thereby obturating the internal aperture. The upper component is subsequently spread under the fascia of the oblique muscle of the external abdominal wall and fastened in the same way as when a PHS or UHS device is used.

The patient will be asked to cough to help in ascertaining whether the plug has been properly positioned. The string, which has previously been pulled tight, is now cut. The fascia and the skin are fastened in the aforementioned way.

In direct inguinal hernias, following the aforesaid principles, the sac is sectioned to the defect on the transversal fascia and opened, succeeding the preparation of the preperitoneal cavity and additional infiltration of the local anaesthetic into the transversal fascia. In case of a focal hernia with the aperture not exceeding 1cm, a 3DP device is used and placed in the aforementioned way, whereas in case of a larger aperture, a PHS or UHS device is employed. Particular emphasis ought to be laid on the fact that in the course of positioning the underlay component, the mesh connector is fixed to the transversal fascia or the oblique muscle of the internal abdominal wall by means of a prolene 2-0 stitch, while the defect on the fascia is narrowed to the width of the connector if necessary. It is essential that the connector is fixed on account of possible mesh shifting as well as the patient’s subjective impression that the hernia is still present despite the surgical operation. The fascia and the skin are fastened in the aforementioned way.

In case of recurrent inguinal hernias, the procedure is similar. To be specific, after the sac section, the existing mesh is not removed. However, after a new mesh has been placed through the new defect (attention ought to be paid to the aperture size), it is necessary to fix the connector to the existing mesh by means of a single prolene 2-0 stitch.

As for femoral hernias, the majority of defects, i.e. the femoral apertures, do not exceed 1cm in diameter. Accordingly, such hernias are repaired efficiently by placing a 3DP patch in the way that is almost identical to the one used in indirect inguinal hernias.

Umbilical hernias are approached through a curved "smiley" incision made under the navel, following the infiltration of a local anaesthetic. By means of the sac section, preferably without opening or resectioning it, space is provided to place the mesh into the preperitoneal cavity, which is greatly facilitated by the sac not being resectioned. It ought to be taken into account that a 3DP device is used in defects not exceeding 2cm, whereas larger defects are repaired by PHS or UHS devices of different sizes, whereby it is frequently necessary to shape the on-

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### TABLE 2

<table>
<thead>
<tr>
<th></th>
<th>PHS</th>
<th>UHS</th>
<th>3DP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inguinal hernia</td>
<td>(39) size: 29 medium; 10 large</td>
<td>inguinal hernia (6) size: medium</td>
<td>inguinal indirect (5)</td>
</tr>
<tr>
<td>Umbilical hernia</td>
<td>(4) size: medium</td>
<td>incisional hernia (2) size: extended</td>
<td>umbilical direct (1)</td>
</tr>
<tr>
<td>Incisional hernia</td>
<td>(2) size: extended</td>
<td></td>
<td>femoral hernia (4)</td>
</tr>
<tr>
<td>Femoral hernia</td>
<td></td>
<td></td>
<td>femoral recurrence (3)</td>
</tr>
</tbody>
</table>

### TABLE 3

<table>
<thead>
<tr>
<th></th>
<th>3 year follow up 70</th>
<th>ING</th>
<th>FEM</th>
<th>UMB</th>
<th>INC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seroma</td>
<td>1 (0.7%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haemathoma</td>
<td>2 (1.4%)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
lay component with scissors, adjusting its size to the one that exceeds the defect by 2-3cm. After the hemostasis, the skin is fastened by an intradermal stitch. In such hernias it is vitally important to obliterate the space between the skin and subcutaneous tissue on the one hand and the fascia to which the mesh has been fixed on the other hand, since seromas might develop and persist despite repeated evacuations over a period of 7-10 days.

These hernia devices can equally be employed to repair small incisional hernias with defects not exceeding 7cm. It ought to be taken into account that PHS and UHS devices are available in three sizes, so for hernia apertures of 7cm in diameter an extended mesh is to be used, its onlay component area being 12.5 x 5.5cm and its underlay being 10cm in diameter. After the surgical incision has been made along the scar, by means of a meticulous section the sac is freed from the surrounding structures, which, together with the aperture section, provides space for the placement of the mesh, which is greatly facilitated by the sac not being resectioned. Following the positioning and the placement of the underlay component, the onlay mesh component is fixed along the border, 1cm from the edge, by means of 6-8 prolene 2-0 stitches, while an extended resorative stitch is used to fix the fascia. Due to a somewhat larger section than in the aforementioned instances, it is frequently necessary to employ aspiratory vacuum drainage.

