Introduction
Hernia is defined as a protrusion of a viscus or part of a viscus through an abnormal opening in the walls of its containing cavity [1].

Inguinal hernias are the commonest type of all hernias. The definitive treatment for inguinal hernia is surgery. The morbidity and mortality rates will increase if hernias are not operated [2].

The success of hernia repair technique depends on its ability to prevent the recurrence of the hernia. Overlooked hernias, inadequate hernioplasty, repair under tension, and deficient tissues, all are factors that can result in the recurrence of hernia [3].

The recurrence rate has decreased by the introduction of tension-free mesh repair, but complications of the polypropylene mesh were noted after that [4].

Chronic pain is the most common and long-term complication following inguinal hernia mesh repair, significantly affecting the lifestyle of patients, with an incidence ranging from 1 to 19% [5].

Complications also include the formation of adhesions, erosions into intraperitoneal organs and migration of mesh. Such complications usually lead to abscess formation, fistulas, and intestinal obstruction [6].

In the early 20th century, the darn repair was introduced to reduce tissue tension by using either autologous tissue or synthetic suture to strengthen the gap between fascial tissues. In 1918, Handley introduced the first use of silk as a prosthetic darn, but nylon followed several years later [7].

The aim of this study was to evaluate the early outcome of mesh hernioplasty versus darn repair for the treatment of primary uncomplicated inguinal hernia.

Objective
To evaluate the early outcome of mesh hernioplasty versus darn repair for the treatment of primary uncomplicated inguinal hernia.

Background
The definitive treatment of inguinal hernia is surgery. The gold standard for open inguinal hernia repair is Lichtenstein tension-free mesh repair, but after a long period of using this technique, complications were noted such as chronic postoperative pain, cost-effectiveness, and infection. So, the present study evaluated the darn repair compared with Lichtenstein repair for inguinal hernia treatment.

Patients and methods
Between October 2018 and December 2019, this prospective case-controlled study was done on 60 patients presenting with uncomplicated inguinal hernia. The 60 patients were randomly divided into two groups. Group A consisted of 30 patients who underwent darning repair, and group B conducted of 30 patients who underwent Lichtenstein repair.

Results
The operative time in group A (64.5 ± 6.4 min) was significantly longer than in group B (47.9 ± 6.05 min) (P < 0.001). Recurrence occurred in two cases in group A compared with one case only in group B. Chronic pain was evaluated by visual analog scale. It was highly significant in group B compared with group A (P < 0.001). There were insignificant differences between the two groups regarding the other postoperative complications.

Conclusion
The darning technique could be an effective and safe procedure for the treatment of primary inguinal hernia.

Keywords:
chronic pain, darn repair, inguinal hernia, Lichtenstein repair, recurrence

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Patients and methods

After approval of the Ethical Committee of Faculty of Medicine Menoufia University, the study was conducted between October 2018 and December 2019. Informed consent was obtained from all patients included in the study. This study was a prospective study that included 60 patients, with a well-established diagnosis of primary uncomplicated inguinal hernia (direct and/or indirect). All patients were divided randomly into two groups: group A and group B. Group A consisted of 30 patients treated with the darn repair, and group B consisted of 30 patients treated with mesh repair.

Inclusion criteria
The following were the inclusion criteria:
(1) Age: older than 18 years
(2) Sex: both sexes
(3) Patients with primary uncomplicated inguinal hernia.

Exclusion criteria
The following were the exclusion criteria:
(1) Recurrent inguinal hernia
(2) Complicated inguinal hernia
(3) Hepatic uncompensated patients.

Preoperative assessment of patients
History taking and clinical examination of all patients were done in this study to exclude cardiovascular diseases, respiratory diseases, and organomegaly. Modifiable risk factors that increase the incidence rate of recurrence of hernia such as smoking, constipation, and cough were managed before hernial repair operations.

Laboratory investigations were done, and abdominopelvic ultrasonography was done to confirm the diagnosis of hernia and exclude risk factors such as ascites.

The type of anesthesia was decided according to the anesthesiologists. At the induction of anesthesia, 1 g of ceftriaxone (intravenous injection) was given to all patients.

Operative procedures
To repair a direct inguinal hernia, tension-free plication of the fascia transversalis was done first using 2–0 monofilament polypropylene (Egyprolene; Taisier-Med Company, Cairo, Egypt) with a rounded needle. To repair an indirect hernia, the sac was excised and then the deep inguinal ring was narrowed by two medial sutures using 2–0 monofilament polypropylene (Egyprolene; Taisier-Med Company) with a rounded needle.

