

## Review

# Existing Controversies in Inguinal Hernia Treatment

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### REZUMAT

#### *Controverse actuale în tratamentul herniei inghinale*

Una dintre cele mai frecvente afecțiuni ce necesită tratament chirurgical ale adultului, hernia inghinală este încă o sursă de controverse. Acest lucru se întâmplă deși evoluția chirurgiei a adus în prim plan o serie de tehnici chirurgicale, niciuna nereușind însă prin rezultate să se impună ca standard chirurgical. Apariția materialelor de aloplastie, a tehnicilor tension-free dar și a tehnicilor minim invazive a dat răspuns multor întrebări din acest domeniu chirurgical. Controversele persistă încă între chirurgia clasică (deschisă) și cea minim invazivă și sunt cu atât mai mari cu cât această patologie chirurgicală reprezintă o importantă problemă pentru sistemele de sănătate, având importante urmări atât în plan economic cât și în plan social.

**Concluzii:** Datele de mai sus oferă răspunsuri controversate, sau nu, la cateva din multiplele probleme legate de tratamentul herniei inghinale indiferent de modalitatea tehnică abordată. Plecând de la aceste date, Societatea Europeană de Herniologie (EHS) a elaborat un “Ghid de tratament pentru hernia inghinală la adult” care din perspectiva tehnicii chirurgicale recomandă în hernia uni/bilaterală operațiile cu material aloplastic prin operație Lichtenstein sau laparoscopică, în hernia recidivată abordare chirurgicală în funcție de metoda folosită la operația anterioară, preferându-se calea nefolosită încă. Între mențiunile speciale, în cazul alegerii metodei laparoscopice, se preferă TEP față de TAPP. Cu excepția operației Lichtenstein și a tehnicilor laparoscopice, niciuna dintre tehnicile chirurgicale alternative cu materiale aloplastice nu are în prezent suficiente date statistice care să susțină alegerea lor.

**Cuvinte cheie:** hernie inghinală, tehnica Lichtenstein, TAPP, TEP, laparoscopie

### ABSTRACT

Inguinal hernia in adults is yet another source of controversies, being also one of the most frequent pathologies that require surgical treatment. Even if surgery progress brought up a series of innovative techniques, none succeeded to deliver best results in order to position itself as best practice. Nevertheless, many answers were provided by introduction of alloplastic materials, tension-free techniques and also minimal invasive procedures.

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Open surgery versus laparoscopic surgery is still an open debate, amplified by the substantial implications in care system, with social and economical consequences.

**Conclusions:** The data presented below offer more or less controversial answers to some of the multiple problems linked to inguinal hernia treatment, regardless of the technique a surgeon might choose. Starting from these data, the European Herniology Society (EHS) elaborated a “Guide for the treatment of inguinal hernia in adults” which, from the perspective of surgical techniques, recommends alloplastic material interventions using either the Lichtenstein or laparoscopic techniques; and for relapsed hernias, a surgical approach depending on the method already used in the previous operation, favoring the yet-unused approach. Special mention should be made - when using a laparoscopic method - for the use of TEP rather than TAPP. With the exception of both Lichtenstein's technique and laparoscopic methods, none of the alternative surgical methods using alloplastic materials benefits at present from sufficient statistical data enabling us to choose one rather than another.

**Key words:** inguinal hernia, Lichtenstein technique, TAPP, TEP, laparoscopy

Inguinal hernia is one of the most frequently encountered adult pathologies requiring surgical treatment, and it represents an important problem for healthcare systems, with multiple consequences on both the social and economic plan. Although its incidence and prevalence are not exactly known, the admitted possibility for an individual to get an inguinal hernia during his lifetime ranges around 27% for men compared to only 3% for women. [1] [2]. The evolution of surgery has brought to the fore multiple technical developments which, although technically alluring, could not manage to become surgical standard procedures. The 80's saw the development of synthetic alloplastic materials and also “tension-free” repair principles, peaking with the Lichtenstein technique, which decreased the relapse rate so much that it made this procedure the “gold standard” of this type of pathology for many surgeons. The development of minimal invasive surgery gradually overtook all abdominal “organs” and the early nineties, starting with 1993, saw the rapid development of minimal invasive techniques for the treatment of inguinal hernia, which proved to be statistically as efficient as the technique Lichtenstein initially described. From that moment on, the surgical world adopted radically different positions, each surgical school offering arguments for or against classical or laparoscopy methods, a dispute which triggered many controversies, more or less backed by statistical data.

The following pages will try to bring to the fore present day controversies in the actual surgical treatment of inguinal hernias, keeping in mind both the

fact that today's patient is a highly- informed person and that the obvious trend leans towards a decrease of surgical invasive techniques, with the avowed purpose of increasing patient well-being and offering him a better quality of life.

Compared with the method Lichtenstein described in the 80's, the laparoscopic method implies coverage of Fruchaud's myopectineal region with alloplastic material, by addressing the posterior face of the abdominal wall. This is made possible by either a trans-peritoneal (TAPP) or a directly extra-peritoneal (TEP) approach. The treatment fundamental objectives remain the same, but the advantages offered by laparoscopic surgery are already well-known (millimetric cutaneous incisions at a distance from the operating field, reduced postoperative algic symptoms, fast postoperative recovery with rapid social-economical reintegration, and particularly the possibility of intraoperative diagnosis for asymptomatic contra-lateral hernias and/or other intraperitoneal lesions). Beyond all the positive aspects of the method, new complications, not known in “classic” surgery, can also occur-a fact which will surely fuel even more controversies.

In 2009 the European Herniology Society (EHS) produced a comprehensive “Guide for the treatment of inguinal hernia in adults” based upon statistical data and seen as an attempt to answer numerous questions posed by the surgical world and also to standardize surgical attitudes towards this type of pathology. But beyond the EHS's recommendations, the accumulation of large amounts of statistically analyzed data has yet to prove the absolute

superiority of one method above others, as many questions and controversies still persist, waiting for definitive answers.

The next pages will reference the main actual controversies; the topic of specific complications for each of the two surgical methods will be addressed in a separate discussion.

Thus, thinking about treatment indications:

**Do all inguinal hernias in the adult patient have a surgical indication?**

**When can conservative treatment be considered a possibility?**

If the operative indication is clear for both symptomatic and complicated hernias, controversies still persist for asymptomatic hernias. These are generally operated in order to prevent complications (incarceration and strangulation) because a complicated hernia operated in emergency conditions has a much higher mortality rate than the same hernia cured using elective surgery (5% versus 0.5%) [3] [4].

From a totally opposed perspective, the probability of hernia incarceration ranges between 0.3 – 3%/ year and surgically approaching each asymptomatic hernia case, especially in elderly patients, can lead to increased rates of morbidity and mortality [5] [6].

Concerning conservative treatment, two randomized studies published in 2006 (Fitzgibbons et al and O'Dwyer et al) analyzed results in the case of operations versus conservative treatment; between 23 and 29% of patients randomized for conservative treatment were operated, a thing which makes the option of conservative treatment in elderly men with asymptomatic or paucisymptomatic hernia seem an acceptable alternative [7] [8].

**What is the best paraclinical diagnostic method in patients with algic symptoms (but without a visible swelling)?**

Clinical examination is credited with a percentage of 74.5-92% sensitivity and of 93% specificity [9] [10], any persisting doubts occurring in the presence of painful symptoms with no palpable swelling. If a differential diagnosis between the three types of inguinal hernia is only necessary when one has doubts concerning a possible femoral hernia, differential diagnosis between a direct and/or indirect hernia does not bring any noticeable benefit [11] [12] [13] [14].

