Heavy-weight (prolene) mesh versus light-weight (ultrapro) mesh in laparoscopic transabdominal preperitoneal inguinal hernia repair

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Received 24 February 2016
Accepted 10 March 2016

The Egyptian Journal of Surgery
2016, 35:236–240

Context
Laparoscopic repair of inguinal hernia has gained its place in the general practice; however, meshes such as prolene were the same as those used for open repair. New types of light-weight meshes such as ultrapro may be associated with less complications and rates of recurrence.
Aim
The study aimed to compare the outcomes of transabdominal preperitoneal inguinal hernia repair using heavy-weight (prolene) mesh versus the light-weight (ultrapro) mesh.
Settings and design
This is a prospective randomized comparative study.
Materials and methods
Sixty patients were recruited for this study. Fifteen patients were operated by transabdominal preperitoneal inguinal hernia repair using the light-weight mesh and 45 patients were operated using the heavy-weight mesh. The patients were surveyed for postoperative complications, such as seroma, obstruction, pain, and recurrence.
Statistical analysis
Continuous variables were expressed as mean and SD. Categorical variables were expressed as frequencies and percentage.
Results
There was no statistically significant difference between the two groups regarding the postoperative complications or recurrence rates. The light-weight meshes were superior regarding the first 24 h pain and pain after 1 week, 1, 6, and 12 months with early return to physical activity in comparison with the heavy-weight meshes.
Conclusion
Light-weight meshes are superior to the heavy-weight meshes in respect to the occurrence of pain and early return to work, yet with comparable results regarding the postoperative complications and recurrence rates.

Keywords:
heavy-weight mesh, laparoscopic hernia repair, light-weight mesh, postoperative pain

Egyptian J Surgery 35:236–240

2090-0686

Introduction

The inguinal hernia repair has undergone several changes during the past few years. Techniques such as tension-free repair and laparoscopic approaches have improved studies concerning inguinal hernia repair [1].

The prevalence of chronic pain after inguinal hernia repair was noted in up to two-thirds of patients [2]. With experienced surgeons, laparoscopic hernia repair techniques are associated with significant less postoperative pain and an earlier return to normal activities compared with open hernia repair [3–5].

In addition, chronic pain is thought to occur due to excessive inflammatory response to the synthetic mesh with reduction in tissue compliance and entrapment of neural structures [6]. Heavy-weight meshes contain high concentrations of foreign material and cause excessive inflammatory response [7]. Light-weight meshes have larger pores and they encourage collagen production with integration of the mesh into the abdominal wall with adequate inflammatory response [8].

The aim of this study is to conduct a comparative prospective clinical study comparing the results of postoperative pain after the laparoscopic transabdominal preperitoneal hernia repair (TAPP) and the persistence of pain after 1 week, 1, 6, and 12 months and the period required to return to normal

activity with the use of heavy-weight (prolene) versus light-weight (ultrapro) meshes.

Patients and methods

The study included 60 male patients of age more than 18 years suffering from a primary unilateral inguinal hernia, who did not have any contraindication for general anesthesia or any other morbidity that contraindicate laparoscopic surgeries and were scheduled for laparoscopic TAPP. The patients were randomly allocated in one of the two groups by computerized block randomization.

All participating patients agreed in an informed written consent according to the ethical committee of the Faculty of Medicine, Ain Shams University.

The study was performed from November 2012 till October 2015 with a minimal of 12 months follow-up for each patient. The patients were allocated into two groups according to the type of mesh used in the repair with standardization of the surgical technique and the team that carried out the procedure. Among these 60 patients, 45 patients (group A) were operated upon using a heavy-weight PROLENE mesh (Ethicon; Johnson and Johnson Co., Somerville, New Jersey, USA) and 15 patients (group B) were operated upon using a light-weight ULTRAPRO mesh (Ethicon; Johnson and Johnson Co.). Group B was less in number due to high cost of mesh ($589.54) relative to group A (mesh costed $180.83).

Materials (types of meshes used)

PROLENE mesh (Ethicon)

Prolene is a heavy-weight nonabsorbable mesh. It is made of polypropylene monofilaments with small pores. Its weight is 80–85 g/m^2 with dimensions 10 × 15 cm [9].

