

## CLINICAL PRACTICE

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## Groin Hernias in Adults

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*This Journal feature begins with a case vignette highlighting a common clinical problem. Evidence supporting various strategies is then presented, followed by a review of formal guidelines, when they exist. The article ends with the authors' clinical recommendations.*

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**A 67-year-old man presents with a bulge in his right groin, which he recently noticed while in the shower. He is easily able to push it back completely, but it reappears intermittently. He says it is not painful and that he has not altered his activity level because of it. Physical examination confirms the presence of a right inguinal hernia. How should his case be managed?**

## THE CLINICAL PROBLEM

The lifetime risk of development of a groin hernia has been estimated at 27% for men and 3% for women.<sup>1</sup> The frequency of surgical correction varies among countries and ranges from 10 per 100,000 population in the United Kingdom to 28 per 100,000 in the United States.<sup>2</sup>

The word “hernia” is from the Latin word “rupture”; the condition occurs when an organ normally contained in one body cavity protrudes through the lining of that cavity. Groin hernias have three components: the neck, which is the opening in the abdominal wall; the sac, which is formed by the protrusion of the peritoneum through the opening; and the contents — that is, any tissue or organ that protrudes through the neck into the hernia sac (Fig. 1). The abdominal wall in the groin region is composed of the peritoneum, transversalis fascia, internal and external oblique muscles and their aponeurotic structures, subcutaneous tissue, and skin. A failure of the transversalis fascia to prevent the intraabdominal contents from protruding through the anatomical area known as the myopectineal orifice of Fruchaud is the final common denominator in the development of all groin hernias (Fig. 2). Groin hernias are inguinal or femoral; inguinal hernias are either direct or indirect. Both direct and indirect hernias protrude above the inguinal ligament; a direct hernia is medial to the inferior epigastric vessels, whereas an indirect hernia is lateral. A femoral hernia protrudes below the inguinal ligament and medial to the femoral vessels (Fig. 1 and 2).

## DEMOGRAPHICS AND RISK FACTORS

Inguinal hernias are more common on the right side than on the left and are 10 times more common in men than in women.<sup>3</sup> Indirect inguinal hernias are twice as common as direct hernias. The reported prevalence of inguinal hernias varies widely from study to study; hernia repair is often used as a surrogate. In a study using the Danish national registry, groin hernias were found to be most commonly diagnosed

## KEY CLINICAL POINTS

## GROIN HERNIAS IN ADULTS

- Groin hernias are much more common in men than in women.
- Patients with symptoms of acute incarceration and strangulation require emergency surgery.
- Watchful waiting is a safe approach for asymptomatic male patients with inguinal hernia, but data from randomized trials suggest that the majority of men will ultimately be referred for surgery, primarily because of pain, within 10 years.
- For an uncomplicated unilateral inguinal hernia, open repair has the advantages of potentially being performed under local anesthesia and incurring lower initial costs; laparoscopic repair results in less postoperative pain and an earlier return to normal activities, but it requires general anesthesia routinely and carries a small risk of major intraabdominal injury.
- Femoral hernias occur more often in women than in men, are associated with much higher risk of strangulation, and can be difficult to distinguish from inguinal hernias; watchful waiting is not recommended in women.

at the extremes of life. Among adults, the annual frequency of groin hernia repair was found to increase consistently with age, from 0.25% at 18 years of age to 4.2% at 75 to 80 years of age.<sup>4</sup> Femoral hernias account for fewer than 5% of groin hernias; however, 35 to 40% of femoral hernias are not diagnosed until the patient presents with strangulation or bowel obstruction, and mortality is higher in association with emergency repair than with elective repair.<sup>5-7</sup> The incidence of femoral hernias increases steadily with age and is higher among patients with recurrent hernias. Femoral hernias are more common in women than in men, but a woman with a groin mass is still 5 times more likely to have an inguinal hernia than a femoral hernia; inguinal hernias in women are almost always indirect.<sup>6</sup>