Amongst imagery diagnostic methods, ultra-

sound has a 81-100% specificity and a 33-100% sensitivity for hernias occulted to clinical examination, clearly superior to a CT scan, which is still useful when the surgeon suspects a bladder complication [15] [16] [17] [18] [19] [20] [21] [22] [23] [24] [25].

MRI examination offers the advantage of diagnosing other concomitant local pathologies (inflammation/ tumor) especially for athletes, with a sensitivity and specificity of 94.5% and 96.3% respectively [25].

The most sensitive and specifically accurate (100%) paraclinical investigation method is herniography. Still, it has two major disadvantages; it cannot identify the preherniary lipoma, which is sometimes responsible for the whole symptomatology, and the complication rate of this invasive method is about 4.3% [26] [27] [28] [29] [30] [31] [32] [33] [34]. A meta-analysis of the role radiological examinations play in the diagnosis of clinically occult inguinal hernias showed that echography had a sensitivity and a specificity of 86% and 77% respectively, while the CT scan had 80% respectively 65% and herniography a sensitivity of 90% and a specificity of 83%. The data lead to the conclusion that herniography should be our first choice for clinically occult hernias, but in its absence echography has a good rate of diagnosis too. If any diagnostic uncertainty still persists, MRI scan should be taken into account too [35].

**What are the main risk factors for inguinal hernia?**

**Do efficient prevention measures exist?**

Although technical literature cites a large number of factors with a role in inguinal hernia emergence (or relapse), smoking is certainly one of the most frequently encountered [36] [37]. Abnormal collagen metabolism (including familial inherited varieties), known aortic aneurysms [38] or postnatal persistence of the vaginal process [36] [39] are also accepted and proven risk factors, as is the presence of COPD in adults (inductive of chronic cough syndrome) [40].

Prostatism, constipation and hard physical labor still offer material for controversies concerning their role in inducing inguinal hernias in the adult patient [40] [41].

Ascites and peritoneal dialysis increase both the risk of occurrence and that of relapse for inguinal hernias [42] [43] [44]. Radical retro-pubic urological

interventions can produce inguinal hernias in 7-21% of cases; all the more reason for the urologist to seriously evaluate the prophylaxis of any such pathology [45] [46] [47] [48] [49].

Prevention wise, the only proven protective factors for inguinal hernia prophylaxis are giving up the habit of smoking, as well as avoiding strenuous and hard physical labor for extended periods of time. Other factors proven to elicit relapse are: type of surgical technique, type of hernia with significantly higher risk for direct hernias), and any relapse of the hernia itself.

### **What is the best surgical treatment technique, taking into consideration both the hernia type and the patient?**

Regardless of the chosen method, surgical treatment objectives are still the same; hernia sac dissection, reduction of sac contents and resection/reduction of the sac itself, and strengthening the fascia defect of the posterior wall of the inguinal canal by using alloplastic material. The final aim of any method is a decrease in relapse percentage and a diminution of postoperative chronic pain syndrome.

Theoretically, the Lichtenstein method places the alloplastic material on the wrong side of the parietal defect, and affixing the mesh behind the parietal (preperitoneal) defect would be the only way of ensuring that intraabdominal pressure keeps it in the correct required position, even when unfixed (as stated by Laplace's physical law). If we add the advantages of minimally invasive surgery to these considerations, one can already sketch the ideal type of operation. In reality, other factors, such as patient type, risk of relapse and / or complications, postoperative rehabilitation, patient satisfaction, method reproducibility and – last but not least - costs for both hospital and society should also be taken into account.

At present the Shouldice technique is unanimously accepted as the best tissue technique [50], while the mesh technique Lichtenstein proposed in 1984 is the best evaluated method from a statistical perspective and also the most frequent choice for open surgery treatment of inguinal hernias, with a fast learning curve (under twenty cases), low morbidity, feasible in one-day surgery using local anesthetic, and - more importantly - with a long-term relapse rate of under 4% [51] [52].

### **With or without mesh?**

This is a seldom asked question for the surgeon,

since an analysis of studies dating from 2002-2003 has shown the neat advantages of mesh operations upon tissue interventions, both in relapse percentages and the occurrence of chronic postoperative pain (with the Shouldice technique being analyzed separately) [53] [54] [55]. A study of Shouldice technique vs. laparoscopic surgery, published by Bittner et al in the British Journal of Surgery, 2005, has conclusively proven that there are no significant differences in relapse percentages when using any of the technical procedures, but the incidence of postoperative pain is higher in the tissue technique (5.4% vs. 2.2%,  $p < 0.00007$ ) [53]. On the other hand, three randomized studies comparing the Shouldice and Lichtenstein techniques (tissue vs. mesh) found higher relapse rates for tissue procedures. [56] [57] [58].

### **Open-approach or laparoscopic mesh?**

This is the great question, and the point of origin for important controversies and debates of the present.

Literature offers a large data field, including two meta-analyses of randomized studies published in 2005 and comparing different mesh techniques, both open (Lichtenstein) and endoscopic (TAPP and TEP); with obvious advantages for minimally invasive methods, through lower incidence of wound infection and hematomas, decreased incidence of chronic pain and hence a faster reintegration into everyday routines (about 6 days), but also a small decrease in the duration of hospitalization for a comparable relapse rate [59]. Any drawbacks of laparoscopic procedures, described by the same meta-analysis performed by Memo MA et al, were represented by a larger percentage of seldom occurring complications of laparoscopic surgery (vascular and visceral lesions - especially of the bladder) most of them being described for TAPP techniques (0.65% vs. 0-0.17% for both TEP and open procedures).

Shorter intervention time (between 8 and 13 minutes/operation), lower incidence of seromas and an equal rate of relapse were arguments in favor of Lichtenstein's technique [60].

Another meta-analysis including all studies made between 2002-2008 with a follow-up rate of more than 48 months, and analyzing relapse rate and the occurrence of chronic postoperative pain showed Lichtenstein's technique to have a minimal advantage upon the laparoscopic method as regards

relapse quotients (OR 1.16, 95% CI: 0.63-2.16) but also a minimally significant positive trend towards the apparition of chronic severe postoperative pain syndrome (OR 0.48, 95% CI: 0.11-2.06).

Thus, the best method for mesh treatment of inguinal hernia still remains a controversy, mainly because of debates linked to relapse and chronic postoperative pain syndrome. It is also true that traveling along the learning curve (estimated at 50 cases for laparoscopic surgery) significantly reduces the relapse rate. One can also note the fact that the occurrence of relapse is higher in studies where meshes with dimensions of 7-8/12 cm were used, instead of the recommended 10/15 cm standard [60] [61].

In relapsing inguinal hernias laparoscopic access after an initial anterior approach or open access after an initial laparoscopic approach both seem to offer obvious advantages, since they can use a still intact dissection plan for treating the relapse. In a 2006 study by Dedemadi et al comparing TEP vs. TAPP vs. Lichtenstein approaches in the treatment of relapsed inguinal hernia after an initial anterior approach, endoscopic approach showed less perioperative complications, less postoperative pain, lowered need for analgesics and faster social reinsertion [62].

The Lichtenstein technique remains unanimously accepted in large inguinal- scrotal hernias, after pelvis surgery, after pelvis radiotherapy, or whenever general anesthesia is contraindicated.

