

**UNIVERSITY OF MEDICINE AND PHARMACY
“CAROL DAVILA” BUCHAREST
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**THE ADVANTAGES AND DISADVANTAGES OF
LAPAROSCOPIC SURGERY IN REPAIR OF THE ABDOMINAL WALL
DEFECTS**

DOCTORATE LEADER:
PROFESOR DOCTOR ȘERBAN DRAGOȘ

PhD Student:
DUMITRESCU VICTOR

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An inguinal hernia is an opening in the myofascial area of the oblique and transverse muscles that can allow herniation of intra-abdominal or extraperitoneal organs. These inguinal hernias can be divided into indirect, direct and femoral depending on the location. Most patients have a swelling or pain in the groin area. Health professionals recommend repair of all symptomatic hernias to avoid complications[1, 2].

The number of patients undergoing this procedure, per year, exceeds 20 million[3]. Patients with inguinal hernias are mainly symptomatic, requiring surgery; but even those who are asymptomatic have a 70% risk of needing surgery within 5 years of watchful waiting[4]. Inguinal hernia repair is one of the most frequently performed operations in general surgery, especially in the digestive field. Since the introduction of laparoscopic repair as well as the use of a synthetic mesh, surgical trends have changed over the last decade in the treatment of inguinal hernias. TAPP provides a better view of the inguinal anatomy and the procedure also has a short learning curve[12].

At the same time, TAPP could intraoperatively detect asymptomatic contralateral inguinal hernias and treat all types of inguinal hernias[8, 13].

We therefore aimed to evaluate the safety and early outcome of the laparoscopic transabdominal preperitoneal technique for inguinal hernia repair in adult patients. The overall objective of this paper was to illustrate the advantages of using the laparoscopic transabdominal preperitoneal (TAPP) method in inguinal hernia repair in adult patients. The quantification of these advantages will be done by: low level of postoperative pain, low number of postoperative complications, low number of days of hospitalization.

The general hypothesis of this research project was: It is assumed that by using the transabdominal preperitoneal laparoscopic method (TAPP), the medical staff can help the patient diagnosed with inguinal hernia in faster postoperative recovery, relapses can be avoided, and the patients' quality of life will increase.

Therefore, the present work is made up of two chapters: a theoretical part, the current state of the literature in the field of inguinal hernia surgery, and a practical part in which the effectiveness of some surgical methods is highlighted.

In the General Part, aspects related to the history of surgery in the repair of the abdominal wall, the classification of inguinal hernias and surgical techniques used in cases diagnosed with this condition are discussed.

Thus, in the first chapter we discussed the history of medicine in terms of surgical breakthroughs in inguinal hernia repair. We also discussed classic but also modern abdominal wall repair techniques, techniques such as TAPP, TEP and Lichenstein.

In the second chapter we addressed aspects such as the classification of inguinal hernias, the anatomy of the abdominal wall, but also aspects related to its functionality.

The part of personal contributions includes 2 studies through which we highlighted the important role of using the preperitoneal transabdominal laparoscopic method in the repair of inguinal hernia in adult patients.

So, in study I we illustrated the case of a 29-year-old young woman, recently operated on for a right inguinal hernia by the TAPP method, who was re-hospitalized in our clinic for intense pain in the lower abdominal floor and right iliac fossa with obstructive characteristics bowel movements in the last 24 hours. Intraoperatively, an intestinal occlusion was observed due to an ileal loop incarcerated at the level of a peritoneal defect of approximately 2 cm in diameter, in the area of the flap suture, after the TAPP technique. Moreover, the phlegmonous appendix was found in the properitoneal space, fixed at the level of the polypropylene mesh. Appendectomy was performed and the peritoneal defect was repaired, with the patient having a rapid postoperative recovery.

In the presented case, the early postoperative complication was major and rare, associating intestinal obstruction with protrusion of the ileal loop into a peritoneal breach and acute phlegmonous appendicitis. This complication could be easily avoided by meticulous closure of the peritoneal flap after the TAPP procedure, preventing contact between the intraperitoneal viscera and the mesh. In any patient undergoing laparoscopic surgery, laparoscopic re-operation should be performed sooner rather than later for timely diagnosis and management of a complication.