In addition to male sex and increased age, a major risk factor for a groin hernia is a family history of groin hernias, which is associated with up to eight times the risk.<sup>8,9</sup> Other conditions reported to be associated with increased risk include chronic obstructive pulmonary disease, smoking, lower body-mass index, high intraabdominal pressure, collagen vascular disease, thoracic or abdominal aortic aneurysm, patent processus vaginalis, history of open appendectomy, and peritoneal dialysis.<sup>8</sup> Patients with matrix metalloproteinase (MMP) abnormalities, such as Ehlers–Danlos, Marfan’s, Hurler’s, and Hunter’s syndromes, also have increased risks of having a hernia; consistent with these observations is the report of markers of abnormal connective-tissue homeostasis, including an increased type I:type III collagen ratio and increased metalloproteinase activity (in-

creased MMP-2 and MMP tissue inhibitor 2 activity),<sup>10</sup> in association with hernias in the general population.

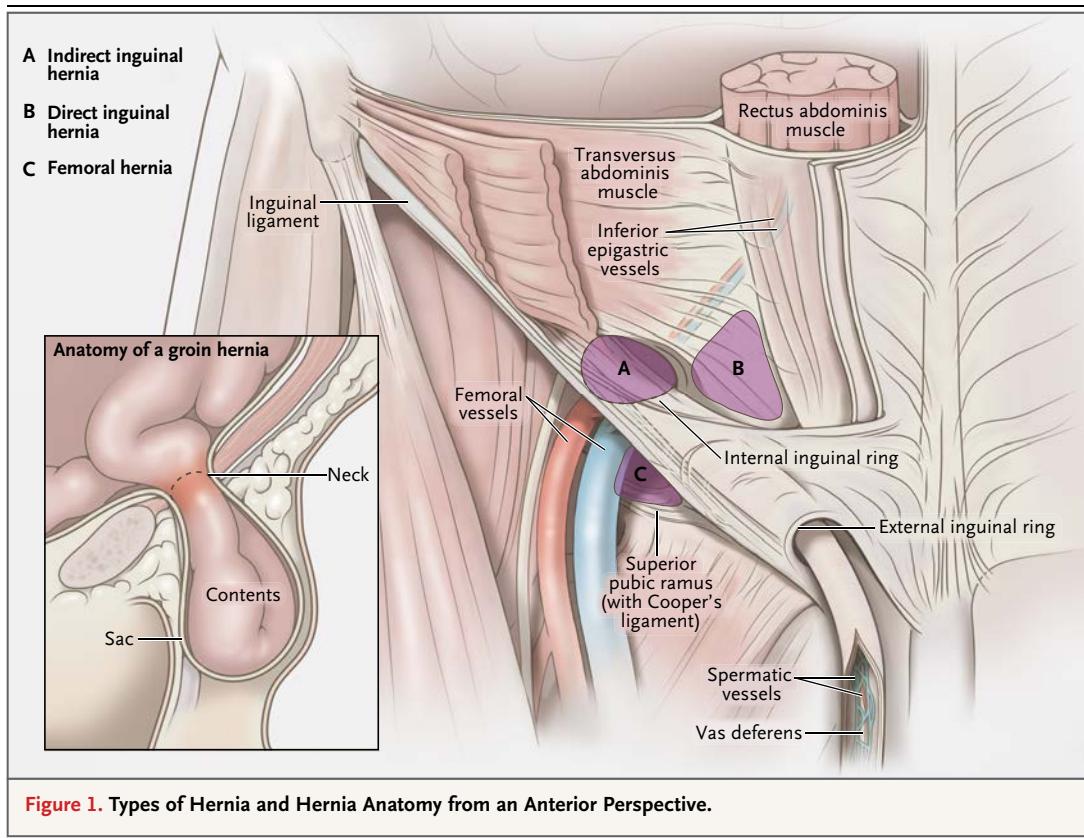
Whether heavy lifting is also a risk factor remains controversial. A recent systematic review showed data concerning the relationship between occasional heavy lifting, repeated heavy lifting, or a single strenuous lifting episode and the development of a groin hernia to be inconclusive.<sup>11</sup> Of note, weight lifters do not have an increased incidence of inguinal hernias.<sup>12</sup>