ULTRAPRO mesh (Ethicon)

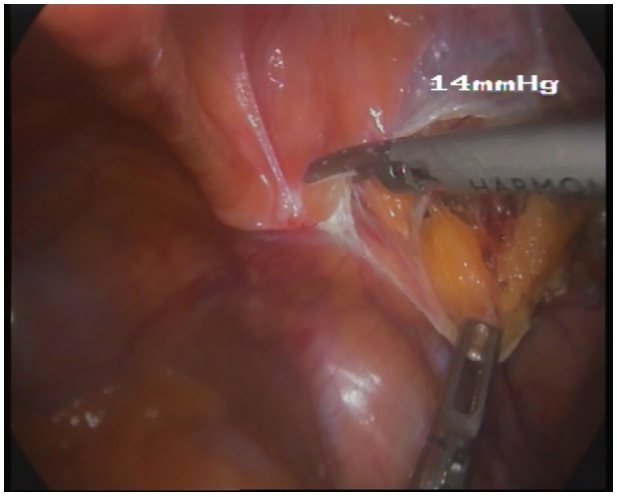
Ultrapro is a light-weight partially absorbable mesh. It is made of polypropylene and polyglecaprone monofilaments with large pores (3–4 mm). The polyglecaprone monofilaments are absorbed within 90–120 days due to hydrolysis. Its weight is 28 g/m^2 (part of the polypropylene that is not absorbed) with dimensions 10 × 15 cm [9].

The patients were recruited from the outpatient clinic. Full detailed history was obtained from the patients and full physical examination was carried out including scrotal ultrasound with duplex to rule out associated hydroceles, document testicular size, and blood supply preoperatively, and abdominal ultrasound to eliminate any possible causes of recurrence.

Surgical technique

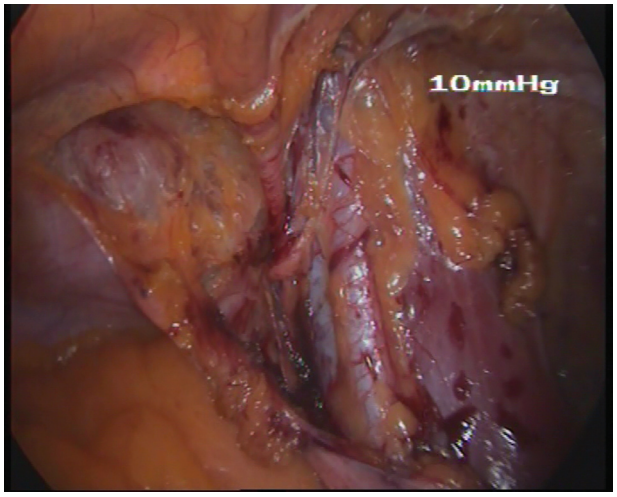
All patients were subjected to general anesthesia. Pneumoperitoneum was established by CO_2 at 14 mmHg. A 10 mm trocar was placed at the umbilicus for the camera followed by one 10 mm trocar and one 5 mm trocar, which were inserted laterally on the right and left side, respectively. The hernia was identified and the peritoneum was incised from above the anterior superior iliac spine till the lateral leaflet of the medial umbilical ligament using a harmonic scalpel (Ethicon; Johnson and Johnson Co.). The peritoneum flaps were then dissected upwards and downwards from the spermatic cord structures (Figs. 1 and 2).

Figure 1



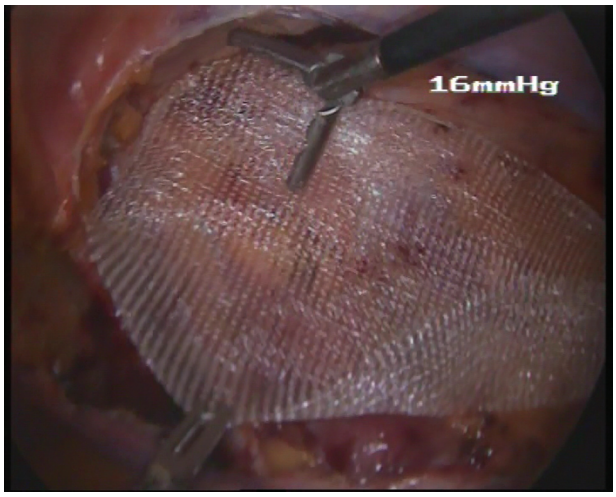
Incision of peritoneum by harmonic scalpel.

Figure 2



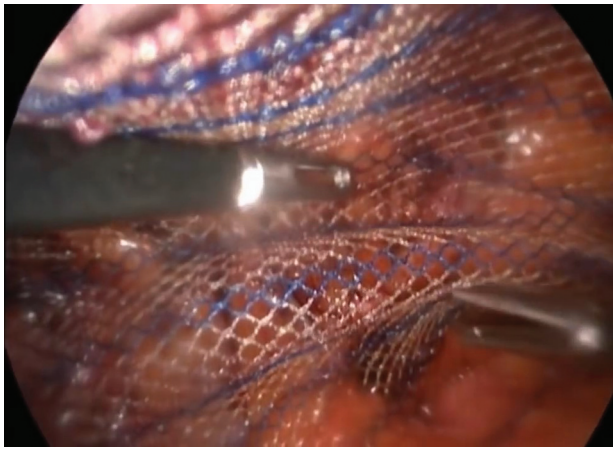
Elevation of peritoneal flaps.