In the second study, we aimed to investigate the effects of the use of the transabdominal preperitoneal laparoscopic method (TAPP) and the Lichtenstein method on the perceived pain level of patients diagnosed with inguinal hernia one day after surgery.

At the same time, we also analyzed the differences between the immediate results of using the transabdominal preperitoneal laparoscopic method (TAPP) and the Lichtenstein method in the case of adult patients operated on for inguinal hernia. The immediate results are quantified by the number of days of hospitalization, the occurrence of postoperative complications and the perceived level of pain one day after surgery.

To achieve the above objectives, we tested the following hypotheses:

I1. It is assumed that following the application of the transabdominal preperitoneal laparoscopic method (TAPP) and the Lichtenstein method in inguinal hernia repair, patients will perceive a lower level of pain one day after the intervention.

12. It is assumed that there are statistically significant differences between adult patients operated by the transabdominal preperitoneal laparoscopic method (TAPP) and patients operated by the Lichtenstein method in terms of the perceived level of pain one day after the intervention, the number of days in hospital and the occurrence of postoperative complications.

Between October 2019 and December 2021, data were taken from adult patients admitted to the General Surgery II ward of the University Emergency Hospital in Bucharest, with their freely expressed consent. Also, the consent of the local ethics commission was obtained for the realization of the present project. Patients were randomized into two groups, one to which the preperitoneal transabdominal laparoscopic technique was applied (N=126) and one to which the classic lichtenstein method (N=109) was applied for inguinal hernia repair.

A total of 235 adult patients participated. All patients were examined by general clinical examination, blood tests, EKG, imaging studies (abdominal ultrasound, CT – where applicable).

At the same time, all patients were monitored for one year after the inguinal hernia operation. The inclusion criteria in the two groups were:

- Age greater than or equal to 18 years;
- The general condition should be at least satisfactory;
- The level of motor activity should be over 40%.

The research design is experimental with pretest and posttest. Both the first and second groups were tested before and after the inguinal hernia surgery, and then the results were compared.

The instruments used (Activity Assessment Scale - Scale for measuring motor activity [34], Groin Pain Questionnaire - IPQ [35], Carolina Equation for Quality of Life (CeQOL) [37]) in the study were first adapted to the specifics of the Romanian language in a pilot study, thus respecting all the methodological norms in force.

Statistical data analysis was performed using R software, JASP, IBM SPSS Statistics Version 23 software, and JAMOVI. The paired-samples t-test was applied to show the effectiveness of the surgical methods applied to patients diagnosed with inguinal hernia, and the Fisher Exact Test and the independent-samples t-test were applied to assess whether the two groups were homogeneous in terms of general condition, of the type of hernia and the level of involvement in motor activities. Independent samples t-test and Mann Whitney U Test were also used to illustrate the advantages of using the TAPP method over the Lichtenstein method for inguinal hernia repair.

The obtained results revealed that the hypothesis 1, according to which it is assumed that following the application of the transabdominal preperitoneal laparoscopic method (TAPP) and the Lichtenstein method in inguinal hernia repair, patients will perceive a lower level of pain one day after the intervention, was supported by data collected.

On the other hand, the second hypothesis that it is assumed that there are statistically significant differences between adult patients operated by the transabdominal preperitoneal laparoscopic method (TAPP) and patients operated by the Lichtenstein method in terms of the perceived level of pain one day after the intervention, the number of hospital days and the occurrence of postoperative complications was partially supported by the collected data, as statistical significance was reached only for the number of hospital days and the perceived level of pain.

Although there is no statistically significant difference between the two groups in terms of the number of postoperative complications, approximately 6% fewer occurred in the TAPP group than in the Lichtenstein group.

The original elements of this doctoral thesis result from the fact that we have adapted to the specifics of the Romanian language instruments by which we obtain an objective measurement of the effects of using the transabdominal preperitoneal laparoscopic method (TAPP) in inguinal hernia repair, but also by highlighting the fact that if doctors apply TAPP in the repair of inguinal hernia in adult patients, relapses can be avoided, the postoperative recovery of patients will be faster, and their quality of life will increase, on the other hand. Another element of originality of the present work can be the best practices guide proposed by us in the first studio. The medical practice at a high level in our hospital is also illustrated by the resolution of complications arising from an inguinal hernia operation in a case study.