In darn repair (group A)
The repair was started by taking the first stitch on the pubic tubercle using No. 1 monofilament polypropylene (Egyprolene; Taisier-Med Company) with a rounded needle. The thread was passed through the inguinal ligament and the conjoined tendon in a continuous tension-free technique (Fig. 1). With a 1-cm interval between each suture, the repair was proceeded from medial to lateral in a crisscross pattern until reaching the deep inguinal ring. Care was taken to pass the sutures around the cord without any pressure on cord contents, and then the sutures are ended 2–3 cm lateral to the deep ring. The same suture then took the reverse direction as the second layer of darn and was tied medially at the pubic tubercle.

Lichtenstein repair (group B)
The procedure was done by using a 6 × 11 cm polypropylene mesh) prolene mesh; Ethicon Company, Cincinnati, USA) placed in the posterior wall of the inguinal canal extended around the spermatic cord at the deep ring. The mesh was first sutured to the pubic tubercle using 2–0 monofilament polypropylene (Egyprolene; Taisier-Med Company) with a rounded needle. A running suture of the same thread was used to fix the lower edge of the mesh to the inguinal ligament. An opening was made in the mesh at the deep inguinal ring to accommodate the spermatic cord without any pressure on it and then additional interrupted sutures to the cut edges of the mesh together again around the cord at the deep ring. Then interrupted sutures were done to fix the upper border of the mesh to the conjoined tendon.

Figure 1
Darn repair of right inguinal hernia.
Follow-up schedule
All patients were informed about dates of their visits at the outpatient clinic (2 weeks, 1 month, 3 months, 6 months, and after 1 year). All were examined for assessment of complications such as seroma, hematoma, early infection, genital edema, chronic pain according to visual analog scale (VAS), and recurrence.

Statistical analysis
Data were collected and entered into the computer using SPSS (Statistical Package for Social Science) program, version 16.0 (SPSS Inc., Chicago, Illinois, USA), for statistical analysis. Data were entered as numerical or categorical, as appropriate. Two types of analysis were done:

(1) Descriptive statistics: in which quantitative data were represented in the form of the mean, SD, and range, and qualitative data were represented in the form numbers and percentages

(2) Analytic statistics:
(a) \( \chi^2 \) test was used to study the association between two qualitative variables. Whenever any of the expected cells were less than five, Fisher’s exact test was used
(b) Student \( t \) test was used for comparison of quantitative variables between two groups of normally distributed data
(c) Mann–Whitney test \( (U) \) was used for comparison of quantitative variables between two groups of not normally distributed data
(d) \( P \) value of less than 0.05 was considered statistically significant. \( P \) value of less than 0.001 was considered highly statistically significant.

Results
The age of the patients in group A ranged from 23 to 65 years, whereas in group B ranged from 24 to 64 years. There was no significant difference regarding the mean age and sex of patients in both groups (Table 1).

No significant differences were noted between the two groups regarding smoking, diabetes mellitus, chronic constipation, chronic obstructive pulmonary disease, and benign prostatic hypertrophy (Table 2).

There was no significant difference regarding the type of anesthesia in both groups. Operative time in group A was more than in group B. In group A, operative time was 55–75 min, with mean of 64.5 min, but in group B, operative time was 35–55 min, with a mean of 47.9 years. The difference was highly significant \((P > 0.001)\) (Table 3).

Postoperative complications (hematoma, seroma, genital edema, surgical site infection, urine retention, and recurrence) showed insignificant differences between both groups. In group A, hematoma was seen in 6.7%, seroma in 3.3%, genital edema in 6.7%, superficial surgical site infection in 3.3%, urine retention in 3.3%, and recurrence occurred in two (6.7%) patients, whereas in group B, hematoma was seen in 3.3%, seroma in 10%, genital edema in 13.3%, superficial surgical site infection in 6.7%, urine retention in 3.3%, and recurrence occurred in one (3.3%) patient (Table 4).

Regarding VAS [8], chronic pain was evaluated at the first day, 2 weeks, 1 month, 3 months, 6 months, and 1 year in both groups (Table 5). It was noted that chronic pain was more in group B than in group A on first day, after 2 weeks, first month, after 3 months, after 6 months. This difference was highly significant \((P > 0.001)\). However, after 1 year, the difference was insignificant.

Discussion
An inguinal hernia is the most common problem in all external hernias, and surgeries for inguinal hernia are commonly performed, accounting for approximately one-third of all interventions [9].