Figure 3



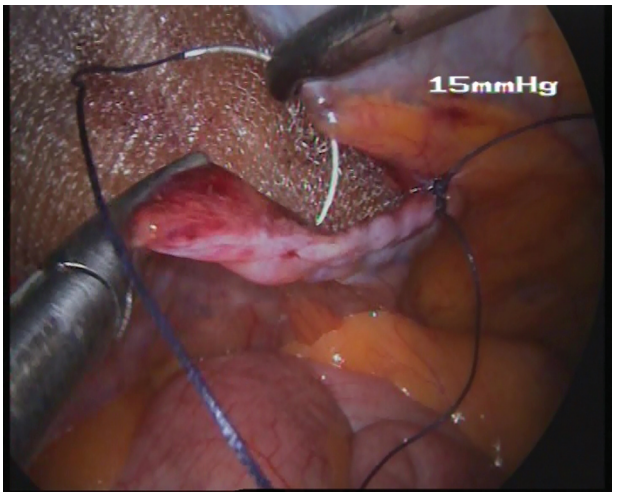
Insertion of prolene mesh.

Figure 4



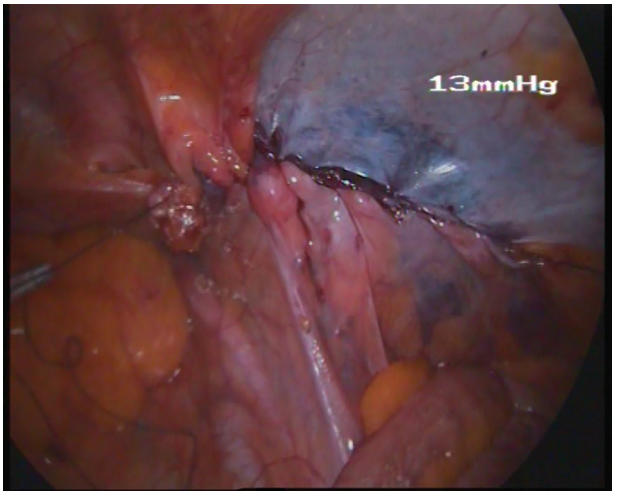
Insertion of ultrapro mesh.

Figure 5



Closure of peritoneum by vicryl.

Figure 6



Peritoneum after closure.

The sac was reduced. Then, the mesh was inserted taking into consideration to cover the region of the internal ring, the inferior epigastric vessels, and the medial compartment to guard against recurrences (MEP_L_fig3Figs. 3 and 4).

All meshes were of the same size 10 × 15 cm. The mesh was then fixed into the position by spiral tacks (Protack, Covidien; Medtronic, Dublin, Republic of Ireland) into Cooper's ligament, medial and lateral to the epigastric vessels with avoidance of tacks in the triangle of doom and triangle of pain. The peritoneum was closed by continuous absorbable sutures (vicryl 3/0) (fig5Figs. 5 and 6).

The patients were followed-up in the postoperative period for any complications, such as seroma formation, mesh infection, occurrence of obstruction, and the postoperative pain. The pain was scored according to Numeric Rating Scale (NRS), where 0 = no pain and 10 = extremely painful. The pain is scored in the first 24 h, after 1 week, 1, 6, and 12 months. The duration of hospital stay and the period to start returning to the physical activity (first day to return to nonweight bearing normal daily activity) were recorded.

Results

All statistical analyses were performed using the SPSS 17 software package (SPSS Inc., Chicago, Illinois, USA).

Patients' demographics

All the patients were men with a mean age (mean ± SD) of 39.8 ± 8.825 years in the light-weight mesh group (group A) ranging from 27 to 55 years. In the heavy-

weight mesh group (group B), patients had a mean age of 38.667 ± 9.777 years, ranging from 22 to 55 years. The *P*-value was 0.692, which was statistically nonsignificant.

In group A (15 patients), three patients (20%) had direct hernias, whereas 12 patients (80%) had indirect hernias. In group B (45 patients), nine patients (20%) had direct hernias, whereas 36 patients (80%) had indirect hernias.

Operative time

In group A, the mean operative time was 72.267 ± 8.916 min, ranging from 59 to 87 min. In group B, the mean operative time was 75.222 ± 5.756 min, ranging from 62 to 89 min. The *P*-value was 0.245, which was statistically nonsignificant.

Postoperative complications

In group A, one patient (6.7%) developed seroma, which was managed conservatively and no patients developed infection or obstruction.

In group B, two patients (4.4%) developed seroma, which was managed conservatively and no patients developed infection or obstruction.