First of all, regarding the Activity Assessment Scale we can state that it was made to measure the motor activity [34] of patients with inguinal hernia. This includes 13 items covering a broad sample of physical, sedentary, movement-related and graded-intensity activities. Respondents are asked to rate the degree of difficulty in performing each of these activities in the past 24 hours on a 5-point scale from No difficulty to Can't do it. A response item that did not result for other reasons is also included but not scored.

The AAS has three subscales: sedentary activities (items 1–4); daily activities (items 6–8); work/exercise activities (items 11–13). AAS total and subscale scores are transformed to produce a range of 0–100, with higher values indicating greater functional activity. The Groin Pain Questionnaire – IPQ[35] was developed as a modification of the questionnaire proposed by Kehlet and colleagues[36].

The previous questionnaire treated pain intensity as a dichotomous variable; however, the IPQ uses a seven-step fixed-point rating scale to assess pain, with steps related to pain behavior rather than numbers or verbal descriptions of pain, with additional monitoring of pain duration. In the IPQ, patients are asked in separate questions to report their current groin pain as well as the worst pain experienced during the previous week. A second part of the questionnaire focuses on interference with daily activities, in accordance with a proposal by Kehlet and colleagues[36]. There are 18 items in total, and the total questionnaire takes about 10 minutes to complete.

The Carolina equation for quality of life (CeQOL) [37] predicts the incidence of chronic pain after inguinal hernia repair. Users of this mobile app simply answer 18 simple questions about themselves, their hernia, and their current quality of life considering the existence of their hernia, and a percentage chance of having some form of discomfort one year after operation is produced and interpreted.

Since none of the above tools were adapted to the specifics of the Romanian language before applying them in this study, the author of this research project conducted a pilot study on 50 patients with inguinal hernia. The internal consistency index for the IPQ, AAS and CeQOL expressed by the Cronbach- α index was equal to 0.83, 0.79 and 0.71, respectively, which illustrates that these scales measure what they aim to measure.

At the same time, the adaptation of these scales to the specifics of the Romanian language was achieved by complying with all the methodological norms in force. Thus, 2 primary doctors specializing in general surgery and a specialist clinical psychologist each translated all the scales, then chose the best option. A translator checked the content of the translated scales, but also of the original scales, and finally the final version was decided according to his observations.

Thus, we can affirm the fact that through this scientific approach we have obtained in our country instruments with a great objective value in measuring the immediate results of laparoscopic intervention with the aim of repairing inguinal hernia in adults. In addition, by using a two-group pretest-posttest experimental design, we were able to highlight the advantages of using the TAPP method over the Lichtenstein method in inguinal hernia repair in adult patients.

The quality of life of our patients increases with the fast postoperative recovery, the quick return to usual activities. In addition, by conducting a randomized study like ours, i.e. by randomly selecting participants and randomly including them in the two groups, by using a

large number of participants and by applying standardized instruments we can generalize the conclusions obtained.

Thus, the questions from the studies in the specialized literature were answered in an objective manner, where, as we have highlighted throughout this work, fewer and fewer randomized studies are done. Last but not least, the best practice guide brings to light steps that if the surgeon follows, the chances of success of the operation will increase significantly. In conclusion, the present work meets many needs in the literature, both through the studies analyzed from the general side, through the experimental study carried out, but especially through the best practice guide designed to help surgeons in case management.

One of the possible limitations of this study could be that the mean ages of the two compared groups were close. In the literature, however, there are studies that support the fact that age and gender would not have such a great influence, as long as the surgeon applies the most appropriate methods for the patients' problems[48]. One of the future research directions would be to compare the TAPP method with another laparoscopic method. We believe that minimally invasive laparoscopic operations help patients recover quickly and increase their quality of life. So doctors can make a significant contribution to all these aspects by choosing the most suitable methods.

