CONTINUING MEDICAL EDUCATION

Evidence-Based Hernia Treatment in Adults

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SUMMARY

Background: Inguinal hernia repair is the most common general surgical procedure in industrialized countries, with a frequency of about 200 operations per 100 000 persons per year. Suture- and mesh-based techniques can be used, and the procedure can be either open or minimally invasive.

Method: This review is based on a selective search of the literature, with interpretation of the published findings according to the principles of evidence-based medicine.

Results: Inguinal hernia is diagnosed by physical examination. Surgery is not necessarily indicated for a primary, asymptomatic inguinal hernia in a male patient, but all inguinal hernias in women should be operated on. For hernias in women, and for all bilateral hernias, a laparoscopic or endoscopic procedure is preferable to an open procedure. Primary unilateral hernias in men can be treated either by open surgery or by laparoscopy/endoscopy. Patients treated by laparoscopy/endoscopy develop chronic pain less often than those treated by open surgery. A mesh-based repair is generally recommended; this seems reasonable in view of the pathogenesis of the condition, which involves an abnormality of the extracellular matrix.

Conclusion: The choice of procedure has been addressed by international guidelines based on high-level evidence. Surgeons should deviate from their recommendations only in exceptional cases and for special reasons. Guideline conformity implies that hernia surgeons must master both open and endoscopic/laparoscopic techniques.

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Inguinal hernia repair is the most common operation in visceral and general surgery. It has therefore been the subject of many clinical trials, meta-analyses, and systematic reviews. These, in turn, provide the basis for the existing international guidelines, which were formulated with the application of the Oxford criteria. The recommendations contained in them are based on high-level evidence and should therefore be followed in essentially all cases, with rare, individually justified exceptions.

Learning goals

This article is intended to acquaint the reader with the modern treatment of inguinal hernia, and in particular with:

- the indications for treatment,
- the indications for each of the available treatment methods (tailored approach), and
- the significance of chronic postoperative pain and its prevention.

Epidemiology

The lifetime risk of developing an inguinal hernia is 3% for women and 27% for men (e1). The incidence rises with age and is eight times higher in persons with a positive family history.

The following risk factors have been described (1):

- chronic obstructive pulmonary disease,
- cigarette smoking,
- low body-mass index,
- and collagen diseases.

Indirect, direct, and femoral hernias are anatomically distinct from one another and arise at different frequencies. Indirect hernias are twice as common as direct ones; femoral hernias account for

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Lifetime risk

The lifetime risk of developing an inguinal hernia is 3% for women and 27% for men.

TABLE 1

Treatment options for primary inguinal hernia

	Conservative	Operative	open / anterior approach	laparoscopic / endoscopic
Unilateral hernia in a man, asymptomatic, non-progressive	+	+	+	+
Unilateral hernia in a man, symptomatic and/or progressive	–	+	+	+
Bilateral hernia in a man, asymptomatic, non-progressive	+	+	–	+
Bilateral hernia in a man, symptomatic and/or progressive	–	+	–	+
Hernia in a woman, unilateral/bilateral/asymptomatic/symptomatic/non-progressive/progressive	–	+	–	+

only 5% of all inguinal hernias. Inguinal hernias are more often on the right side than the left (e2).

Clinical features and diagnostic evaluation

A reducible protrusion in the inguinal region is definitive evidence of an inguinal hernia and needs no further diagnostic evaluation beyond physical examination. This consists of inspection followed by palpation of the patient's groin in the standing and the supine positions, including digital exploration of the inguinal canal. An inguinal hernia can be distinguished from a scrotal hernia with an accompanying hydrocele by palpation, with the aid of diaphanoscopy if necessary, before further studies such as ultrasonography are performed. In contrast, non-reducible inguinal masses always need further diagnostic evaluation, even if they are asymptomatic. A meta-analysis confirmed the utility of ultrasonography for this purpose, with 96.6% sensitivity, 84.8% specificity, and a positive predictive value of 92.6% (1). In a study of 36 patients with occult hernias, magnetic resonance imaging was found to be superior to both ultrasonography and computerized tomography (e3). Remarkably, herniography is still mentioned in a current systematic review as the most sensitive diagnostic modality of all (2). Dynamic sonography is a good compromise with regard to expense, diagnostic value, and availability, although this can only be stated as a grade C recommendation because of the suboptimal quality of the underlying studies.