## STRATEGIES AND EVIDENCE

## DIAGNOSIS AND EVALUATION

Symptoms are absent in about a third of patients<sup>13</sup> but, when present, include a heavy or dragging sensation, a burning sensation, a sharp pain, or discomfort or pain during coughing, defecation, micturition, exercise, or sexual intercourse. Symptoms are usually worse by the end of the day and are relieved by lying down or manually reducing the hernia. The sudden onset of severe pain suggests strangulation and is a surgical emergency.

Inguinal hernias are diagnosed by means of a physical examination disclosing a visible bulge or an easily palpable mass on straining with an examining finger in the external ring. Differentiating an indirect from a direct inguinal hernia is unnecessary, because it does not affect treatment. It is not always possible to differentiate an inguinal hernia from a more worrisome femoral hernia during physical examination.<sup>5,14</sup> Imaging studies are required only in cases in which there are typical symptoms in the absence of physical



**Figure 1.** Types of Hernia and Hernia Anatomy from an Anterior Perspective.

findings, to rule out an occult hernia or other condition. Ultrasonography is relatively inexpensive and avoids the use of radiation, but its accuracy is operator-dependent.<sup>15</sup> Computed tomography and magnetic resonance imaging (MRI) are alternatives; MRI provides the best anatomic detail and has the highest sensitivity and specificity.<sup>16,17</sup>

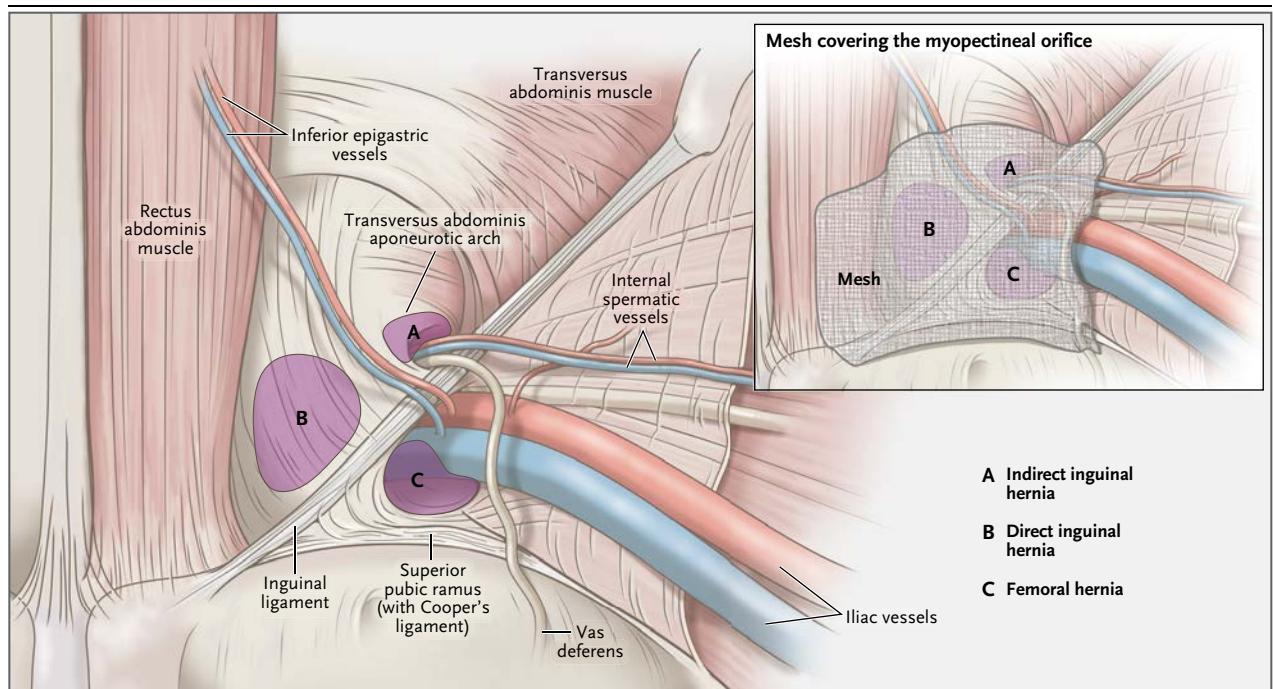
The differential diagnosis varies according to the clinical presentation. In the case of a groin mass thought to be a hernia, other possible causes include lymphadenopathy, a soft-tissue tumor, or an abscess. Possible causes of scrotal masses include a hydrocele or a testicular tumor. In the case of a patient with symptoms consistent with a groin hernia but without a mass, possible causes (other than occult hernia) include epididymitis, local musculoskeletal abnormalities (e.g., arthritis of the hip, osteitis pubis, or tenosynovitis), nerve-root compression, and renal calculi. Athletes can have unusual syndromes that result in symptoms suggestive of a hernia; these include athletic pubalgia, femoral acetabular impingement, and adductor longus tendinopathy.