In conclusion, the present work can be a pillar for future studies, but above all, it can be a good practice guide for surgeons, having practical-applicative importance.

BIBLIOGRAPHY (SELECTIVE)

- [1] Ng AY, Lin J, Ching SS, et al. Does primary closure of direct inguinal hernia defect during laparoscopic mesh repair reduce the risk of early recurrence? *Hernia J Hernias Abdom Wall Surg* 2020; 24: 1093–1098.
- [2] Berney CR. The Endoloop technique for the primary closure of direct inguinal hernia defect during the endoscopic totally extraperitoneal approach. *Hernia J Hernias Abdom Wall Surg* 2012; 16: 301–305.
- [3] International guidelines for groin hernia management | SpringerLink, <https://link.springer.com/article/10.1007/s10029-017-1668-x> (accessed 29 May 2023).
- [4] Fitzgibbons RJJ, Ramanan B, Arya S, et al. Long-term Results of a Randomized Controlled Trial of a Nonoperative Strategy (Watchful Waiting) for Men With Minimally Symptomatic Inguinal Hernias. *Ann Surg* 2013; 258: 508.

- [5] Burcharth J, Pedersen M, Bisgaard T, et al. Nationwide Prevalence of Groin Hernia Repair. *PLOS ONE* 2013; 8: e54367.
- [6] Risk Factors for Inguinal Hernia among Adults in the US Population | *American Journal of Epidemiology* | Oxford Academic, <https://academic.oup.com/aje/article/165/10/1154/57933?login=false> (accessed 29 May 2023).
- [7] Impact of occupational mechanical exposures on risk of lateral and medial inguinal hernia requiring surgical repair | *Occupational & Environmental Medicine*, <https://oem.bmj.com/content/69/11/802> (accessed 29 May 2023).
- [8] van den Heuvel B, Dwars BJ. Repeated laparoscopic treatment of recurrent inguinal hernias after previous posterior repair. *Surg Endosc* 2013; 27: 795–800.
- [9] Patient-Related Risk Factors for Recurrence After Inguinal Hernia Repair: A Systematic Review and Meta-Analysis of Observational Studies - Jakob Burcharth, Hans-Christian Pommergaard, Thue Bisgaard, Jacob Rosenberg, 2015, <https://journals.sagepub.com/doi/10.1177/1553350614552731> (accessed 29 May 2023).
- [10] Sun L, Shen Y-M, Chen J. Laparoscopic versus Lichtenstein hernioplasty for inguinal hernias: a systematic review and Meta-analysis of randomized controlled trials. *Minim Invasive Ther Allied Technol* 2020; 29: 20–27.
- [11] McCormack K, Wake B, Perez J, et al. Laparoscopic surgery for inguinal hernia repair: systematic review of effectiveness and economic evaluation. *Health Technol Assess Winch Engl* 2005; 9: 1–203, iii–iv.
- [12] Thanh Xuan N, Huu Son N. Laparoscopic Transabdominal Preperitoneal Technique for Inguinal Hernia Repair in Adults. *Cureus*; 12: e8692.
- [13] Yang X-F, Liu J-L. Laparoscopic repair of inguinal hernia in adults. *Ann Transl Med* 2016; 4: 402.
- [14] Basile F, Biondi A, Donati M. Surgical approach to abdominal wall defects: history and new trends. *Int J Surg* 2013; 11: S20–S23.
- [15] Skandalakis JE. *Skandalakis' Surgical Anatomy: The Embryologic and Anatomic Basis of Modern Surgery*. PMP, 2004.
- [16] Sakorafas GH, Halikias I, Nissotakis C, et al. Open tension free repair of inguinal hernias; the Lichtenstein technique. *BMC Surg* 2001; 1: 3.
- [17] Murray M. Nyhus and Condon's Hernia, 5th Edition. *Ann Surg* 2002; 236: 693.
- [18] Aliuş C, Balalau C, Dumitrescu D, et al. Essentials of surgical anatomy and technique in TAPP repair of inguinal hernia. *J Clin Investig Surg* 2018; 3: 66–71.
- [19] Mancini R, Pattaro G, Spaziani E. Laparoscopic trans-abdominal pre-peritoneal (TAPP) surgery for incarcerated inguinal hernia repair. *Hernia J Hernias Abdom Wall Surg* 2019; 23: 261–266.
- [20] Wake BL, McCormack K, Fraser C, et al. Transabdominal pre-peritoneal (TAPP) vs totally extraperitoneal (TEP) laparoscopic techniques for inguinal hernia repair. *Cochrane Database Syst Rev* 2005; 2005: CD004703.
- [21] *Review of Gross Anatomy a Dynamic Approach*.