#### **Is the risk of relapse after tissue method higher in women than in men?**

#### **Is there need for a different strategy in approaching inguinal hernias in women?**

8-9% of inguinal hernia operations are performed on female patients, and an analysis of several studies shows that the rate of relapse in women operated using a tissue technique is between 2-13% [63] [64] [65] [66].

Epidemiological studies also seem to suggest that the rate of re-intervention is higher in women, with no discernible differences between tissue and open mesh operations [67] [68]; in approximately 40% of cases a femoral hernia is also diagnosed, without being able to tell whether it had already been present and undiagnosed at the moment the initial intervention was performed, or appeared after the operative maneuver.

The increased frequency of femoral hernias after

the surgical cure of the initial inguinal hernia represents a clear argument in favor of choosing a laparoscopic technique in women, as it is able to cover simultaneously both the inguinal and the femoral orifices, or in other words the whole myopectineal Fruchaud region - and not just the posterior wall of the inguinal canal.

#### **What is the most suitable type of mesh for inguinal hernias?**

#### **Do mesh-relates specific complications really exist?**

At present we can be certain that the use of alloplastic material dramatically decreases the risk of relapse in inguinal hernia, regardless of its placement, and that its presence seems to reduce and not amplify chronic postoperative pain syndrome [69]. The European Herniology Society (EHS) recommends (with A-degree priority) the use of non-resorbable mesh or composite mesh with non-resorbable components.

Many types of non-resorbable meshes are available now, differing by: polymer type and inter-perspersion, pore dimension, elasticity, weight and surface -, their use generating either non-specific complications (such as pain, infection or relapse) or specific ones (contraction, migration, dislocation or intestinal fistulae). The use of mono-filament polypropylene mesh is recommended for open surgery in order to minimize the risk of mesh colonization in case of infection [70].

Low-weight mesh with high porosity (>1000 microns) and oligofilamentary mesh incur less evolutionary shrinkage, produce weaker inflammatory reactions and reduced fibrosis, which makes them more easily incorporable, with diminished discomfort and smaller percentage of "foreign body" symptoms in open surgery, but with a possibly higher risk of relapse - especially for larger hernias and/if hernias which were not accurately fixed [71] [72] [73] [74] [75] [76] [77] [78] [79] [80] [81].

#### **What is the safety and efficiency of one-day surgery in inguinal hernias?**

First used for inguinal hernia treatment in 1955, with obvious advantages (faster patient mobilization, lowered costs and better patient compliance) the technique was confirmed in the late seventies by both randomized and prospective studies and accepted as being sure, efficient and 56% cheaper than hospital admission [82] [83] [84] [85] [86] [87].

What is more, an ample Danish study showed that readmission rate for this type of surgery is 0.8%, and that although the Lichtenstein technique in combination with local anesthesia seems to be the most suitable procedure for this type of surgery, other types of operations and anesthetic techniques can be successfully practiced, with the notable exception of Stoppa's technique [88] [89].

Initially this type of surgery was preferentially performed on younger non-obese patients with ASA I-II scores and an estimated operation time of under one hour; nowadays surgical criteria have become more lax, any patient able to benefit from proper at-home postoperative care being eligible; one cannot minimize the importance of the anesthetist's role in patient admission and selection [90] [91] [92].

These reasons, amongst others, explain the increasing global trend in the number of patients operated under one-day surgery techniques, with local differences largely due to different healthcare systems. Between 2003-2004, around 35% of operations performed in Holland and 35% in Spain were of this type, whereas in Sweden the percentage was around 75% [54] [93].

#### **Is routine antibiophylaxis a necessity?**

Judging from the point of view of one-day surgery followed by home care, one could be tempted to answer affirmatively. The risk of postoperative infection, either with or without mesh, is around 0- 14.4% in prospective studies delineating an incidence of 4.3% surgical wound infection for tissue methods and 2.4% for mesh procedures [94] [95] [96] [97] [98] [99] [100] [101] [102] [103] [104] [105] [106] [107].

A meta-analysis using a group of 1,867 patients undergoing tissue interventions for inguinal hernias found a rate of infection of 2.88% for the antibiophylaxis group and 4.30% in the control group (OR 0.65, 95%CI: 0.35-1.21). The same type of meta-analysis using this time a group of 3,006 patients operated using mesh techniques found an infection rate of 1.6% in the antibiotic- protected group and 3.1% in the control group, with no statistical significance (OR 0.59, 95%CI: 0.34-1.03), the EHS recommendation in this case being abstention from antibiotic prophylaxis for low-risk patients.

#### **Is local anesthesia more satisfactory, safer and more efficient than other types of anesthesia?**

##### **Should regional anesthesia be avoided?**

The most suitable type of anesthesia for inguinal

hernia operations should be simple and safe for both surgeon and patient, cost efficient and with a low morbidity rate, because anesthetic secondary effects as well as increased hospital stay are frequently due to anesthetic techniques.

General anesthesia, with its use of modern short-acting medication (with or without local anesthetic potentiation) is considered safe for one-day surgery. Problems may arise from an increased risk of respiratory and cardiovascular complications, postoperative nausea and emesis, but also from urinary tract complications following central hypnotic effects of anesthetic drugs, which can lead to increased duration of hospitalization [108].

Regional anesthesia can trigger acute urine retention, although progress has been made by introducing short- acting anesthetics or using an association of spinal opioid and lower anesthetic doses [97] [109] [110] [111].

The open surgery treatment of inguinal hernia is almost always possible using local anesthetic techniques [112] [113] [114] either through local tissue infiltration, or by iliohipogastricus or ilioinguinal nerve blocks – or even a combination of the two approaches; efficiency depends upon the surgeon's degree of training in anesthetic technique, but also upon a gentle intraoperative manipulation of tissues and organs [115] [116] [117] [118]. Young anxious patients, obese patients and those with large inguino-scrotal hernias or a suspicion of complicated hernias are considered unsuitable for this type of anesthetic technique. At present a number of 14 randomized studies exist, comparing local and regional/general anesthesia [108] [109] [119] [120] [121] [122] [123] [124] [125] [126] [127] [128] [129] [130] but we found only one study analyzing general vs. regional anesthesia.

With the notable exception of one study [126], the advantages of local anesthesia seem obvious; less intense postoperative pain, less post-anesthetic complications, easier spontaneous micturition, quicker hospital discharge, faster postoperative recovery and lowered costs.

#### **Which operative technique has the shortest recovery period?**

Recovery period varies considerably, due to each surgeon's postoperative recommendations and each patient's personal level of activity [131].

Thus operative technique type is not the sole factor involved in an operated patient's recovery

process; one can also consider postoperative algic syndrome, associated co-morbidity and also local cultural customs [132] [87] [54] [133] [134].

All tension -free, open or laparoscopic procedures allow for faster postoperative recovery than tissue techniques. As a mean, a patient operated using mesh-techniques recovers 4 days earlier than a comparable patient operated using a tissue- procedure; and a patient operated using laparoscopy recovers 7 days earlier than a comparable patient operated using open surgical mesh techniques [53] [54] [135] [136] [137] [138] [139] [140] [141] [142] [143] [99].

In this sense, the EHS recommendation favors laparoscopic surgery if one aims for fast postoperative recovery times.