The perfect procedure for the repair of inguinal hernia should effectively deal with all range of pathologies encountered in all types of inguinal hernias whether direct or indirect and a small or big hernial defect [10]. The present study compared the darn repair with mesh repair.

### Table 1 Sociodemographic characteristics of the studied groups

<table>
<thead>
<tr>
<th>Sociodemographic data</th>
<th>Group A (darn) (n=30) [n (%)]</th>
<th>Group B (mesh) (n=30) [n (%)]</th>
<th>Total (n=60) [n (%)]</th>
<th>Test of significance</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>43.17±12.75 (23-65)</td>
<td>43.5±13.02 (24-64)</td>
<td>43.33±12.78 (23-65)</td>
<td>( t=0.1 )</td>
<td>0.921</td>
</tr>
<tr>
<td>Sex</td>
<td>Male 28 (93.3)</td>
<td>27 (90)</td>
<td>55 (91.7)</td>
<td>FE=0.218</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Female 2 (6.7)</td>
<td>3 (10)</td>
<td>5 (8.3)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\( t \), Student \( t \) test. FE, Fisher’s exact test.
The present study showed operative time in group A more than in group B. In group A, time ranged from 55 to 75 min, with a mean of 64.5 ± 6.4, but in group B, time ranged from 35 to 55 min, with a mean of 47.9 ± 6.05. This difference was highly significant. Similarly, the study by Abd El Maksoud et al. [11] showed the time taken by darn repair was more than time taken by Lichtenstein tension-free mesh. In darn repair, time ranged from 45 to 120 min, but in Lichtenstein tension-free mesh, time ranged from 60 to 90 min. This difference was significant.

In the present study, in group A, hematoma occurred in two (6.7%) patients and seroma occurred in
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Table 5 Postoperative chronic pain

<table>
<thead>
<tr>
<th>Postoperative chronic pain (VAS)</th>
<th>Group A (darn) (n=30)</th>
<th>Group B (mesh) (n=30)</th>
<th>Total (n=60)</th>
<th>Test of significance (U)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAS 1 day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Means±SD</td>
<td>2.5±0.97</td>
<td>5.5±0.97</td>
<td>4±1.79</td>
<td>6.547</td>
<td>&gt;0.001*</td>
</tr>
<tr>
<td>Range</td>
<td>1-4</td>
<td>4-7</td>
<td>1-7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VAS 2 weeks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Means±SD</td>
<td>2.4±0.86</td>
<td>5.4±0.86</td>
<td>3.9±1.73</td>
<td>6.685</td>
<td>&gt;0.001*</td>
</tr>
<tr>
<td>Range</td>
<td>1-4</td>
<td>4-7</td>
<td>1-7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VAS 1 month</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Means±SD</td>
<td>2.07±0.91</td>
<td>5.1±0.89</td>
<td>3.6±1.79</td>
<td>6.774</td>
<td>&gt;0.001*</td>
</tr>
<tr>
<td>Range</td>
<td>1-3</td>
<td>4-6</td>
<td>1-6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VAS 3 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Means±SD</td>
<td>1.47±0.51</td>
<td>4.47±0.51</td>
<td>2.97±1.59</td>
<td>6.873</td>
<td>&gt;0.001*</td>
</tr>
<tr>
<td>Range</td>
<td>1-2</td>
<td>4-5</td>
<td>1-5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VAS 6 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Means±SD</td>
<td>0.77±0.43</td>
<td>3.43±0.5</td>
<td>2.1±1.42</td>
<td>6.976</td>
<td>&gt;0.001*</td>
</tr>
<tr>
<td>Range</td>
<td>0-1</td>
<td>3-4</td>
<td>0-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VAS 1 year</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Means±SD</td>
<td>0.47±0.81</td>
<td>1.05±1.4</td>
<td>0.76±1.9</td>
<td>U=0.92</td>
<td>0.054</td>
</tr>
<tr>
<td>Range</td>
<td>0-1</td>
<td>1-2</td>
<td>0-2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

VAS, visual analog scale. *P<0.001: highly significant.

one (3.3%) patient, whereas in group B, hematoma occurred in one (3.3%) patient and seroma occurred in three (10%) patients. Hematoma and seroma were treated conservatively in both groups. No significant differences were detected between both groups. Similarly, the study by Kaynak et al. [12] was done on 651 patients, where 354 patients were treated with mesh repair and 297 with the darn repair. They showed that in the darn repair group, hematoma occurred in eight (2.69%) patients and seroma occurred in six (2.02%) patients, whereas in mesh group, hematoma occurred in seven (1.97%) patients and seroma occurred in eight (2.26%) patients. No significant difference was detected between both groups.