#### MANAGEMENT

A strangulated hernia, which results in intestinal ischemia, requires emergency surgery. The patient presents with a tense, exquisitely tender groin mass and may have signs of sepsis (e.g., fever, tachycardia, hypotension, vomiting, and confusion). Incarceration (i.e., a state in which a hernia cannot be reduced) is not synonymous with strangulation; many patients with chronically irreducible hernias have no symptoms. Careful examination of the groin should be performed for any patient presenting with a bowel obstruction. In contrast to other causes of bowel obstruction, hernias causing this complication are almost always associated with complete obstruction and cannot be managed conservatively. Unless an obstructed hernia is treated expeditiously, progression to strangulation is inevitable.

#### ASYMPTOMATIC OR MINIMALLY SYMPTOMATIC HERNIAS

Regardless of the type of hernia, symptomatic patients should be offered repair to improve quality



**Figure 2. Anatomy of the Groin from an Intraabdominal Perspective.**

Groin hernias occur through the myopectineal orifice, which is bordered by the arch formed by the termination of the aponeurotic fibers of the transversus abdominis muscle cranially, the rectus abdominis muscle medially, the iliopsoas muscle laterally, and the superior pubic ramus with attached Cooper's ligament inferiorly. In the inset, a mesh prosthesis is shown covering the entire myopectineal orifice, as one would see in a laparoscopic inguinal herniorrhaphy.

of life. However, the results of two randomized trials comparing prompt repair with a strategy of watchful waiting for asymptomatic or minimally symptomatic inguinal hernias have argued against routine repair.<sup>18,19</sup> One of these, a single-center randomized trial from the United Kingdom involving 160 patients, showed no significant difference between groups in pain scores and a minimal difference in scores on the 36-Item Short Form Health Survey at 1 year.<sup>18</sup> In a larger multicenter trial from North America (involving 720 patients), there was no significant difference at 2 years in pain or quality of life between the group that underwent surgery and the group that did not.<sup>19</sup> In both studies, approximately one quarter of patients assigned to watchful waiting crossed over to surgery (by 15 months in the first and by 2 years in the second), primarily because of increasing pain; the delay did not affect the frequency of operative complications.<sup>20</sup> The incidence of an acute presentation was very low (a total of 3 patients in both studies combined, and 2 of

the 3 patients had the hernia reduced and repaired electively), and there was no mortality or increased morbidity with watchful waiting as compared with prompt repair.