### Should physical labor and sport be forbidden postoperatively?

This is an extremely pertinent question if one takes into consideration differences in both local customs and healthcare systems. A prospective study analyzing the relapse rate a year after surgery by comparing two types of postoperative recommendations regarding physical effort (starting hard physical labor after 3 weeks vs. 10 weeks) after surgical hernia cure using tissue procedures, showed this had no influence whatsoever upon the relapse rate [144]. More, in the case of patients operated using Lichtenstein's technique under local anesthetic a recommendation of limited hard physical labor for 3 weeks postoperatively was issued, but it was noted that 75% of them restarted their current daily routines after 6 days and resumed physical labor after another 6 days [145].

Concerning motor vehicle driving, recommendations vary considerably, studies showing that 7 days postoperatively the driving reaction time was normal in 82% of patients who underwent laparoscopic surgery, 64% of patients operated using Lichtenstein's technique, and 33% of patients upon which a tissue method operation was performed [146].

## CONCLUSIONS

The data presented above offer more or less controversial answers to some of the multiple problems linked to inguinal hernia treatment, regardless of the technique a surgeon might choose. Starting from these data, the European Herniology Society (EHS) elaborated a "Guide for the treatment of inguinal hernia in adults" which, from the perspective of

surgical techniques, recommends alloplastic material interventions using either the Lichtenstein or laparoscopic techniques; and for relapsed hernias, a surgical approach depending on the method already used in the previous operation, favoring the yet- unused approach. Special mention should be made, when using a laparoscopic method, for the use of TEP rather than TAPP.

With the exception of both Lichtenstein's technique and laparoscopic methods, none of the alternative surgical methods using alloplastic materials benefits at present from sufficient statistical data enabling us to choose one rather than another.

## REFERENCES

1. IM. Rutkov, Epidemiologic, economic and sociologic aspects of hernia surgery in the United States in 1990s., 1998, vol. 78.
2. Goldacre MJ. 25. Primates P, "Inguinal hernia repair: incidence of elective and emergency surgery, readmissions and mortality," s.l.:Int J Epidemiol, pp. 835-839, 1996.
3. Kehlet H, Strand L, Malmstrom J, Andresen FH, Wara P, Juul P, Callesen T., Bay-Nielsen M, "Quality assessment of 26304 herniorrhaphies in Denmark: a prospective nationwide study. Danish Hernia database Colaboration," 351 2001.
4. Stylianidis G, Haapamaki M, Nillson E, Nordin P, Nillson H, "Mortality after groin hernia surgery," Ann Surg, vol. 245, pp. 656-660, 2007.
5. Dawson J, Jarvis M, Holbsley M. Gallegos NC, "Risk of strangulation in groin hernias," Br J Surg, vol. 78, pp. 1171-1173, 1991.
6. S. Post, "Against the principle surgical indications in inguinal hernia," Chirurg, vol. 68, pp. 1251-1255, 1997.
7. Giobbie-Hurder A, Gibbs JO, Dunlop DD, Reda DJ, McCarthy M Jr, Neumayer LA, Barkun JS, Hoehn JL, Murphy JT, Sarosi GA Jr, Syme WC, Thompson JS, Wang J, Jonasson O. Fitzgibbons RJ Jr, "Watchful waiting vs repair of inguinal hernia in minimally symptomatic men: a randomized clinical trial," JAMA, vol. 295, pp. 285-292, 2006.
8. Chung L. O'Dwyer PJ, "Watchful waiting was as safe as surgical repair for minimally symptomatic inguinal hernias," Evid Based Med, vol. 11, p. 73, 2006.
9. Kolb H, Kuckuk B, Haaga S, Leibl BJ, Kraft K, Bittner R. Kraft BM, "Diagnosis and classification of inguinal hernias," Surg Endosc, vol. 17, pp. 2021-2024, 2003.
10. de Valois JC, Go PM, Rosenbusch G. van den Berg JC, "Detection of groin hernia with physical examination, ultrasound and MRI compared with laparoscopic findings," Invest Radiol, vol. 34, pp. 739-743, 1999.
11. Kurzer M, Waters KJ. Kark A, "Accuracy of clinical diagnosis of direct and indirect inguinal hernia," Br J Surg, vol. 81, pp. 1081-1082., 1994.
12. Hutchinson A, Roberts A, Withers H. McIntosh A, "Evidence-based management of groin hernia in primary care - a systematic review.," Fam Pract, vol. 17, pp. 442-447, 2000.
13. Brain AJ, Grundy DJ, Hobsley M. Ralphs DN, "How accurately can direct and indirect hernias be distinguished?," Br Med J, vol. 280, pp. 1039-1040, 1980.
14. Obertop H. Simons MP, "Lichamelijk onderzoek geeft uitsluitsel over een mediale dan wel een laterale liesbreuk.," van Everdingen JJE (ed) Medische misvattingen., 2001.
15. Nice C, Uberoi R. Alam A, "The accuracy of ultrasound in the diagnosis of clinically occult groin hernias in adults.," Eur radiol, vol. 15, pp. 2457-2561., 2005.
16. Morgan D, Pentlow B, Roe A. Bradley M, "The groin hernia - an