Hospital stay

The mean hospital stay for group A was 1.4 ± 0.632 days (ranging from 1 to 3 days), whereas in group B was 1.844 ± 1.882 days. The *P*-value was 0.375, which was statistically nonsignificant.

Postoperative pain, chronic pain, and starting return to work

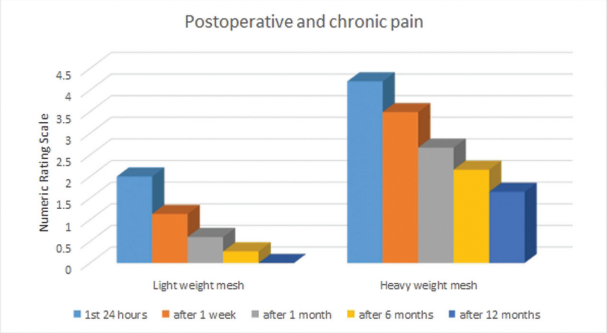
The patients were recorded with respect to the postoperative and chronic pain using NRS, where 0 = no pain and 10 = extreme pain.

In group A, the first 24 h pain had a mean of 2 ± 0.926 and ranges from 1 to 3 on the NRS, whereas in group B, the immediate postoperative pain had a mean of 4.2 ± 0.944 and ranges from 3 to 6 on the NRS.

With respect to the follow-up, the pain in group A after 1 week was 1.133 ± 0.990 (ranging from 0 to 3), after 1 month was 0.6 ± 0.910 (ranging from 0 to 3), after 6 months was 0.267 ± 0.594 (ranging from 0 to 2), and after 12 months, none of the patients suffered from any pain.

The pain in group B after 1 week was 3.489 ± 1.079 (ranging from 2 to 6), after 1 month was 2.667 ± 1.187 (ranging from 2 to 5), after 6 months was 2.156 ± 1.205 (ranging from 2 to 5), and after 12 months was 1.644 ± 1.151 (ranging from 0 to 3). The postoperative pain and chronic pain are shown in MEP_L_fig7Fig. 7.

Figure 7



Comparison between light and heavy-weight mesh regarding the incidence of pain.

The patients in group A started to return to work after 5.033 ± 1.189 days, whereas in group B was 7.867 ± 2.662 days.

The rate of recurrence within 1 year

The rate of recurrence in group A was 6.7% (one patient, which did not comply properly with nonheavy weight bearing in the first 3 months postoperatively, which may have predisposed to recurrence), whereas in group B was 4.4% (two cases, one of them was a smoker, who suffered from recurrent chest infections for 6 weeks from second to fourth month that may have added to the risk of recurrence). The *P*-value was one which was statistically nonsignificant.

Discussion

The conventional inguinal approach has been largely converted to the laparoscopic approach recently, yet the right material for the right procedure has been a matter of controversy. This has commercially revolutionize the concept of replacing the formerly and still frequently used heavy-weight meshes to the light-weight meshes for the laparoscopic approach [10].

Light-weight meshes were first introduced in 1998. They have large pores (normally 3–5 mm) and a small surface area. They stimulate less inflammatory reaction than the heavy-weight meshes and, therefore, have greater elasticity and flexibility [11].

In this study, two groups were operated upon by TAPP and were compared regarding the type of mesh used. There were no significant statistical differences between the two groups regarding the age, type of hernia, or operative time. With respect to the postoperative complications, both groups recorded

the incidence of seroma. Similar results were also observed by Bangash *et al.* [10] and Langenbach *et al.*[12].

Regarding the incidence of pain, there was significant reduction in the first 24 h and the pain after 1 week, 1, 6, and 12 months in the patients with the light-weight mesh than the patients with the heavy-weight mesh. Similar results were obtained by Bangash *et al.* [10], who conducted the study using TAPP and Chowbey *et al.*[13], who conducted the same study using the totally extraperitoneal approach. This can be attributed to the fact that the light-weight mesh is more easily integrated into the abdominal wall than the heavy-weight mesh and promote less inflammatory reaction. Besides, the absorbable part of the mesh starts to be absorbed after 3 weeks and become completely absorbed after 3 months. This also allows the patients of the first group to have early return to work than the other group which agreed with the study carried out by Bangash *et al.*[10].

There is no statistically significant difference between the two groups regarding the recurrence rate within 1 year. This is consistent with the studies performed by Weyhe *et al.*[14], Horstmann *et al.*[15], and Arvidsson *et al.*[16].

Conclusion

The laparoscopic approach for inguinal hernia repair is widely adopted now. The use of light-weight meshes is associated with less incidence of postoperative and chronic pain in comparison with the heavy-weight meshes and allows for early return to work with no increased incidence of recurrence.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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