Both studies have recently been updated with longer-term follow-up data.<sup>21,22</sup> The estimated frequency of crossover to surgery from the watchful-waiting group was 72% by 7.5 years in the U.K. trial and 68% by 10 years in the North American trial; most crossovers to surgery were a result of increasing pain. In the subset of men who underwent randomization after 65 years of age in the original North American study, 79% were predicted to need surgery. The logical conclusion is that watchful waiting is safe but only delays the inevitable surgery. Concern that watchful waiting would result in greater complication rates as a result of increasing severity of coexisting conditions and larger fascia defects in cases where surgery was later performed was not borne out.<sup>20</sup> Because the patients in both studies had presented to their physicians with concerns about

their hernias, the results may not be generalizable to the larger group of patients with asymptomatic hernias and no concerns. Another important caveat is that these results apply only to inguinal hernias and not to femoral hernias, because of the higher risks of serious complications with the latter. Surgical repair is routinely recommended for women because of their higher incidence of femoral hernias and the difficulty in accurately differentiating them from inguinal hernias by means of physical examination.<sup>6,23-26</sup>

#### SURGICAL TREATMENT

Hernia repair is performed as either an open procedure or a laparoscopic procedure. Open repairs are divided into two types: tension-free repair with the use of a prosthetic mesh (usually polypropylene) or sutured repair. A Cochrane meta-analysis strongly supported the superiority of prosthetic-mesh repairs over sutured repairs, reporting a 50 to 75% lower risk of hernia recurrence, a lower risk of chronic postherniorrhaphy groin pain, and an earlier return to work.<sup>27</sup> The Lichtenstein tension-free repair or one of its modifications (e.g., “plug and patch”) is the most commonly performed repair of all types in the United States. Sutured repairs are generally limited to unique indications such as an infected or contaminated field where the use of a prosthesis might be contraindicated. One type of sutured repair (the Shouldice repair) is still used in certain specialty clinics but requires a complex dissection that is not easily mastered without specialized training; in general practice, the hernia recurrence rate associated with this type of repair is higher than with mesh techniques.<sup>28</sup>

#### LAPAROSCOPIC INGUINAL HERNIA REPAIR

The laparoscopic method uses the preperitoneal space behind the musculofascial elements of the groin area to place a prosthesis over the entire myopectineal orifice. The preperitoneal space may be entered directly through the abdomen by making an incision in the peritoneum (transabdominal preperitoneal technique). Alternatively, one can avoid the abdomen by dissecting the space between the peritoneum and the muscular elements, with or without the aid of a dissecting balloon (totally extraperitoneal repair) (Fig. 3).

Laparoscopic herniorrhaphy results in less pain initially, an earlier return to normal activities, and easier repair of recurrent hernias that have