- ultrasound diagnosis?," *Ann R Coll Surg Engl*, vol. 85, 2003.
17. Arregui ME, Lilly MC, "Ultrasound of the inguinal floor for evaluation of hernias," *Surg Endosc*, vol. 16, pp. 659-662., 2002.
  18. Hensor E, Lansdown MJ, Ambrose NS, Chapman AH, Robinson P, "Inguinofemoral hernia accuracy of sonography in patients with indeterminate clinical features," *AJR Am J Roentgenol*, vol. 187, pp. 1168-1178., 2006.
  19. Pflingsten FP, Dreuw B, Schumpelick V, Truong S, "Value of sonography in diagnosis of uncertain lesions of the abdominal wall and inguinal region," *Chirurg*, vol. 64, pp. 468-475, 1993.
  20. Turkbey B, Ozcan O, Akdogan B, Karcaaltincaba M, Ozen H, Akpınar E, "Bilateral scrotal extraperitoneal herniation of ureters: computed tomography urographic findings and review of the literature.," *J Comput Assist Tomogr*, vol. 29, pp. 790-792, 2005.
  21. Baltacıoğlu F, Tuney D, Cimsit NC, Ekinci G, Biren T, Andac N, "Inguinoscrotal bladder herniation: is CT a useful tool in diagnosis?," *Clin Imaging*, vol. 26, pp. 347-348., 1980.
  22. Finocchi V, Giunta S, De Carli P, Crecco M, Caterino M, "Bladder cancer within a direct inguinal hernia: CT demonstration.," *Abdom Imaging*, vol. 26, pp. 664-666., 2001.
  23. Rygaard H, Jess P, Hojer AM, "CT in the diagnosis of abdominal wall hernias: a preliminary study.," *Eur Radio*, vol. 7, pp. 1416-1418., 1997.
  24. De Valois JC, Go PM, Rosenbusch G, van den Berg JC, "Radiological anatomy of the groin region.," *Eur Radiol*, vol. 10, pp. 661-670., 2000.
  25. de Valois JC, Go PM, Rosenbusch G, van den Berg JC, "Detection of groin hernia with physical examination, ultrasound and MRI compared with laparoscopic findings.," *Invest Radiol*, vol. 34, pp. 739-743. , 1999.
  26. Evans R, Neilson D, Hurley P, Calder F, "Value of herniography in the management of occult hernia and chronic groin pain in adults.," *Br J Surg*, vol. 87, pp. 824-825. , 2000.
  27. Patel S, Glaves J, Ravi K, Garner JP, "Is herniography useful?," *Hernia*, vol. 10, pp. 66-69. , 2006.
  28. Walsh S, Bury R, Bowyer K, Walker S, Gwanmesia II, "Unexplained groin pain: safety and reliability of herniography for the diagnosis of occult hernias.," *Postgrad Med J*, vol. 77, pp. 250-251., 2001.
  29. Hall PN, Wingate JP, Neoptolemos JP, Hall C, "Evaluation of herniography in the diagnosis of an occult abdominal wall hernia in symptomatic adults.," *Br J Surg*, vol. 77, pp. 902-906. , 1990.
  30. Sproat IA, Starling JR, Heise CP, "Peritoneography (herniography) for detecting occult inguinal hernia in patients with inguinodynia.," *Ann Surg*, vol. 235, pp. 140-144. , 2002.
  31. Ubhi SS, Rodgers PM, Watkin DF, Loftus IM, "A negative herniogram does not exclude the presence of a hernia.," *Ann R Coll Surg Engl*, vol. 79, pp. 372-375. , 1997.
  32. Kahn AM, Hamlin JA, "Herniography: a review of 333 herniograms.," *Am Surg*, vol. 64, pp. 965-969., 1998.
  33. Wingate JP., Jones RL, "Herniography in the investigation of groin pain in adults.," *Clin Radiol*, vol. 53, pp. 805-808. , 1998.
  34. Brown PW, van Beek EJ, Collins MC, Nadkarni S, "Herniography: a prospective, randomized study between midline and left iliac fossa puncture techniques.," *Clin Radiol*, vol. 56, pp. 389-392., 2001.,
  35. Victor B, Tsirlina, Amanda L, Walters, Amy E, Lincourt, Igor Belyansky, B Todd Heniford, Paul DD Colavita, "Laparoscopic versus open hernia repair: outcomes and sociodemographic utilization results from the nationwide inpatient sample.," *Surg Endosc*, vol. 27, pp. 109-117. , 2013.
  36. De Gruijl A, Hofman A, Van Beek AJ, Hoes AW, Pleumeekers HJ, "Prevalence of aortic aneurysm in men with a history of inguinal hernia repair.," *Br J Surg*, vol. 86, pp. 1155-1158. , 1999.
  37. Friis E, Jorgensen T, Vennits B, Andersen BR, Rasmussen GI, Kjaergaard J, Sorensen LT, "Smoking is a risk factor for recurrence of groin hernia.," *World J Surg*, vol. 26, pp. 397-400. , 2002.
  38. Zheng H, Si ZY, Bhardwaj R, Klosterhalfen B, Schumpelick V, Klinge U, "Altered collagen synthesis in fascia transversalis of patients with inguinal hernia.," *Hernia*, vol. 4, pp. 181-187. , 1999.
  39. Wadouch F, Lehnert B, "High coincidence of inguinal hernias and abdominal aortic aneurysms.," *Ann Vasc Surg*, vol. 6, pp. 134- 137. , 1992.
  40. Sanchez JL, Peris RT, Ivorra JC, Del Bano MJ, Sanchez CS, Arraez JI, Greus PC, Carbonell JF, "Risk factors associated with inguinal hernias: a case control study.," *Eur J Surg*, vol. 159, pp. 481- 486. , 1993.
  41. Alfonso JL, Delgado F, Prado MJ, Cortina P, Flich J, "Inguinal hernia and certain risk factors.," *Eur J Epidemiol*, vol. 8, pp. 277- 282. , 1992.
  42. Read RC, Cannon DJ, "Metastatic emphysema: a mechanism for acquiring inguinal herniation.," *Ann Surg*, vol. 194, pp. 270-278. , 1981.
  43. Youngson GG, Engeset J, "Ambulatory peritoneal dialysis and hernial complications.," *Surg Clin North Am*, vol. 64, pp. 385-392., 1984.
  44. Renke M, Bigda J, Smietan'ska I, Rutkowski B, Witkowski P, Sledziński Z, Smietan'ski M, "Management of inguinal hernia on peritoneal dialysis: an audit of current Polish practice and call for a standard.," *Int J Artif Organs*, vol. 29, pp. 573-577., 2006.
  45. Shinohara N, Harabayashi T, Sazawa A, Suzuki S, Kawarada Y, Nonomura K, Abe T, "Postoperative inguinal hernia after radical prostatectomy for prostate cancer.," *Urology*, vol. 69, pp. 326-329., 2007.
  46. Bergdahl C, Nyberg M, Pileblad E, Stranne J, Hugosson J, Lodding P, "Inguinal hernia after radical retropubic prostatectomy for prostate cancer: a study of incidence and risk factors in comparison to no operation and lymphadenectomy.," *J Urol*, vol. 166, pp. 964-967. , 2001.
  47. Hugosson J, Iversen P, Morris T, Lodding P, Stranne J, "Inguinal hernia in stage M0 prostate cancer: a comparison of incidence in men treated with and without radical retropubic prostatectomy – an analysis of 1105 patients.," *Urology*, vol. 65, pp. 847- 851., 2005.
  48. Hugosson J, Lodding P, Stranne J, "Post-radical retropubic prostatectomy inguinal hernia: an analysis of risk factors with special reference to preoperative inguinal hernia morbidity and pelvic lymph node dissection.," *J Urol*, vol. 176, pp. 2072-2076., 2006.
  49. Hugosson J, Lodding P, Stranne J, "Inguinal hernia is a common complication in lower midline incision surgery.," *Hernia*, vol. 11, pp. 247-252., 2007.
  50. Kleijnen J, van Geldere D, Hoitsma HF, Obertop H, Simons MP, "Role of the Shouldice technique in inguinal hernia repair: a systematic review of controlled trials and a meta-analysis.," *Br J Surg*, vol. 83, pp. 734-738. , 1996.
  51. Shulman AG, Lichtenstein IL, Amid PK, "Open "tensionfree" repair of inguinal hernias: the Lichtenstein technique.," *Eur J Surg*, vol. 162, pp. 447-453., 1996.
  52. Shulman AG, Amid PK, Montllor MM, Lichtenstein IL, "The tension-free hernioplasty.," *Am J Surg*, vol. 157, pp. 188-193. , 1989.
  53. Sauerland S, Schmedt CG, Bittner R, "Comparison of endoscopic techniques vs Shouldice and other open nonmesh techniques for inguinal hernia repair: a meta-analysis of randomized controlled trials.," *Surg Endosc*, vol. 19, pp. 605-615., 2005.
  54. Scott NW, Go PM, Ross S, Grant AM., McCormack K. (2003) Laparoscopic techniques versus open techniques for inguinal hernia repair. s.l. : EU Hernia Trialists Collaboration.
  55. McCormack K, Graham P, Go PM, Ross SJ, Grant AM, Scott NW. (2002) Open mesh versus non-mesh for repair of femoral and inguinal hernia.
  56. Redecke J, Kolninger J, Butters M, "Long-term results of a randomized clinical trial of Shouldice, Lichtenstein and transabdominal preperitoneal hernia repairs.," *Br J Surg*, vol. 94, pp. 562-565. , 2007.
  57. Alexandre JH, Campanelli G, Corcione F, Cucurullo D, Pascual MH, Hoferlin A, Kingsnorth AN, Mandala V, Palot JP, Schumpelick V, Simmermacher RK, Stoppa R, Flament JB, Miserez M, "The European hernia society groin hernia classification: simple and easy to remember.," *Hernia*, vol. 11, pp. 113-116. , 2007.
  58. Bartelmeß P, Jansson C, Svensson C, Edlund G, Nordin P, "Randomized trial of Lichtenstein versus Shouldice hernia repair in general surgical practice.," *Br J Surg*, vol. 89, pp. 45-49. , 2002.