In a recent study, a standardized questionnaire was used to evaluate symptoms in 231 patients with a documented inguinal hernia, and in a control group of 231 persons chosen at random (3). 69% had discomfort in the hernia itself and 66% in the groin, while 50% complained of increased peristalsis, without any difference between right-sided, left-sided, or bilateral hernias. Only 7% had no symptoms. The hernia patients complained significantly more than the control subjects did of pain in the groin and in the genital area, pain on urination/urinary function, increased peristalsis, and tenesmus. The latter two symptoms were mainly a feature of left-sided hernias, while urinary problems were mainly a feature of right-sided ones. In another survey, 23% of 160 men with inguinal hernias complained of pain during sexual activity (e4). 17% said that their sex life was moderately or severely impaired. Surgical treatment did not lead to a significant reduction in symptoms; in this study, patients who had symptoms preoperatively still showed significantly more symptoms postoperatively than the control subjects. The preoperative symptoms and the severity of pain in the early postoperative period were important risk factors for chronic pain (4). This is an important matter that should be discussed with patients before surgery. The point is underscored by a further study in which a population at increased risk for postoperative pain was defined preoperatively through the patients' reaction to standardized thermal stimulation of the skin (5). 12.4% of the patients in this study complained of moderate to severe pain 6 months after surgery.

Evidence-based treatment

Physical examination of the groin is an obligate part of every general physical examination, not only when patients complain of abdominal pain.

Dynamic ultrasonography

Inguinal hernia is primarily diagnosed by physical examination. Dynamic ultrasonography is used if necessary.

Figure: The operative field in a transabdominal inguinal hernia repair procedure,
a) after adequate exposure and
b) after the introduction of a 12x17 cm mesh.

The pathogenesis of inguinal hernia

Inguinal hernia in adults is now thought to be due to a disturbance of the extracellular matrix. Changes are seen, for example, in matrix metalloproteases and their inhibitors (6), and the patients' collagen metabolism is disturbed in a characteristic way. The degradation of immature type III collagen is reduced in persons with inguinal hernias compared to controls, while the turnover of type IV collagen in the basal membrane is increased (e5). Parallel findings have been made with regard to the development of cicatricial hernias (e5) and aortic aneurysms (e6). Epidemiologic studies have shown that direct and indirect inguinal hernias differ in that only the former are correlated with cicatricial hernia (7). Although these two entities presumably

differ in their pathogenetic mechanisms, we do not yet understand how; this theoretical difference is irrelevant to treatment as currently practiced and is not reflected in the guidelines. Thus, there is no need to differentiate direct from indirect hernias preoperatively (8, 9).

Indications for treatment

The goal of treatment is to improve symptoms and the quality of life in general, and to prevent adverse events such as incarceration, while keeping the rate of surgical complications low. Treatment with a truss does not achieve any of these goals. Surgery can improve the quality of life of patients with symptomatic inguinal hernias (10), even if they are elderly (e7). In patients with asymptomatic hernias that are stationary in size, the danger of incarceration is still often cited as a reason to operate. Two randomized trials and one systematic review addressed this issue in men with primary inguinal hernias, with a period of observation exceeding 10 years (11–13). The rate of conversion from “watchful waiting” to surgery was 72% at 7.5 years in one trial, and 68% at 10 years in the other. In the second trial, separate statistics were reported for patients under and over age 65: in the latter, the rate of conversion was 79%. The rate of incarceration was 0.27% at 2 years and 0.55% at four years. Incarceration had no effect on the rate of complications after emergency reoperative procedures.

Level 1 evidence now invalidates the former general recommendation for surgery in men with asymptomatic, non-progressive inguinal hernias. The alternative, i.e., watchful waiting, must be discussed with the patient. The risk of incarceration should not be cited as a reason to operate (grade B recommendation) (9).

According to the guideline of the European Hernia Society (EHS), primary inguinal hernias in women should be operated on in all cases because of the possibility of a femoral hernia, which cannot be unambiguously diagnosed by clinical and ancillary examinations alone and is incarcerated in up to 30% of cases (evidence level 2, recommendation grade B) (8, 9, 14).

There have been no good studies of the possible indication for surgery in case of recurrent inguinal hernia. The decision must be made individually, in consideration of the initial technique (with or without a mesh), symptoms, and accompanying morbidity. Recurrences after hernia repair with a mesh that have palpable, well-defined hernia borders may have a greater tendency to be incarcerated than recurrences after suture-based techniques; the indication for a second operation in

Pathogenesis

Inguinal hernia is not a rupture of the groin; rather, it is due to an abnormality of the extracellular matrix.