RESULTS

Over a three-year period (from January 2006 to January 2009), 70 patients were operated on, 59 (84%) being male and 11 (16%) being female, with a mean age of 51.5 years (32-79 years). There were 54 patients (77%) with an inguinal hernia - 7 recurrent (38 indirect and 16 direct), 4 femoral (5.7%), 8 umbilical (11.6%) and 4 incisional hernias (5.7%) in which the aperture size did not exceed 7cm. As for the etiology of the incisional hernias, one was the consequence of a pararectal incision due to the appendectomy, two followed a Pfanensteil incision (hysterectomy and caesarean section), and one followed the gall-bladder surgical operation through a subcostal incision.

A mean diameter of the hernia aperture in the inguinal, femoral and umbilical hernias was 2.5cm, while in the incisional hernias it was 4.5cm (3-6cm). A mean operating time was 34 minutes (17-60 min): for umbilical hernias - 31 min (15-25 min); for femoral hernias - 22 min (15-25 min); for umbilical hernias - 31 min (28-35 min); and for incisional hernias - 53 min (42-60 min). A mean hospital stay was 2.4 hours (2-6 hr). A hospital stay longer than 2 hours is due to the demographic characteristics. This refers to the 10 patients (14%) whose residence is more than 100km from the clinic, and their stay at the clinic ranged from 3 to 6 hours.

The incidence of infection, chronic pain and recurrence was 0%. There were no requirements for urinary drains. Having been released from hospital, all the patients were given some of nonsteroidal anti-inflammatory medicines orally. In the course of the first three days postoperatively, 43 patients (61%) were taking nonsteroidal anti-rheumatic medicines, maximum three times a day. Following the incisional hernia repair, two patients had a drain placed which were removed before the hospital discharge.

Three of the patients (4.3%) had complications. There was a seroma in one patient, following an incisional hernia repair (after hysterectomy); a drain was not placed; the problem was solved by means of aspiration after two postoperative examinations. There were hematomas in two patients after inguinal hernioplasty. In one patient the hematoma was resorbed spontaneously. The other patient’s discomfort was manifested as a swelling and slight pain within the incision site, both becoming apparent on the fifth postoperative day. Previously, the patient had not felt any discomfort; since the patient was constantly very active, the only restriction concerned strenuous activities.

Following a telephone conversation with the surgeon, the patient was admitted to the clinic; the revision of the surgical incision was conducted under local anaesthesia, whereby no active bleeding was discovered. The hematoma was evacuated, superficial epigastric vessels were identified; they had been coagulated by means of diathermy during the first hernia repair; now they were ligated since their bleeding presumably caused the hematoma (since then, the author has regularly ligated the aforementioned vessels). The surgical incision was cleaned without the need to open the fascia of the exterior oblique muscle, and the patient was released from the clinic 4 hours afterwards. Over a 20-month follow-up, the patient has not had any discomfort. (Table 3)

DISCUSSION

The development and employment of a diversity of prosthetic materials and several types of mesh different in construction, as well as the insights gained since the introduction of laparoscopic techniques, have provided better opportunities for a further insight into the anatomy of the inguinal canal and the introduction of tension-free techniques that are becoming the top priority when it comes to the choice of the method for repairing abdominal wall hernias. Traditionally, a herniorrhaphy was one of the first surgical operations enabling registrars to enter the magical world of surgery. However, new insights indicate that surgery is a challenging field which requires a very serious approach.

Since the primary aim of this retrospective analysis is the employment of PHS, UHS and 3DP devices (Ethicon, inc, Johnson and Johnson Company, Somerville, NY) in the treatment of inguinal, femoral, umbilical and small incisional hernias, their types and construction ought to be considered.

Each aforementioned mesh system consists of three components - onlay and underlay components linked by a connector, except for the 3DP mesh, which contains plug and patch components. Such construction provides adequate protection of the whole bottom of the inguinal canal, i.e. MPO. It provides the protection of the anterior (onlay) and posterior (underlay) parts, as well as the protection of the internal inguinal orifice (connector ring). At the same time, it prevents the shifting of the device, which can often cause numerous complications.
PHS and 3DP mesh systems are entirely made of nonresorptive prolene, whereas UHS being fairly recent belongs to lightweight mesh made of resorptive monocryl (poliglecapron 25) and nonresorptive prolene (polypropylene). The advantages of the UHS are as follows: thinner threads, larger pores, the resorbent component offering physiological compatibility with the abdominal wall, which, over time (4 months), owing to the resorption, reduces the quantity of the material of extraneous origin. 10,11