59. Postiglione V, Pancaldi R, Lippa M, Tonni MP, Morandi O, Mazzetti S, Beschi M, Diana DR, Vergallo A, Bruni GC, Balducci D, "Prosthetic repair of inguinal and crural hernias.," *Minerva Chir*, vol. 52, pp. 1069–1075. , 1997.
60. Giobbie-Hurder A, Jonasson O, Fitzgibbons R Jr, Dunlop D, Gibbs J, Reda D, Henderson W, Neumayer L, "Open mesh versus laparoscopic mesh repair of inguinal hernia.," *N Engl J Med*, vol. 350, pp. 1819–1827., 2004, Veterans Affairs Cooperative Studies Program 456 Investigators..
61. Smedberg S, Arvidsson D, "Laparoscopic compared with open hernia surgery: complications, recurrences and current trends.," *Eur J Surg Suppl*, vol. 585, pp. 40–47. , 2000.
62. Sgourakis G, Karaliotas C, Christofides T, Kouraklis G, Karaliotas C, Dedemadi G, "Comparison of laparoscopic and open tension-free repair of recurrent inguinal hernias: a prospective randomized study.," *Surg Endosc*, vol. 20, pp. 1099–1104., 2006.
63. Schunk R, Dudda W, "Late follow-up analysis after 1202 operations for inguinal and femoral hernias.," *Langenbecks Arch Chir* , vol. 375, pp. 351–358., 1990, Lotheissen-McVay repair of hernia.
64. Feichter A, Hirbawi A, Kux M, Fuchsjaeger N, "Bassini operation with polyglycolic acid or polyester. A prospective randomized study of 300 cases.," *Chirurg*, vol. 60, pp. 273–276. , 1998.
65. Herzog U, "Late results following inguinal or femoral hernia surgery.," *Langenbecks Arch Chir*, vol. 375, pp. 5–10, 1990.
66. Aebersold P, Kulpfer K, Stucki U, Stirnemann H, Doran J, Ris HB, "10 years' experience using a modified Shouldice surgical technic for inguinal hernia in adults. II. Which factors modify the recurrence of inguinal hernia? ,," *Chirurg*, vol. 58, pp. 100–105., 1987.
67. Kehlet H, Bay-Nielsen M, "Inguinal herniorrhaphy in women. ," *Hernia*, vol. 10, pp. 30–33, 2006.
68. Edwards A, Haapaniemi S, Nordin P, Kald A, Koch A, "Prospective evaluation of 6895 groin hernia repairs in women.," *Br J Surg* , vol. 92, pp. 1553–1558., 2005.
69. Collaboration. EH, "Repair of groin hernia with synthetic mesh: meta-analysis of randomized controlled trials.," *Ann Surg*, vol. 235, pp. 322–332. , 2002.
70. O'Dwyer PJ, Taylor SG, "Chronic groin sepsis following tension-free inguinal hernioplasty.," *Br J Surg*, vol. 86, pp. 562–565. , 1999.
71. Heikkinen TJ, Wollert S, Osterberg J, Smedberg S, Granlund H, Ramel S, FellaInder G, Anderberg B, Bringman S, "Early results of a single-blinded, randomized, controlled, Internetbased multicenter trial comparing Prolene and Vypro II mesh in Lichtenstein hernioplasty.," *Hernia*, vol. 8, pp. 127–134. , 2004.
72. Wollert S, Osterberg J, Heikkinen T, Bringman S, "Early results of a randomized multicenter trial comparing Prolene and VyproII mesh in bilateral endoscopic extraperitoneal hernioplasty (TEP).," *Surg Endosc*, vol. 19, pp. 536–540., 2005.
73. Wollert S, Osterberg J, Smedberg S, Granlund H, FellaInder G, Heikkinen T, Bringman S, "One year results of a randomised controlled multi-centre study comparing Prolene and Vypro II-mesh in Lichtenstein hernioplasty.," *Hernia*, vol. 9, pp. 223–227., 2005.
74. Wollert S, Osterberg J, Smedberg S, Granlund H, Heikkinen TJ, Bringman S, "Three-year results of a randomized clinical trial of lightweight or standard polypropylene mesh in Lichtenstein repair of primary inguinal hernia. ," *Br J Surg*, vol. 93, pp. 1056–1059., 2006.
75. Wollert S, Osterberg J, Smedberg S, Bringman S, Heikkinen T, "Early results of a randomised trial comparing Prolene and VyproII-mesh in endoscopic extraperitoneal inguinal hernia repair (TEP) of recurrent unilateral hernias. ," *Hernia*, vol. 10, pp. 34–40. , 2006.
76. Hellwig M, Classen C, Rolttgermann S, Palmes D, Horstmann R, "Impact of polypropylene amount on functional outcome and quality of life after inguinal hernia repair by the TAPP procedure using pure, mixed, and titanium-coated meshes. ," *World J Surg*, vol. 30, pp. 1742–1749. , 2006.
77. Schmidt J, Zirngibl H, Langenbach MR, "Comparison of biomaterials in the early postoperative period.," *Surg Endosc* , vol. 17, pp. 1105–1109, 2003.
78. Schmidt J, Zirngibl H, Langenbach MR, "Comparison of biomaterials: three meshes and TAPP for inguinal hernia. ," *Surg Endosc* , vol. 20, pp. 1511–1517. , 2006.
79. Kumar S, Nixon SJ, Khan LR, "Early results for new lightweight mesh in laparoscopic totally extra-peritoneal inguinal hernia repair. ," *Hernia*, vol. 10, pp. 303–308., 2006.
80. Kingsnorth AN, Molloy RG, Small PK, Lammers B, Horeysek G, O'Dwyer PJ, "Randomized clinical trial assessing impact of a lightweight or heavyweight mesh on chronic pain after inguinal hernia repair. ," *Br J Surg* , vol. 92, pp. 166–170. , 2005.
81. Weiss B, Willer M, Neufang T, Lorenz D, Post S, "Randomized clinical trial of lightweight composite mesh for Lichtenstein inguinal hernia repair. ," *Br J Surg*, vol. 91, pp. 44–48. , 2004.
82. Ruckley CV. IA, *Br Med J*, vol. 2, pp. 712–714., 1979.
83. Walter F, Michelsen M, "Comparison of outpatient and inpatient operations for inguinal hernia (1971 to 1978) (author's transl). ," *Zentralbl Chir*, vol. 107, pp. 94–102., 1982.
84. Contandriopoulos AP, Valois M, Bastian ML, Lance JM, Pineault R, "Randomized clinical trial of one-day surgery. Patient satisfaction, clinical outcomes, and costs. ," *Med Care*, vol. 23, pp. 171–182., 1985.
85. Cuthbertson C, Fenwick N, Garraway WM, Ruckley CV, Prescott RJ, "Economic aspects of day care after operations for hernia or varicose veins. ," *J Epidemiol Community Health*, vol. 32, pp. 222–225., 1978.
86. Cuthbertson C, Fenwick N, Prescott RJ, Garraway WM, Ruckley CV, "Day care after operations for hernia or varicose veins: a controlled trial. ," vol. 65, pp. 456–459. , 1978.
87. Ogonna BC, Iya D, Ramyl VM, "Patient acceptance of outpatient treatment for inguinal hernia in Jos, Nigeria. ," *Cent Afr J Med*, vol. 45, pp. 244–246., 1999.
88. Bartholdy J, Hjortso NC, Engbaek J, "Return hospital visits and morbidity within 60 days after day surgery: a retrospective study of 18,736 day surgical procedures.," *Acta Anaesthesiol Scand*, vol. 50, pp. 911–919. , 2006.
89. Winnemoller C, Hellwig A, Meurer K, Plugge H, Kasoly K, Laubenthal H, Bauer KH, Uhl W, Weyhe D, "115 b SGB V threatens outpatient treatment for inguinal hernia. Analysis of outcome and economics. ," *Chirurg*, vol. 77, pp. 844–855., 2006.
90. Houghton K, Montgomery JE, Davies KE, "Obesity and day-case surgery.," *Anaesthesia*, vol. 56, pp. 1112–1115. , 2001.
91. Jarrett PE, "Day care surgery. ," *Eur J Anaesthesiol Suppl*, vol. 23, pp. 32–35. , 2001.
92. Chung F, Prabhu A, "Anaesthetic strategies towards developments in day care surgery.," *Eur J Anaesthesiol Suppl*, vol. 23, pp. 36–42. , 2001.
93. Prismant., *Jaardiskette voor ziekenhuizen 1999–2000.*, 2000.
94. Burcharth F, Larsen HW, Ruyder O, Andersen B, Andersen JR, "Polyglycolic acid, silk, and topical ampicillin. Their use in hernia repair and cholecystectomy.," *Arch Surg*, vol. 115, pp. 293–295., 1980.
95. van Geldere D, van Mesdag T, Bossers AN, Dekker B, Scheijde E, van Nieuwenhuizen R, Hiemstra E, Maduro JH, Juttman JW, Hofstede D, van Der Linden CT, Gouma DJ, Simons MP, Aufferacker TJ, "The role of antibiotic prophylaxis in prevention of wound infection after Lichtenstein open mesh repair of primary inguinal hernia: a multicenter doubleblindrandomized controlled trial. ," *Ann Surg* , vol. 240, pp. 955–960. , 2004.
96. Frieyro O, de la Pinta JC, Souto JL, Esteban J, Rubio JM, Sen ~ar ~s JF, Celdra~n A, "The role of antibiotic prophylaxis on wound infection after mesh hernia repair under local anesthesia on an ambulatory basis. ," *Hernia*, vol. 8, pp. 20–22. , 2004.
97. Miller SF, Jones LM, Finley RK Jr, "Elimination of urinary retention following inguinal herniorrhaphy. ," *Am Surg* , vol. 57, pp. 486–488., 1991.
98. Carmona A, Paga~ Morales R, "Utility of antibiotic prophylaxis in reducing wound infection in inguinal or femoral hernia repair using polypropylene mesh. ," *Cir Esp*, vol. 67, pp. 51–59. , 2000.
99. Chiotasso P, Massip P, Materre JP, Sarkissian M, Lazorthes F, "Local antibiotic prophylaxis in inguinal hernia repair.," *Surg Gynecol Obstet*, vol. 175, pp. 569–570. , 1992.

