

# New minimally invasive technique for repairing femoral hernias: 3-D patch device through a femoris approach

Wenzhang Lei, MD\*  
Jianpeng Huang, MD†  
Ciren Luoshang, MD‡

From the \*Therapeutic and Training Centre of Hernia, West China Hospital, the †Gastrointestinal Surgery Department, Yunyang Medicine College, People's Hospital of Shiyang City and ‡General Surgery Department, People's Hospital of Xizang Province, China

Accepted for publication  
Dec. 20, 2010

## Correspondence to:

W. Lei  
Therapeutic and Training Centre of Hernia  
West China Hospital  
Chengdu, Sichuan Province  
China  
610041  
aiabao999@163.com

DOI: 10.1503/cjs.030710

**Background:** Femoral hernias are less common than inguinal hernias. The use of preformed mesh to repair femoral hernias without tension has become increasingly common. We sought to investigate the safety and feasibility of repairing femoral hernias with a Prolene 3-dimensional (3-D) patch using a femoris approach.

**Methods:** We identified all consecutive patients with femoral hernias treated at our centre with a Prolene 3-D patch using a femoris approach in our institution over a 5-year period (2004–2009). We assessed duration of surgery, length of stay in hospital, recurrence, postoperative pain and complications.

**Results:** We repaired 73 hernias with this technique during the study period. The mean duration of surgery was 13.1 minutes, most patients were discharged in less than 24 hours, no recurrence was noted, and only minor complications occurred.

**Conclusion:** This technique has not only the same advantage of other tension-free repairs, but also the advantages of convenience and shorter duration of surgery.

**Contexte :** Les hernies fémorales sont moins courantes que les hernies inguinales. On utilise de plus en plus des filets préformés pour réparer les hernies fémorales sans tension. Nous avons voulu vérifier l'innocuité et la faisabilité des réparations d'hernies fémorales à l'aide d'une prothèse tridimensionnelle (3D) de type Prolene par approche fémorale.

**Méthodes :** Nous avons recensé tous les patients consécutifs atteints d'hernies fémorales traités au moyen d'une prothèse 3D de type Prolene par approche fémorale dans notre établissement sur une période de 5 ans (2004–2009). Nous avons évalué la durée de la chirurgie, la durée du séjour hospitalier, les récurrences, la douleur postopératoire et les complications.

**Résultats :** Nous avons réparé 73 hernies au moyen de cette technique au cours de la période de l'étude. La durée moyenne de la chirurgie a été de 13,1 minutes, la plupart des patients ont reçu leur congé en l'espace de moins de 24 heures, aucune récurrence n'a été notée et seules des complications mineures sont survenues.

**Conclusion :** Non seulement cette technique procure les mêmes bienfaits que les autres techniques de réparation sans tension, mais elle comporte en outre les avantages et la commodité d'une durée d'intervention plus brève.

Femoral hernias are less common than inguinal hernias. The incidence of femoral hernias has been reported to be 2%–8% in adults.<sup>1,2</sup> The use of preformed mesh to repair inguinal hernias without tension has become increasingly common since it was described by Lichtenstein and colleagues.<sup>3</sup> Advantages of a tension-free technique include the ability to provide ambulatory care with local/regional anesthesia for several types of hernias, minimal postoperative pain, low complication and recurrence rates, and minimal restriction of activity after surgery.<sup>3–6</sup> Therefore, tension-free repair for femoral hernias has become generally accepted in hernia surgery. The prostheses mainly include mesh, mesh plugs and the Prolene Hernia System (PHS).<sup>7–11</sup> In 2004, we adopted a new tension-free herniorrhaphy technique using a Prolene

3-dimensional (3-D) patch device through a femoris approach to prevent femoral hernia recurrence, and our preliminary results have been encouraging. We describe our 5-year experience and follow-up using this technique.

**METHODS**

We identified all consecutive patients who underwent herniorrhaphy under local anesthesia with the 3-D patch at our centre from March 2004 to June 2009. Because of the possibility of strangulation, an incarcerated, painful or tender hernia usually requires an emergency operation, but in this series, all patients underwent elective operations performed by the same surgical team.

The Prolene 3-D patch comprises 3 parts: the inferior 3-D device (diamond-shaped device), upper oval patch and retention suture. When the retention suture is pulled tightly, the inferior 3-D device will extend to form a round patch with a maximum diameter of 5 cm, which will protect the femoral area and prevent organs in the abdominal cavity from dropping into the femoral canal.