In the present study, genital edema occurred in two (6.7%) patients in group A, whereas it occurred in four (13.3%) patients in group B, with an insignificant difference between both groups. Genital edema was mild in both groups and was treated conservatively. Similarly, the study by Olasehinde et al. [13] was done on 67 patients, where 33 patients were treated with mesh repair and 34 patients with darn repair. It was noted that in the darn repair group, genital edema occurred in five (14.7%) patients, whereas in mesh group, genital edema occurred in six (18.2%) patients, with insignificant difference between both groups.

In the present study, superficial surgical site infection occurred in one (3.3%) patient group A. The patient was diabetic and neglected to control his medical condition postoperatively. However, in group B, superficial surgical site infection occurred in two (6.7%) patients, where one of both patients was diabetic and the other was not diabetic. All cases were treated by drainage of pus and then antibiotic was taken according to culture and sensitivity. The difference was insignificant between both groups. Similarly, the study by Memon and Shah [14] was done on 92 patients, where 46 patients were treated with mesh repair and 46 with the darn repair. It was noted that in the darn repair group, surgical site infection occurred in two (4.3%) patients, whereas in mesh group, surgical site infection occurred in three (6.5%) patients. The study by Mahesh et al. [7] was done on 50 patients, where 25 patients were treated with mesh repair and 25 patients with darn repair. It was noted that in darn repair group, surgical site infection occurred in three (15%) patients, whereas in mesh group, surgical site infection occurred in four (20%) patients.

In the present study, urine retention occurred in one (3.3%) patient in each group. Two patients were treated by urinary catheterization to empty the urinary bladder for 1 day. Similarly, the study by Olasehinde et al. [13], study was done on 67 patients, where 33 patients were treated with mesh repair and 34 patients with darn repair. It was noted that urine retention occurred in one (3%) patient in each group. The study by Abd El Maksoud et al. [11] was done on 227 patients, where 119 patients were treated with mesh repair and 108 with the darn repair. It was noted that urine retention occurred in six (5.6%) patients in the darn repair group, whereas it occurred in five (4.5%) patients in the mesh group. The difference was insignificant between both groups.

In the present study, the recurrence of hernia occurred in two (6.7%) patients in group A. One of them was a heavy smoker, and the other was chronic obstructive...
pulmonary disease. Both patients neglected to control these problems. However, recurrence of hernia occurred in one (3.3%) patient in group B. The recurrence of hernia in the three cases occurred after 6 months. The difference was insignificant. Similarly, the study by Memon and Shah [14] was done on 92 patients, where 46 patients were treated with mesh repair and 46 with the darn repair. It was noted that in the darn repair group, recurrence occurred in three (6.5%) patients, whereas in mesh group, the recurrence of hernia occurred in one (2%) patient. The difference was insignificant between both groups. The study by Affin [15] was done on 61 patients, where 31 patients were treated with mesh repair and 30 with the darn repair. It was noted that recurrence occurred in one (3.3%) patient in each group.

The incidence of debilitating chronic pain after hernioplasty affecting normal daily activities or work has been estimated to be from 0.5 to 6% [16].

The present study evaluated chronic pain according to VAS on the first day, 2 weeks, 1 month, 3 months, and 6 months in both groups. It was noted that chronic pain was significantly higher in group B compared with group A. This difference was highly significant. However, after 1 year, the difference was insignificant. Similarly, the study by Abd El Maksoud et al. [11] evaluated chronic pain according to VAS at first 6 h, first day, 3 months, 6 months, and 1 year postoperatively. It was noted that chronic pain was significantly higher in the mesh group compared with the darn group. The study by Affin [15] was done on 61 patients, where 31 patients were treated with mesh repair and 30 with the darn repair. It was noted that mild pain occurred in 18 (60%) patients in the darn group, whereas it occurred in one (3.2%) patient in mesh group. Moderate pain occurred in 11 (36.7%) patients in the darn group, whereas it occurred in 24 (77.4%) patients in mesh group. Severe pain occurred in one (3.3%) patient in the darn group, whereas it occurred in six (19.4%) patients in the mesh group. The difference was significant between both groups.

**Conclusion**

This study showed that the darning technique is an effective and safe procedure for the treatment of primary inguinal hernia. Darn repair is a good alternative procedure to the gold standard (Lichtenstein repair) for the treatment of primary inguinal hernia, especially in developing countries where the mesh is not suitable.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.