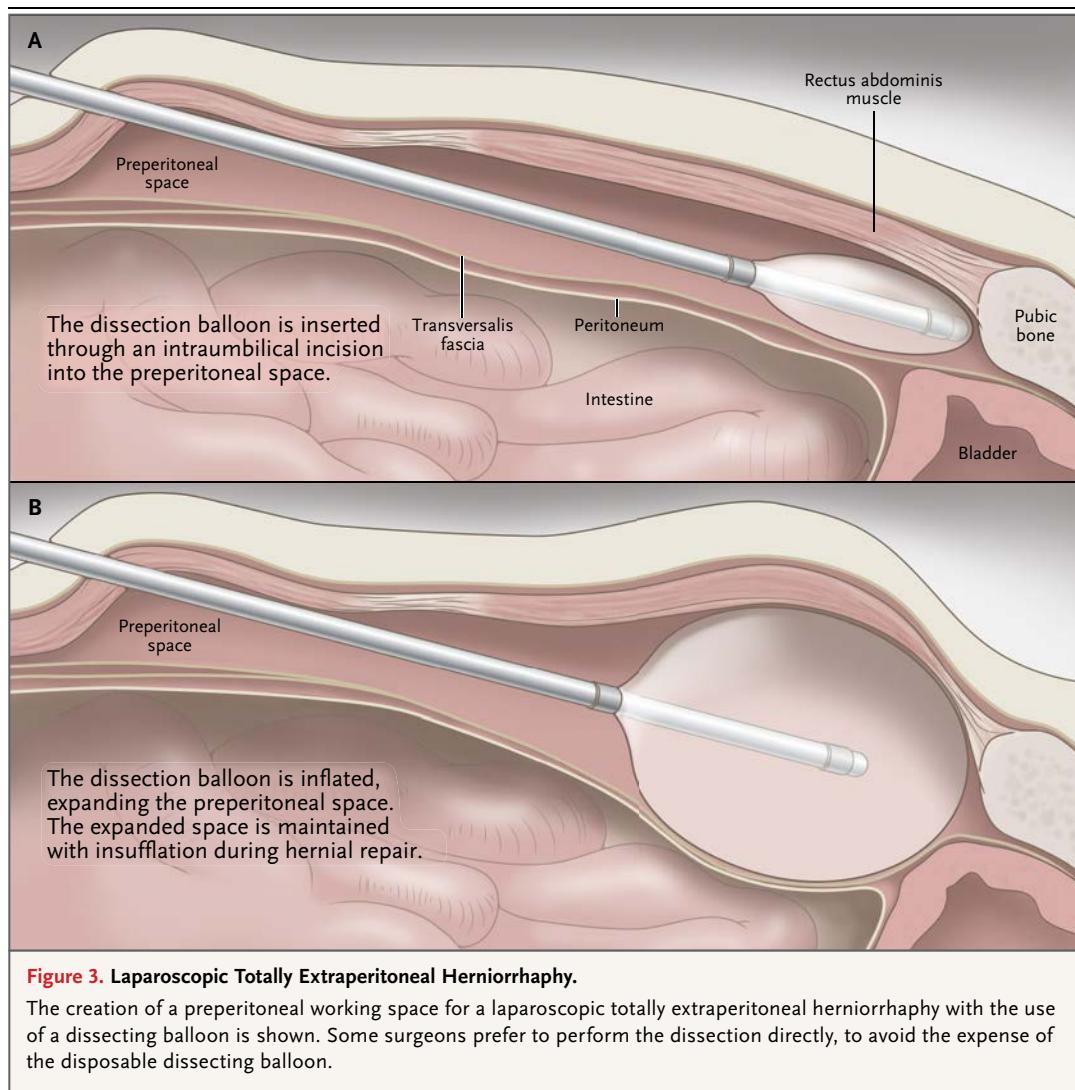
previously undergone open repair, and it allows treatment of bilateral hernias through the same skin incisions.<sup>29,30</sup> The risks of common surgical complications are similar for laparoscopic and open repair; complications include wound seroma or hematoma (approximately 7 to 8% risk),<sup>15</sup> wound infection (approximately 1% risk),<sup>15</sup> testicular complications (approximately 0.7% risk),<sup>30</sup> and complications related to the mesh — for example, contraction, erosion, and infection. However, laparoscopic repair is associated with a small risk of life-threatening vascular or visceral injury (0.9 and 1.8 per 1000 procedures, respectively<sup>31</sup>). Whereas laparoscopic repair requires general anesthesia, open repair can be performed under local anesthesia (although registry data from Europe indicate that local anesthesia is used in only about 10% of cases<sup>32</sup>); the possibility of using local anesthesia is a particular advantage in older patients who require repair and have serious coexisting medical conditions. Laparoscopic herniorrhaphy is more expensive, but the costs of the procedure may be offset by an earlier return to daily function and work.<sup>33</sup> A Cochrane meta-analysis including 41 randomized trials showed no significant difference in recurrence rates between open mesh and laparoscopic repairs.<sup>29</sup> However, other studies, including a recent large cohort study<sup>34</sup> and a more recent meta-analysis including 27 randomized trials, have revealed a significantly higher risk of recurrence of primary hernias after laparoscopic repair as compared with open repair<sup>35</sup> (reoperation rates in the cohort study, 4.1% vs. 2.1%). No significant difference between the two types of procedures has been noted in recurrence rates after repair of recurrent hernias.<sup>34,36</sup> Numerous studies have shown that the most important factor influencing the outcome of laparoscopic herniorrhaphy is the experience of the surgeon.<sup>34,37</sup> The learning curve for laparoscopy is steep; inexperienced surgeons have poorer results with higher rates of complication and recurrence. The number of procedures required for a surgeon to become proficient is not clearly defined.