*Operative technique*

Local anesthesia and a femoris approach were used for all patients. The surgeon made a longitudinal incision of about 3 cm through the skin and subcutaneous tissue to

expose the hernia sac. The hernia sac was then anatomic-ally isolated, dissected from the peritoneum and ligated or replaced into the abdominal cavity. For irreducible hernias, the femoral ring was enlarged by partially slitting the inguinal ligament. The femoral vein and artery should be carefully protected during the operation. Once the hernia sac was ligated or replaced, the inferior part of the Prolene 3-D patch was inserted into the preperitoneal space from the outlet of the femoral canal. Then the retention suture was pulled tightly, and the redundant upper oval patch retention sutures were trimmed off. The surgeon then sutured the upper patch to the inguinal ligament, pectineal ligament and pubic tubercle.

*Data abstraction*

We assessed duration of surgery, length of stay in hospital, postoperative complications, recurrences and pain severity after surgery. Patients had follow-up assessments, including history and physical examination, every 6 months. Some patients were assessed daily for 7 days using a visual analogue scale (VAS). The results were measured (from 0 to 100 mm) on the scale by the investigator.

**RESULTS**

A total of 73 hernia repairs were performed in 72 patients during our study period. Patient demographic and clinical characteristics are summarized in Table 1.

Most patients ( $n = 67$ ) were discharged the same day of admission, and none died. We were able to contact 68 patients for follow-up (11 patients were followed for 5 yr, 10 for 4 yr, 16 for 3 yr, 14 for 2 yr and 17 for 1 yr). The median follow-up was 39 months. No recurrences were noted. Thirty-five patients were assessed daily for 7 days using the VAS. The results of pain assessment are summarized in Table 1. The mean duration of surgery in our series (13.1 min) is compared with that of other current techniques in Table 2.

**DISCUSSION**

A weakness or defect in aponeurosis is the major source of groin hernias.<sup>14</sup> A femoral hernia passes beneath the ilio-pubic tract and inguinal ligament into the upper thigh.

**Table 1. Demographic and clinical characteristics of patients presenting with a femoral hernia ( $n = 72$ )**

Characteristic	No. (%)*
Age, mean (range) yr	65 (32–78)
Sex, no. male:female	13:59
Hernia	
Primary	73 (101.4)
Bilateral	1 (1.4)
Recurrent	0
Irreducible	65 (89.0)
Reducible	8 (11.0)
Duration of surgery, min	13.1 (10–19)
Diameter of hernia ring, cm	1.3 (0.5–2.5)
Hospital stay	
< 24 h	67 (93.0)
24 h	4 (5.6)
> 24 h	1 (1.4)
Complication	
Seroma	0
Wound infection	0
Cord edema	0
Recurrence	0
Postoperative pain, mean (range) VAS score	
Day 0	18.9 (9–65)
Day 3	12.7 (5–60)
Day 7	6.3 (0–40)

\*Unless otherwise indicated.

**Table 2. Mean duration of surgery for current techniques of femoral hernia repair**

Technique	Duration of surgery, mean min.	$p$ value
Prolene 3-dimensional patch, femoris approach	13	
Bard mesh, infrainguinal approach <sup>12</sup>	40	< 0.001
Prolene Hernia System, inguinal approach <sup>13</sup>	27	< 0.001
Lichtenstein mesh, inguinal approach <sup>13</sup>	37	< 0.001

The predisposing anatomic feature of femoral hernias is a small empty space between the lacunar ligament medially and the femoral vein laterally — the femoral canal.

Thus, the principle of femoral hernia repair is to eliminate the peritoneal sac and to close the femoral canal.<sup>15</sup> In the McVay repair, suture of the unyielding Cooper ligament and the conjoined tendon results in high tension. The Cooper ligament and inguinal ligament are strong enough, but they lack elasticity; therefore, sutures may break or cut through tissues, eventually resulting in recurrence. According to a report by Schumpelick and colleagues,<sup>16</sup> the recurrence rate associated with this type of herniorrhaphy could be as high as 10%–15%.