Men vs. women

For primary, asymptomatic, non-progressive inguinal hernia in a man (as opposed to a woman), watchful waiting is a valid option.

TABLE 2

Treatment options for recurrent inguinal hernia

	Conservative	Operative	Open / anterior approach	laparoscopic / endoscopic
Asymptomatic, non-progressive hernia after a prior anterior approach	+?	+	–	+
Asymptomatic, non-progressive hernia after a prior posterior approach	+?	+	+	(+)
Symptomatic or progressive hernia after a prior anterior approach	–	+	–	+
Symptomatic or progressive hernia after a prior posterior approach	–	+	+	(+)

(+)= in the hands of a surgeon with adequate expertise in laparoscopic hernia surgery

such cases may, therefore, be stronger. This statement is only supported by level 5 evidence, however, and is thus only a grade D recommendation.

Methods of inguinal hernia repair

Inguinal hernias can be repaired by suture- or mesh-based techniques, through an anterior or a posterior approach, and by either open surgery or laparoscopy/endoscopy. Minimally invasive procedures are always done through a posterior approach and with the use of a mesh; open, suture-based operations are performed through the classic anterior approach. The well-known suturing techniques are those of Bassini, Shouldice, and Desarda (e8). The data on the Desarda technique are still too sparse for a definitive evaluation. The standard mesh-based technique through an anterior approach is that of Lichtenstein. In the discussion below, we will also present data on further techniques—“plug and patch” and the use of special net systems that are used in open procedures to cover both the anterior and the posterior surface.

According to a recent meta-analysis of open suture-based and open mesh-based techniques, the Shouldice repair is associated with a lower recurrence rate than other popular suture-based techniques, such as that of Bassini (7% vs. 4.3%) (15), but the recurrence rate of suture-based techniques in general is four times higher than that of mesh-based techniques (4% vs. 0.9%).

It is unambiguously stated in the guidelines of the European Hernia Society (EHS) (8, 9) and the Danish Hernia Database (14) that mesh-based techniques have

a lower recurrence rate than suture-based techniques (evidence level 1); therefore, for adult patients, either the Lichtenstein procedure or an endoscopic/laparoscopic technique (if the surgeon has the necessary expertise) is recommended as the standard for hernia repair in adults (recommendation grade A). The Danish recommendations go so far as to advise against the use of suture-based techniques in general. Persons aged 18 to 30 also benefit from mesh-based techniques, and registry studies have shown that such techniques have no effect on male fertility (e9).

Comparisons of open, mesh-based techniques

The EHS guidelines of 2009 (8) mentioned only the Lichtenstein technique, as adequate data on other techniques were not yet available. The 2014 update (9) additionally addresses the more recent trials of the “plug and patch” and polypropylene hernia system (PHS) techniques. These were compared with the standard Lichtenstein repair in multiple randomized trials and are equivalent to it in rates of recurrence and chronic postoperative pain, with follow-up ranging from 1 to 4 years (evidence level 1, recommendation grade B).

Comparison of laparoscopic/endoscopic techniques (TAPP versus TEP)

In the 2009 guidelines, the extraperitoneal approach (TEP) was preferred to the transabdominal approach (TAPP) because of a supposedly lower complication rate (*Figure*) (8), but this has been clearly refuted since. According to the guidelines of the International

Mesh-based technique

A mesh-based repair with the Lichtenstein technique or a laparoscopic/endoscopic repair is recommended for primary inguinal hernia. These methods have lower recurrence rates than alternative methods, and comparable complication rates.

Different treatments

Unilateral primary inguinal hernia can be treated either by open surgery or by endoscopy/laparoscopy; the latter seems preferable because of the lower frequency of chronic postoperative pain.

Endohernia Society (IEHS) (16), the two approaches have similar rates of severe complications and recurrences (evidence level 1) and can thus be considered clinically equivalent (recommendation grade A). There is no need for further debate over which of these two techniques to use, but the surgeon must have the requisite expertise in whichever one he or she mainly uses. The learning curve for laparoscopic/endoscopic hernia repair is longer than that for open repair by the Lichtenstein technique (evidence level 3–4) (8, 17).