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#### AREAS OF UNCERTAINTY

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Now that the rate of hernia recurrence has decreased dramatically with the widespread adoption of prosthetic repairs, chronic postherniorrhaphy groin pain (defined as pain lasting >3 months)



has emerged as the most important postoperative issue reported by patients, in that it is both distressing to patients and poorly understood by — and the subject of controversy among — hernia surgeons. Although the incidence varies widely in the literature (1.5 to 54%<sup>38,39</sup>), the consensus is that approximately 10% of patients who have undergone an inguinal herniorrhaphy have some chronic pain, and in 2 to 4% it interferes with daily living.<sup>30</sup> Whether this complication is less likely after laparoscopic repair than after open repair remains controversial.<sup>30,38</sup> Pain has been attributed to one or more of the following factors: damaged or trapped nerves (neuropathic) or scar tissue or a reaction to the prosthetic material (nociceptive); however, the exact

mechanisms are unknown. Because the pain resolves within 6 months in about a third of cases, antiinflammatory medication is a reasonable initial treatment. In patients with persistent pain, strategies for treatment have included mesh and suture excision, neurectomy, and neuroma excision, but there is wide variation in the reported rates of improvement after these interventions in case series.<sup>40,41</sup> Rigorous studies are needed to clarify the efficacy of various treatment strategies. Postherniorrhaphy pain should be discussed as part of informed consent.

There is a paucity of information to guide the management of groin hernias in women. A particular concern in women is their higher frequency of femoral hernias, with the attendant

high risks of strangulation, as well as the potential misdiagnosis of femoral hernias as inguinal hernias. The Lichtenstein operation, unless specifically modified (i.e., by opening the inguinal floor to look below the inguinal ligament at the femoral canal), will miss a femoral hernia. Indeed, a large study of more than 6000 women from Sweden showed a rate of femoral-hernia recurrence that was much higher than that among men, especially after the repair of a direct hernia; because direct hernias are extremely rare in woman, this observation suggests that the femoral hernia was actually missed during the index operation.<sup>6</sup> Thus, many experts recommend laparoscopic repair (which results in coverage of the entire myopectineal orifice) (Fig. 2, inset) for all women with groin hernias.<sup>6,14,30,42</sup> However, a modified Lichtenstein operation, attaching the inferior edge of the prosthesis to Cooper's ligament instead of the inguinal ligament, can achieve the same coverage.

The use of a truss (hernia belt) for a groin hernia in men is controversial. Data to determine whether their use prevents hernia complications are lacking.

#### GUIDELINES

Guidelines for the management of inguinal hernias have been published by the U.K. National Institute for Health and Care Excellence,<sup>25</sup> the European Hernia Society,<sup>30</sup> the Society for Surgery of the Alimentary Tract,<sup>43</sup> the Danish Hernia Database,<sup>24</sup> the International Endohernia Society,<sup>44</sup> and the Agency for Healthcare Research and

Quality.<sup>26</sup> The current recommendations are generally consistent with these guidelines.

#### CONCLUSIONS AND RECOMMENDATIONS

This 67-year-old man presents with a history and physical-examination results consistent with an inguinal hernia. Imaging studies are not indicated. Watchful waiting is an acceptable strategy, although data from randomized trials predict that, given his age (>65 years), he has an 80% chance of requiring surgical hernia repair for evolving symptoms. If surgery is performed, an open conventional prosthetic inguinal herniorrhaphy would be recommended by most surgeons; however, a laparoscopic herniorrhaphy performed by an experienced surgeon is also an acceptable option. The laparoscopic operation would be expected to result in less pain and an earlier return to normal activities, but the differences would probably be modest for this uncomplicated unilateral hernia; at the same time, it would carry a risk (albeit a small one) of a serious vascular or visceral injury. If the patient were a woman, surgery would be recommended routinely, given the greater concern for a femoral hernia and the greater associated risk of complications.

No potential conflict of interest relevant to this article was reported.

Disclosure forms provided by the authors are available with the full text of this article at NEJM.org.

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