The well-known advantages of tension-free hernia repair led to the development of new techniques for femoral hernia repair, for which various techniques using polypropylene mesh or the PHS have been described. However, owing to the narrowness of the femoral ring (mean diameter of 1.3 cm in our trial), it can be difficult to place the PHS and polypropylene mesh. They must be placed through an inguinal approach. This technique requires exposure of the groin from the transversalis fascia to the peritoneum via a lower abdominal incision to close the fascial defect. It requires more initial dissection and is associated with higher complication and recurrence rates when performed by less experienced surgeons. For example, injury of the iliohypogastric nerve, ilioinguinal nerve or genitofemoral nerve will result in postoperative numbness or pain.

A femoral hernia has the greatest associated risk of incarceration and strangulation of all groin hernias, and in our series irreducible hernias accounted for 89.0% (65 of 73) of all cases. For irreducible hernias, the hernia sac is difficult to replace, thus partially incising the inguinal ligament is necessary to enlarge the femoral ring. In these cases it could be handier to use a femoris approach rather than an inguinal approach.

The femoris approach was used in our series and proved to be convenient. After skin and subcutaneous tissue incision, the hernia sac was exposed, with no need to incise the external oblique aponeurosis and transverse fascia. Meanwhile, the iliohypogastric nerve, ilioinguinal nerve and genitofemoral nerve could be well protected. The mean duration of surgery in our series (13.1 min) was comparable to that of other current techniques, but was significantly shorter. Surgical trauma was trivial, with no complications of seroma or cord edema occurring in the series. The postoperative pain was minimal and equal to that reported with other current techniques.<sup>17,18</sup> All 68 patients who were available for follow-up felt comfortable and had no pain at 1 year.

Before being extended, the inferior 3-D patch device is diamond shaped and easy to insert, even when the hernia ring is narrow. Once extended, it can form a patch with a maximum diameter of 5 cm, which can effectively close the

femoral ring. The upper plain film also closes the outlet of the femoral canal. Thus, a dual repairing effect is achieved, thereby substantially reducing the recurrence rate of femoral hernias.

## CONCLUSION

The 3-D patch using a femoris approach is the most logical method of closing the femoral canal with a prosthetic material and repairing femoral hernias. Various techniques using polypropylene mesh or the PHS have been described, whereas, to our knowledge, the use of a Prolene 3-D patch to achieve herniorrhaphy through a femoris approach has not previously been studied. In the present trial, satisfactory results of 73 hernia repairs proved that this technique has the same advantages of open, tension-free repairs: minimal postoperative pain, low complication and recurrence rates, and minimal restriction of activity after surgery. Even more advantageous is the convenience of the procedure and its shorter duration.

Because its borders are distinct and unyielding, a femoral hernia has the highest risk of incarceration and strangulation of all groin hernias. At the time of the procedure, the surgeon must decide whether to explore the abdomen to ensure the intestine is viable. If the patient has leukocytosis or clinical signs of peritonitis, or if the hernia sac contains dark or bloody fluid, the abdomen should be explored; however, the 3-D patch using a femoris approach is not convenient for such exploration. If it is discovered during the operation that the patient has a strangulated bowel, we recommend making another incision to allow the bowel to be explored carefully and immediately.

**Competing interests:** None declared.

**Contributors:** W. Lei designed the study. C. Luoshang acquired the data, which J. Huang analyzed. J. Huang wrote the article, which all authors reviewed and approved for publication.

## References

1. Glassow F. Femoral hernia. Review of 2105 repairs in a 17-year period. *Am J Surg* 1985;150:353-6.
2. Waddington RT. Femoral hernia: a recent appraisal. *Br J Surg* 1971; 58:920-2.
3. Lichtenstein IL, Shulman AG, Amid PK, et al. The tension-free hernioplasty. *Am J Surg* 1989;157:188-93.
4. Amid PK, Shulman AG, Lichtenstein IL. Critical scrutiny of the open "tension-free" hernioplasty. *Am J Surg* 1993;165:369-71.
5. Lichtenstein IL, Shulman AG, Amid PK. The cause, prevention and treatment of recurrent groin hernia. *Surg Clin North Am* 1993;73: 529-44.
6. Kurzer M, Belsham PA, Kark AE. The Lichtenstein repair. *Surg Clin North Am* 1998;78:1025-46.
7. Hachisuka T. Femoral hernia repair. *Surg Clin North Am* 2003;83: 1189-205.