Differences in the treatment of inguinal hernia

Guidelines based on solid evidence are now available, yet their recommendations are not uniformly followed by surgeons in the United States and Canada (18). The EHS recommends open surgery for primary, unilateral inguinal hernia in a male patient (9). It was found in two meta-analyses that TEP has a significantly higher recurrence rate than Lichtenstein repair (9, 19), but this conclusion was based on the findings of a Scandinavian randomized multicenter trial in which a single participating surgeon accounted for 33% of the recurrences after TEP (20). Once this surgeon's results are set aside, the difference disappears. The meta-analysis of O'Reilly et al. (19) did not reveal any disadvantage of TAPP in terms of recurrence rates, and the laparoscopic/endoscopic techniques were superior to the open techniques with regard to chronic postoperative pain. As mentioned above, one trial (5) revealed a significantly lower rate of chronic pain after TAPP than after Lichtenstein repair; in this study, a group of patients at increased risk for postoperative pain was identified preoperatively by means of their response to a standardized noxious stimulus. The authors concluded that patients in this group should undergo laparoscopic/endoscopic rather than open surgery.

An American registry study addressed the question of perioperative complication rates after open versus endoscopic/laparoscopic primary hernia repair (21). In 37 645 patients, 16.9% of whom underwent endoscopic/laparoscopic surgery, there was no difference between the two types of procedure in 30-day morbidity or mortality (evidence level 2). Complications arose in about 1% of patients, severe complications in 0.5%. The mortality was 0.02% for laparoscopic and 0.05% for open procedures.

Inguinal hernias in women are a special case. Analysis of data from a Danish registry (22) revealed that recurrent femoral hernias arise in women only after sur-

gery by an open anterior approach (evidence level 2). Earlier analyses of data from the Danish Hernia Database led to a general recommendation of endoscopic/laparoscopic surgery for female patients because of a high recurrence rate after Lichtenstein repair (recommendation grade B) (14).

Bilateral inguinal hernias should be repaired with an endoscopic/laparoscopic technique; this conclusion was reached in 2010 on the basis of results from a case series, compared with those in the literature (e10). The EHS recommends accordingly in its guidelines (8), despite a level of evidence of only 2C in the older Oxford classification. The same recommendation was made as early as 2004 by the National Institute for Health and Care Excellence in the United Kingdom; a survey in Scotland, however, revealed that it was poorly implemented (e11). Current recommendations for the treatment of primary inguinal hernia are summarized in *Table 1*.

Recurrent inguinal hernia is another special case. Its proper management depends on the type of initial surgery, as presented in *Table 2*. Anterior inguinal scarring after surgery by an anterior approach makes a posterior approach preferable for the reoperation, and vice versa; the results reported in the literature bear out this common-sense conclusion. A Swedish registry study (23) revealed a significantly lower rate of second recurrences when an endoscopic/laparoscopic approach was used after prior anterior surgery, rather than a repeated anterior approach. After prior posterior surgery, however, a repeated posterior approach yielded equivalent results to an anterior approach. The EHS recommends endoscopic/laparoscopic surgery for recurrences after prior surgery through an anterior approach (24).

Mesh technology and aspects of surgical technique

As mentioned above, a meta-analysis has shown that the use of a mesh does not increase the likelihood of chronic pain (15). The important attributes of modern meshes have been summarized by Klinge (25) (*Table 3*).

Histopathologic study of hernia meshes explanted from human patients has shown that they possess the desired properties (26). The markedly reduced foreign-body reaction to polyvinylidene fluoride (PVDF) has been demonstrated in long-term animal experiments, as has the effect of polypropylene (PP) and PVDF on collagen synthesis (e12). PVDF visualization with

Indications

The classic indications for endoscopy/laparoscopy are inguinal hernia in a woman, bilateral inguinal hernia, and recurrent hernia after a prior anterior approach.

Mesh technology

Large-pore meshes are obligatory. In laparoscopic/endoscopic hernia repair, as opposed to the Lichtenstein technique, they do not need to be fixed in most cases.

supramagnetic iron ions is not merely of scientific interest; it can also be used as a diagnostic aid for the evaluation of complications (27).

In summary, large-pore meshes are associated with reduced chronic pain after open inguinal hernia surgery (28) (evidence level 1). Although this has not yet been demonstrated for laparoscopic/endoscopic surgery (29) (evidence level 1), large-pore meshes are recommended in such cases as well, by analogy (16).

The utility of self-adhesive meshes cannot yet be definitively assessed. The Lichtenstein technique requires fixation with non-resorbable material (e13); mesh fixation is largely unnecessary in laparoscopic/endoscopic hernia repair (e14) (evidence level 1). In a Swedish study, fixation with short-term resorbable material (e.g., when a self-adhesive mesh was used) yielded a higher recurrence rate than fixation with long-term resorbable or non-resorbable material (30). The follow-up intervals in the studies on self-adhesive meshes and on glue fixation in the Lichtenstein technique were too short (about 1 year) (31, 32), but they did reveal that gluing causes significantly less chronic pain (evidence level 1).