100. Ciga MA, Ortiz H, Oteiza F, "Antibiotic prophylaxis in inguinal hernioplasty.," *Cir Esp*, vol. 75, pp. 69–71., 2004.
101. Roxas MF, Hilvano SS, Perez AR, "A randomized, double-blind, placebo-controlled trial to determine effectiveness of antibiotic prophylaxis for tension-free mesh herniorrhaphy.," *J Am Coll Surg*, vol. 200, pp. 393–397., 2005.
102. Zaleznik DF, Hopkins CC, Dellinger EP, Karchmer AW, Bryan CS, Burke JF, Wikler MA, Marino SK, Holbrook KF, Tosteson TD, Segal MR, Platt R, "Perioperative antibiotic prophylaxis for herniorrhaphy and breast surgery.," *N Engl J Med*, vol. 322, pp. 153–160., 1990.
103. Seco-Gil JL, Sanchez-Manuel FJ, "Antibiotic prophylaxis for hernia repair Antibiotic prophylaxis for hernia repair.," *Cochrane Database Syst Rev* 4:CD003769., 2004.
104. BaIrlehner E, Schwetling R, "Is there an indication for general perioperative antibiotic prophylaxis in laparoscopic plastic hernia repair with implantation of alloplastic tissue?," *Zentralbl Chir*, vol. 123, pp. 193–195., 1998.
105. Byrne DJ, Leaper DJ, Karran SJ, Browne MK, Mitchell KJ, Taylor EW, "Antibiotic prophylaxis and open groin hernia repair.," *World J Surg*, vol. 21, pp. 811–814., 1997.
106. Delikoukos S, Christodoulides G, Spyridakis M, Mantzos F, Tepetes K, Athanassiou E, Hatzitheofilou C, Tzovaras G, "The role of antibiotic prophylaxis in elective tension-free mesh inguinal hernia repair: results of a single-centre prospective randomised trial.," *Int J Clin Pract*, vol. 61, pp. 236–239., 2007.
107. Akin EB, Dolalan S, Turkcapar AG, Pehlivan M, Gecim IE, Kuterdem E, Yerdel MA, "Effect of single-dose prophylactic ampicillin and sulbactam on wound infection after tension-free inguinal hernia repair with polypropylene mesh: the randomized, double-blind, prospective trial.," *Ann Surg*, vol. 233, pp. 26–33, 2001.
108. Greilich NB, White PF, Watcha MF, Tongier WK, Song D, "Recovery profiles and costs of anesthesia for outpatient unilateral inguinal herniorrhaphy.," *Anesth Analg*, vol. 91, pp. 876–881., 2000.
109. Zetterstrom H, Gunnarsson U, Nilsson E, Nordin P, "Local, regional, or general anaesthesia in groin hernia repair: multicentre randomised trial.," *Lancet*, vol. 362, pp. 853–858., 2003.
110. Adye BA, Jolly PC, Mulroy MF 2nd, Ryan JA Jr, "Outpatient inguinal herniorrhaphy with both regional and local anesthesia.," *Am J Surg*, vol. 148, pp. 313–316., 1984.
111. Jagdish S, Pai D, Rajendiran KM, Sultana A, "Inguinal herniorrhaphy under local anaesthesia and spinal anaesthesia – a comparative study.," *J Indian Med Assoc*, vol. 97, pp. 169–170, 175., 1999.
112. Bech K, Kehlet H, Callesen T, "One-thousand consecutive inguinal hernia repairs under unmonitored local anesthesia.," *Anesth Analg*, vol. 93, pp. 1373–1376., 2001.
113. Kurzer MN, Belsham PA, Kark AE, "Three thousand one hundred seventy-five primary inguinal hernia repairs: advantages of ambulatory open mesh repair using local anesthesia.," *J Am Coll Surg*, vol. 186, pp. 447–455., 1998.
114. Bay Nielsen M, Kehlet H, "Anaesthetic practice for groin hernia repair – a nation-wide study in Denmark 1998–2003.," *Acta Anaesthesiol Scand*, vol. 49, pp. 143–146., 2005.
115. Shulman AG, Lichtenstein IL, Amid PK, "Local anesthesia for inguinal hernia repair step-by-step procedure.," *Ann Surg*, vol. 220, pp. 735–737., 1994.
116. Shulman AG, Lichtenstein IL, Amid PK, "Open "tensionfree" repair of inguinal hernias: the Lichtenstein technique.," *Eur J Surg*, vol. 162, pp. 447–453., 1996.
117. Kingsnorth AN, Devlin HB, "Management of abdominal hernias.," 1998.
118. Ponka, JL, "Hernias of the abdominal wall.," 1980.
119. Godbole CSM, Alsarrage SAM, "A randomised controlled trial to compare local with general anaesthesia for inguinal hernia repair.," *J Kuwait Med Assoc*, vol. 24, pp. 31–34., 1990.
120. Hashemi F, Stryker SJ, Ujiki GT, Poticha SM, Behnia R, "A comparison of general versus local anesthesia during inguinal herniorrhaphy.," *Surg Gynecol Obstet*, vol. 174, pp. 277–280., 1992.
121. Faoual J, Hohlldobler G, Becker HP, Lampl L, Gerngross H. B, "A prospective randomized study on inguinal hernia repair according to the Shouldice technique. Benefits of local anesthesia.," *Chirurg*, vol. 71, pp. 52–57., 2000.
122. Greenan J, Ranasinghe DD, Shabestary SM, Pollock AV, Godfrey PJ, "Ventilatory capacity after three methods of anaesthesia for inguinal hernia repair: a randomized controlled trial.," *Br J Surg*, vol. 68, pp. 587–589., 1981.
123. Cubukcu A, Alponat A, GoInullullu NN, "Comparison of local and general anesthesia in tension-free (Lichtenstein) hernioplasty: a prospective randomized trial.," *Hernia*, vol. 6, pp. 29–32., 2002.