8. Sanchez-Bustos F, Ramia JM, Ferrero FF. Prosthetic repair of femoral hernia: audit of long term follow-up. *Eur J Surg* 1998;164:191-3.
9. Zandi G, Vasquez G, Buonanno A, et al. [PHS Repair in femoral hernia surgery] [Article in Italian]. *Minerva Chir* 2003;58:797-9.
10. Reyes-Devesa HE, Martínez-Dejesús F, Martínez-Mier G. A new open anterior tension-free onlay patch technique for inguino-femoral hernia repair. *Am J Surg* 2005;190:118-22.
11. Uen YH, Wen KC. An improved method for deploying the polypropylene underlay patch of the PROLENE Hernia System. *Am Surg* 2007;73:468-71.
12. Licheri S, Erdas E, Pomata M. Femoral hernia repair with Bard Mesh Dart Plug. *Chir Ital* 2004;56:705-10.
13. Vironen J, Nieminen J, Eklund A, et al. Randomized clinical trial of Lichtenstein patch or Prolene Hernia System for inguinal hernia repair. *Br J Surg* 2006;93:33-9.
14. Gilbert AI, Graham MF, Voigt WJ. A bilayer patch device for inguinal hernia repair. *Hernia* 1999;3:161-6.
15. Swarnkar K, Hopper N, Nelson M. et al. Sutureless mesh-plug femoral hernioplasty. *Am J Surg* 2003;186:201-2.
16. Schumpelick V, Treutner KH, Arlt G. Inguinal hernia repair in adults. *Lancet* 1994;344:375-9.
17. Pélessier EP, Monek O, Blum D, et al. The Polysoft patch: prospective evaluation of feasibility, postoperative pain and recovery. *Hernia* 2007;11:229-34.
18. Reyes-Devesa HE, Martínez-Dejesús F, Martínez-Mier G, et al. A new open anterior tension-free onlay patch technique for inguino-femoral hernia repair. *Am J Surg* 2005;190:118-22.

## Canadian Surgery FORUM

The Canadian Surgery FORUM canadien de chirurgie will hold its annual meeting Sept. 13–16, 2012, in Calgary, Alberta. This interdisciplinary meeting provides an opportunity for surgeons across Canada with shared interests in clinical practice, continuing professional development, research and medical education to meet in a collegial fashion. The scientific program offers material of interest to academic and community surgeons, residents in training and students.

The major sponsoring organizations include the following:

- The Canadian Association of General Surgeons
- The Canadian Society of Colon and Rectal Surgeons
- The Canadian Association of Thoracic Surgeons
- The Canadian Society of Surgical Oncology

Other participating societies include the American College of Surgeons, the Canadian Association of Bariatric Physicians and Surgeons, the Canadian Association of University Surgeons, the Canadian Hepato-Pancreato-Biliary Society, the Canadian Undergraduate Surgical Education Committee, the James IV Association of Surgeons, the Québec Surgical Association and the Trauma Association of Canada.

For registration and further information visit [www.cags-accg.ca](http://www.cags-accg.ca).

## FORUM canadien de chirurgie

La réunion annuelle du FORUM canadien de chirurgie aura lieu du 13 au 16 septembre 2012 à la Ville de Calgary, Alberta. Cette réunion interdisciplinaire permet aux chirurgiens de toutes les régions du Canada qui s'intéressent à la pratique clinique, au perfectionnement professionnel continu, à la recherche et à l'éducation médicale d'échanger dans un climat de collégialité. Un programme scientifique intéressera les chirurgiens universitaires et communautaires, les résidents en formation et les étudiants.

Les principales organisations qui parrainent cette réunion sont les suivantes :

- L'Association canadienne des chirurgiens généraux
- La Société canadienne des chirurgiens du côlon et du rectum
- La Société canadienne de chirurgie thoracique
- La Société canadienne d'oncologie chirurgicale

Le *American College of Surgeons*, l'Association canadienne des médecins et chirurgiens spécialistes de l'obésité, l'Association québécoise de chirurgie, le *Canadian Association of University Surgeons*, le *Canadian Hepato-Pancreato-Biliary Society*, le *Canadian Undergraduate Surgical Education Committee*, le *James IV Association of Surgeons* et l'Association canadienne de traumatologie sont au nombre des sociétés qui appuient cette activité.

Pour vous inscrire ou pour plus de renseignements, veuillez consulter le site [www.cags-accg.ca](http://www.cags-accg.ca).