Special cases: incarcerated inguinal hernia

Incarcerated inguinal hernia can and must be differentiated from irreducible hernia on the basis of the severe pain that it causes, acute onset, and (sometimes) clinical evidence of acute bowel obstruction. It is an indication for immediate surgery. An evaluation of the Danish hernia registry, compared to the hospital registry, revealed that incarcerated hernias are not always treated with the requisite speed even in western Europe (33). From 2003 to 2005, 158 patients died after emergency surgery for an incarcerated inguinal hernia. 60% had been symptomatic for more than 48 hours. In 41%, the inguinal area had not been examined at the time of hospital admission; 35% had been admitted to medical rather than surgical wards; and only 23% had undergone surgery within 8 hours of admission. These frightening statistics reveal a problem that is surely not limited to Denmark and underscore the vital importance of thorough physical examination and of surgical consultation in the interdisciplinary emergency room.

The results of surgery for incarcerated hernia were analyzed in a retrospective study of 166 consecutive patients (e15) with inguinal (50.6%), femoral (25.9%), umbilical (22.3%), and other kinds of hernia (1.2%). A mesh was used in 38.5%. Multivariate analysis re-

TABLE 3

Required properties of modern mesh materials, such as polypropylene and polyvinylidene fluoride

	Polypropylene (PP)	Polyvinylidene fluoride (PVDF)
Monofilament	+	+
Pore size >1–2 mm	+	+
Foreign-body reaction	++	+
Visibility in imaging studies (ultrasonography, CT, MRI)	–	++

CT, computerized tomography; MRI, magnetic resonance imaging

vealed that the need for bowel resection was the single independent risk factor for morbidity. The use of a mesh did not alter the rate of any type of complication.

A further retrospective study of 234 patients with incarcerated inguinal hernia, nearly all of whom underwent mesh-based repair, was published very recently (34). Bowel resection was needed in 13.7% of cases. 14 patients (6%) had wound infections. The recurrence rate was only 0.9% on clinical follow-up, with a median observation time of 62.5 months. The authors concluded that mesh-based repair of incarcerated inguinal hernia is reasonable and safe even if bowel resection is needed.

The question whether to use a mesh to repair an incarcerated inguinal hernia was also addressed in a systematic review of 9 individual studies, 2 of which were randomized trials (35). The MINORS scores of the non-randomized studies ranged from 9 to 19 out of 24 points (mean, 14.1). The recurrence rate was found to be 5 times higher without a mesh than with one, and the infection rate was significantly lower in the mesh group. There was no difference between repair with and without a mesh in the small number of patients who needed bowel resection. The authors concluded that mesh-based repair is needed in all cases of incarcerated inguinal hernia.

Patient-specific risk factors for recurrence

Highly relevant information for both the choice of surgical technique and patient information before surgery has been obtained from the analyses of case registries with high-quality data. Open technique is an independent risk factor for recurrence, as is the rare

Emergencies

In any emergency (or even elective) admission to the hospital, examination of the inguinal region by an experienced surgeon is essential when indicated.

Patient-specific risk factors for recurrence

- female sex
- direct hernia
- sliding hernia in males
- cigarette smoking
- already recurrent hernia

situation of a direct hernia in a female patient (22). Sliding hernia in a male patient is significantly correlated with postoperative recurrence (36). Reoperation is twice as common for direct hernias than for indirect ones (37). These results have been confirmed by multivariate analyses of data from 70 000 to 85 000 patients and in a meta-analysis of data from 375 620 patients (38). In summary, direct hernia, female sex, recurrent hernia, and cigarette smoking are all independent factors favoring recurrent herniation (or a second recurrent hernia).

Chronic pain

In this section, we will discuss only the prevention of chronic pain, because its diagnosis and treatment generally require systematic interdisciplinary collaboration (39, 40), an adequate discussion of which could fill a separate article.

The use of endoscopic/laparoscopic technique helps prevent chronic pain (5, 19). Large-pore mesh has been shown to be beneficial for the prevention of chronic pain after open surgery and is analogously recommended when endoscopic/laparoscopic technique is used (16, 28).