- [22] AlMarzooqi R, Tish S, Huang L-C, et al. Review of inguinal hernia repair techniques within the Americas Hernia Society Quality Collaborative. *Hernia J Hernias Abdom Wall Surg* 2019; 23: 429–438.
- [23] McVay C, Anson B. Aponeurotic and fascial continuities in the abdomen, pelvis and thigh. *Anat Rec* 2005; 76: 213–231.
- [24] Rizk NN. A new description of the anterior abdominal wall in man and mammals. *J Anat* 1980; 131: 373–385.
- [25] Selvadurai S. Lee J. Skandalakis Surgical Anatomy and Technique, https://www.academia.edu/26061392/Lee_J_Skandalakis_Surgical_Anatomy_and_Technique (accessed 9 August 2023).
- [26] Furtado M, Claus CMP, Cavazzola LT, et al. SYSTEMIZATION OF LAPAROSCOPIC INGUINAL HERNIA REPAIR (TAPP) BASED ON A NEW ANATOMICAL CONCEPT: INVERTED Y AND FIVE TRIANGLES. *Arq Bras Cir Dig ABCD Braz Arch Dig Surg* 2019; 32: e1426.
- [27] Hollinshead WH. *Anatomy for Surgeons*. Hoeber Medical Division, Harper & Row, 1968.
- [32] Bendavid R. The space of Bogros and the deep inguinal venous circulation. *Surg Gynecol Obstet* 1992; 174: 355–358.
- [33] *Chirurgia peretelui abdominal: Hernii primare*. Editura Medicala Universitara ‘Iuliu Hatieganu’, 2006.
- [34] M M, O J, Ch C, et al. Assessment of patient functional status after surgery. *J Am Coll Surg*; 201. Epub ahead of print August 2005. DOI: 10.1016/j.jamcollsurg.2005.03.035.
- [35] Fränneby U, Gunnarsson U, Andersson M, et al. Validation of an Inguinal Pain Questionnaire for assessment of chronic pain after groin hernia repair. *Br J Surg* 2008; 95: 488–493.
- [36] Kehlet H, Bay-Nielsen M, Kingsnorth A. Chronic postherniorrhaphy pain--a call for uniform assessment. *Hernia J Hernias Abdom Wall Surg* 2002; 6: 178–181.
- [37] ABDALLA RZ, GARCIA RB, SAID DF, et al. QUALITY OF LIFE OF IN PATIENTS SUBMITTED TO ANTERIOR ABDOMINAL WALL LAPAROSCOPIC HERNIOPLASTY. *Arq Bras Cir Dig ABCD Braz Arch Dig Surg* 2014; 27: 30–33.
- [38] Köckerling F, Simons MP. Current Concepts of Inguinal Hernia Repair. *Visc Med* 2018; 34: 145–150.
- [39] Egawa N, Nakamura J, Manabe T, et al. Incidence of postoperative complications in transabdominal preperitoneal repair for groin hernia is influenced by poor performance status rather than by old age. *Ann Gastroenterol Surg* 2019; 3: 318–324.
- [40] Gossetti F, D’Amore L, Annesi E, et al. Mesh-related visceral complications following inguinal hernia repair: an emerging topic. *Hernia J Hernias Abdom Wall Surg* 2019; 23: 699–708.
- [41] Narayanan S, Davidov T. Peritoneal pocket hernia: A distinct cause of early postoperative small bowel obstruction and strangulation: A report of two cases following robotic herniorrhaphy. *J Minimal Access Surg* 2018; 14: 154–157.
- [49] Grant AM, EU Hernia Trialists Collaboration. Laparoscopic versus open groin hernia repair: meta-analysis of randomised trials based on individual patient data. *Hernia J Hernias Abdom Wall Surg* 2002; 6: 2–10.