Local anaesthesia enables quick mobilization, since the patients are able to rise to their feet as soon as the surgical operation is completed; the majority of the patients are released from hospital 2 hours postoperatively, thus minimizing possibilities for thromboembolic complications. All these factors contribute to the reductions in the costs of the medical treatment. 11,12

Since the surgical operations are conducted under local anaesthesia, we must establish certain rules which are supposed to provide the patient with maximum comfort: a surgical incision approximately 5cm long; minimal section of the spermatic cord; there ought not to be any section whatsoever (only sac preparation without the need to open it, and their returning to the preperitoneal cavity, together with lipomas); and minimal use of stitches. The fulfillment of the aforementioned criteria and a well trained surgeon who is capable of performing many surgical operations in a relatively short time on an outpatient basis make a significant contribution to the reduction of waiting lists.

However, since our major concern is people’s health, we ought to keep both feet on the ground and have a critical approach to surgical techniques on the one hand and new types of prosthetic materials and new solutions regarding their construction on the other hand. We cannot adopt new things on a priori grounds and accept them as ‘golden standards’, without an adequate clinical confirmation. Therefore we are faced with certain dilemmas which we expect to be resolved during the observation period following the surgical operations using this technique. The dilemmas are as follows: recurrent hernias and their repairs depending on the quantity of the prosthetic material; vascular operations in the inguinal area and possible problems regarding the approach to the blood vessels and possible problems with regard to the need for the extraction of the mesh in case of infection or chronic pain. Therefore, owing to their composition, lightweight mesh systems (UHS in this case) have priority over heavy mesh systems (PHS, 3DP), and they are the author’s choice.

CONCLUSION

The employment of these prosthetic devices, which, in the author’s view, have not yet been widely accepted in our hospitals, has had outstanding results in outpatient surgery, particularly when a UHS system is used. In addition, the type of anaesthesia and the specific mesh construction provide: a short hospital stay, swift recovery, minimal complications, a swift return to normal activity, being economical, a short learning curve and reduce the waiting lists.

SUMMARY

Primenom različitih tipova protetkih materijala i mreža različite konstrukcije otvara se novo poglavlje u hirurškoj kili, a beztenzije tehniike postaju “zlatni standard” za rešavanje defekata trbušnog zida, dok indikaciono područje za klasične–tenzije procedure obuhvata mlađe pacijente sa manjim ingvinalnim (direktnim i indirektnim), kao i femoralnim kila. Cilj ove retrospektivne analize je da prikaže rezultate primene PHS, UHS i 3DP (Prolene Hernia System, Ultrapro Hernia System i 3D Patch) sistema u tretmanu ingvinalnih, femoralnih, umbilikalnih i malih incizionalnih kila u uslovima dnevne hirurške. U periodu januar 2006.-januar 2009, godine operisano je 70 pacijenata (54 sa ingvinalnom, 4 sa femoralnom, 8 sa umbilikalanom i 4 sa incizionom kilom). Sve pacijente se operisao jedan hirurg, u uslovima dnevne hirurške primenom lokalne infiltrativne anestezije u Opštoj Bolnici (19) i Privatnoj Poliklinici (51). Pacijenti su u prošetku pruženi 18 meseci (0-36 meseci). Srednja veličina kilnog otvora kod preponskih, femoralnih i umbilikalnih kila iznosila je 2,5 cm (1-4 cm), a kod incizionalnih kila 4,5 cm (3-6 cm). prosečno vreme trajanja operacije je iznosilo 2,4 časa (2-6 h). Niko od pacijenata nije zahteva plasiranje urinarnog katetera. incidencija infekcije, hroničnog bola i recidiva iznosila je 0%. Komplikacije u vidu seroma i hematoma su se javile kod 3 pacijenta i to: serom kod jednog pacijenta posle operacije incizionale kile i pojava hematoma kod 2 pacijenta nakon ingvinalne hernioplastike. Zatujčak: Primena PHS, UHS i 3DP sistema, koji još uvek nisu u svakodnevnoj upotrebi u našim bolnicama, daje dobre rezultate u uslovima dnevne hirurške. Tip anestezije i 3D konstrukcija mrežica omogućavaju brz oporavak, kao i brz povratak normalnim aktivnostima.

Ključne reči: dnevna hirurška; kila; PHS, UHS, 3DP sistemi

BIBLIOGRAPHY