124. Kurukahvecioglu O, Karamercan A, Ege B, Ersoy E, Tatlicioglu E, Gultekin FA, "A prospective comparison of local and spinal anesthesia for inguinal hernia repair.," *Hernia*, vol. 11, pp. 153–156., 2007.
125. Mullen JT, Knapp RW, "Clinical evaluation of the use of local anesthesia for repair of inguinal hernia.," *Am Surg*, vol. 42, pp. 908–910., 1976.
126. Serpell MG, Millar K, Paterson C, Young D, Hair A, Courtney CA, Horgan P, Kumar S, Walker A, Ford I, O'Dwyer PJ, "Local or general anesthesia for open hernia repair: a randomized trial.," *Ann Surg*, vol. 237, pp. 574–579., 2003.
127. Kurt MN, Kurt I, Cevikel MH, Ozgul H, "Comparison of local, spinal, and general anaesthesia for inguinal herniorrhaphy.," *Eur J Surg*, vol. 168, pp. 455–459., 2002.
128. Shah S, Treckmann J, Schneider K, Schmitz R, "Extraperitoneal, "tension free" inguinal hernia repair with local anesthesia – a contribution to effectiveness and economy.," in *Langenbecks Arch Chir Suppl Kongressbd*, vol. 114, 1997, pp. 1135–1138.
129. McCrum AM, Williams NB, Horton RE, Teasdale C, "A randomised controlled trial to compare local with general anaesthesia for short-stay inguinal hernia repair.," *Ann R Coll Surg Engl*, vol. 64, pp. 238–242., 1982.
130. Mahabier C, Dawson I, Hop WC, Kok NF, Lange JF, Jeekel J, van Veen RN, "Spinal or local anesthesia in lichtenstein hernia repair: a randomized controlled trial.," *Ann Surg*, vol. 247, pp. 428–433., 2008.
131. T Callesen, "Inguinal hernia repair: anaesthesia, pain and convalescence.," vol. 50, pp. 203–218., 2003.
132. Butler M, Shaw S, Kingsnorth AN, Bowley DM, "Dispositional pessimism predicts delayed return to normal activities after inguinal hernia operation.," *Surgery*, vol. 133, pp. 141–146., 2003.
133. Baker DM, Locker A, Fawcett AN, Rider MA, "Return to work after inguinal hernia repair.," *Br J Surg*, vol. 80, pp. 745–746., 1993.
134. Callesen. T, "Inguinal hernia repair: anaesthesia, pain and convalescence.," vol. 50, pp. 203–218., 2003.
135. Ramel S, Heikkinen TJ, Englund T, Westman B, Anderberg B, Bringman S, "Tension-free inguinal hernia repair: TEP versus mesh-plug versus Lichtenstein: a prospective randomized controlled trial.," *Ann Surg*, vol. 237, pp. 142–147., 2003.
136. Rowland DY, Chung RS, "Meta-analyses of randomized controlled trials of laparoscopic vs conventional inguinal hernia repairs.," *Surg Endosc*, vol. 13, pp. 689–694., 1999.
137. Haukipuro K, Hulkko A, Heikkinen TJ, "A cost and outcome comparison between laparoscopic and Lichtenstein hernia operations in a day-case unit. A randomized prospective study.," *Surg Endosc*, vol. 12, pp. 1199–1203., 1998.
138. Burney RE, Peterson M, Christy B, Jones KR, "Return to work after inguinal hernia repair.," *Surgery*, vol. 129, pp. 128–135., 2001.
139. van Veen RN, Langeveld HR, Steyerberg EW, Jeekel J, Bonjer HJ, Kuhry E, "Open or endoscopic total extraperitoneal inguinal hernia repair? A systematic review.," *Surg Endosc*, vol. 21, pp. 161–166., 2007.
140. Patil NG, Yuen WK, Lau H, "Day-case endoscopic totally extraperitoneal inguinal hernioplasty versus open Lichtenstein hernioplasty for unilateral primary inguinal hernia in males: a randomized trial.," *Surg Endosc*, vol. 20, pp. 76–81., 2006.
141. Wake B, Perez J, Fraser C, Cook J, McIntosh E, Vale L, Grant A, McCormack K, "Laparoscopic surgery for inguinal hernia repair: systematic review of effectiveness and economic evaluation.,"

- Health Technol Assess, vol. 9, pp. 1–203; 2005.
142. Sauerland S, Bittner R, Schmedt CG, “Comparison of endoscopic procedures vs Lichtenstein and other open mesh techniques for inguinal hernia repair: a meta-analysis of randomized controlled trials,” *Surg Endosc*, vol. 19, pp. 188–199., 2005.
143. Shaddock P, Khaitan L, Morton J, Maupin G, Traverso LW, Velanovich V, “Analysis of the SAGES Outcomes Initiative groin hernia database,” *Surg Endosc*, vol. 20, pp. 191–198. , 2006.
144. Dewar EP, Taylor EW, “Early return to work after repair of a unilateral inguinal hernia,” *Br J Surg*, vol. 70, pp. 599–600., 1983.
145. Klarskov B, Bech K, Kehlet H, Callesen T, “Short convalescence after inguinal herniorrhaphy with standardised recommendations: duration and reasons for delayed return to work,” *Eur J Surg*, vol. 165, pp. 236–241., 1999.
146. Irving SO, Iddon J, Deans GT, Brough WA, Wilson MS, “A measurement of the ability to drive after different types of inguinal hernia repair,” *Surg Laparosc Endosc*, vol. 8, pp. 384–387. , 1998.