Adequate analgesia immediately after surgery is important, as patients who report pain of a level higher than 3 on the Visual Analog Scale in the early postoperative period are six times as likely to develop chronic pain thereafter; this finding was statistically significant (4). In this study, the frequency of chronic pain was 1.25% after TEP and 1.29% after TAPP. Pain after inguinal hernia surgery should be documented in a structured fashion on the Visual Analog Scale and treated with adequate, adapted analgesic medication.

This review cannot cover every aspect of inguinal hernia surgery exhaustively. Rather, it is intended to provide an overview of current surgical methods, and to show that no single method is appropriate for all patients. Every surgeon dealing with this disease should have technical mastery of both open surgery and endoscopic/laparoscopic methods, so as to practice in conformity to the existing guidelines and thereby give patients the best possible treatment in the light of current scientific knowledge.

Conflict of interest statement

Prof. Berger has received reimbursement of meeting participation fees, as well as travel and accommodation expenses and honoraria for the preparation of scientific presentations, from med update GmbH.

Chronic pain

The probability of chronic pain can be lowered by certain technical intraoperative measures and by adequate early postoperative analgesia.

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Supplementary material
For eReferences please refer to:
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Question 1

In the epidemiology of inguinal hernia, which of the following statements is true?

- a) It is more common in women.
- b) Its incidence peaks between the ages of 20 and 40.
- c) It is more common on the left.
- d) Femoral hernias are the most common type in men.
- e) Its incidence rises with age.

Question 2

What is now considered an important cause of inguinal hernia?

- a) Direct trauma
- b) A hormonal imbalance
- c) A disturbance of the extracellular matrix
- d) Physical labor
- e) Disordered neuromuscular innervation

Question 3

What is the main method of diagnosing inguinal hernia?

- a) Dynamic ultrasonography
- b) MRI (supine and with a Valsalva maneuver)
- c) Herniography
- d) Physical examination
- e) Diaphanoscopy

Question 4

What should be recommended for a 61-year-old man with an asymptomatic inguinal hernia?

- a) Surgery within 4 weeks
- b) Watchful waiting as an option that is just as good as primary surgery
- c) Adequate analgesic medication in case pain arises
- d) Conservative treatment, as suture-based methods of hernia repair have high recurrence rates
- e) A truss, considering that the patient had a heart attack six years ago

Question 5

What surgical method does the European Hernia Society (EHS) recommend in its guidelines on inguinal hernia treatment in adults?

- a) Repair of bilateral hernias through an anterior approach
- b) Repair of unilateral hernias with a suture-based technique
- c) Laparoscopic/endoscopic repair of inguinal hernias in women
- d) Preferably, laparoscopic/endoscopic techniques for unilateral inguinal hernia
- e) Preferably, Bassini repair when a suture-based technique is used

Question 6

Which of the following is a risk factor for recurrent inguinal hernia based on the technique of the initial operation?

- a) The posterior approach for an inguinal hernia in a woman
- b) The anterior reproach for a recurrence after a prior anterior approach
- c) The posterior approach for a recurrence after a prior posterior approach
- d) Suture fixation of a mesh in an open procedure
- e) Non-use of a mesh in a laparoscopic/endoscopic procedure

Question 7

What patient-specific factor is correlated with recurrent inguinal hernia?

- a) Sliding hernia in a man
- b) Male sex
- c) Indirect hernia
- d) Regular alcohol consumption
- e) Primary inguinal hernia

Question 8

Which of the following is true of hernia repair with a mesh?

- a) Small-pore meshes in open surgery are more likely to cause chronic pain
- b) Large-pore meshes in open surgery are more likely to cause chronic pain
- c) Polyester meshes should be used
- d) Self-adhesive meshes are now the best option
- e) Mesh rupture is a common cause of recurrence

Question 9

Chronic pain after inguinal hernia repair is common. How can it be made less common?

- a) With open surgery
- b) With suture-based techniques
- c) With small-pore meshes
- d) With laparoscopic/endoscopic technique
- e) With early elective surgery

Question 10

A 70-year-old man has had a painful protrusion in his left groin since yesterday and presents to the emergency room at 8 pm with recurrent vomiting. What are the appropriate diagnostic and therapeutic measures to be taken?

- a) Tomographic imaging
- b) Operation the next morning if the hernia is irreducible
- c) Transfer to a hernia center
- d) Operation as soon as possible, with a suture-based repair, because the hernia is incarcerated
- e) Operation as soon as possible, with a mesh-based repair, because the hernia is incarcerated

Supplementary material to:

Evidence-Based Hernia Treatment in Adults

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