- [50] Wellwood J, Sculpher MJ, Stoker D, et al. Randomised controlled trial of laparoscopic versus open mesh repair for inguinal hernia: outcome and cost. *BMJ* 1998; 317: 103–110.
- [51] Lawrence K, McWhinnie D, Goodwin A, et al. Randomised controlled trial of laparoscopic versus open repair of inguinal hernia: early results. *BMJ* 1995; 311: 981–985.
- [52] Barkun JS, Wexler MJ, Hinchey EJ, et al. Laparoscopic versus open inguinal herniorrhaphy: preliminary results of a randomized controlled trial. *Surgery* 1995; 118: 703–709; discussion 709–710.
- [56] Stoker DL, Spiegelhalter DJ, Singh R, et al. Laparoscopic versus open inguinal hernia repair: randomised prospective trial. *Lancet Lond Engl* 1994; 343: 1243–1245.
- [57] Amid PK, Shulman AG, Lichtenstein IL. Critical scrutiny of the open ‘tension-free’ hernioplasty. *Am J Surg* 1993; 165: 369–371.
- [58] Moloney GE, Gill WG, Barclay RC. Operations for hernia; technique of nylon darn. *Lancet Lond Engl* 1948; 2: 45–48.
- [64] Drummond MF, Sculpher MJ, Claxton K, et al. *Methods for the Economic Evaluation of Health Care Programmes*. Oxford University Press, 2015.
- [65] Sofi J, Nazir F, Kar I, et al. Comparison between TAPP & Lichtenstein techniques for inguinal hernia repair: A retrospective cohort study. *Ann Med Surg* 2021; 72: 103054.
- [66] Hauters P, Meunier D, Urgyan S, et al. [Prospective controlled study comparing laparoscopy and the Shouldice technique in the treatment of unilateral inguinal hernia]. *Ann Chir* 1996; 50: 776–781.
- [67] Teasdale C, McCrum AM, Williams NB, et al. A randomised controlled trial to compare local with general anaesthesia for short-stay inguinal hernia repair. *Ann R Coll Surg Engl* 1982; 64: 238–242.
- [68] Wright DM, Kennedy A, Baxter JN, et al. Early outcome after open versus extraperitoneal endoscopic tension-free hernioplasty: a randomized clinical trial. *Surgery* 1996; 119: 552–557.
- [69] Bailey IS, Karran SE, Toyn K, et al. Community surveillance of complications after hernia surgery. *BMJ* 1992; 304: 469–471.
- [70] Saber A, Hokkam EN, Ellabban GM. Laparoscopic transabdominal preperitoneal approach for recurrent inguinal hernia: A randomized trial. *J Minimal Access Surg* 2015; 11: 123–128.
- [71] Lockhart K, Dunn D, Teo S, et al. Mesh versus non-mesh for inguinal and femoral hernia repair. *Cochrane Database Syst Rev* 2018; 9: CD011517.
- [72] Maddern GJ, Rudkin G, Bessell JR, et al. A comparison of laparoscopic and open hernia repair as a day surgical procedure. *Surg Endosc* 1994; 8: 1404–1408.
- [73] Amid PK. Groin hernia repair: open techniques. *World J Surg* 2005; 29: 1046–1051.
- [74] Hammoud M, Gerken J. Inguinal Hernia. In: *StatPearls*. Treasure Island (FL): StatPearls Publishing, <http://www.ncbi.nlm.nih.gov/books/NBK513332/> (2023, accessed 3 June 2023).
- [75] Rivas JF, Molina APR-F, Carmona JM. Transabdominal preperitoneal (TAPP) inguinal hernia repair: how we do it. *Ann Laparosc Endosc Surg*; 6. Epub ahead of print 20 January 2021. DOI: 10.21037/ales-20-109.

[76] GOMES CA, GOMES FC, PODDA M, et al. LIECHTENSTEIN VERSUS LAPAROSCOPIC TRANSABDOMINAL PREPERITONEAL (TAPP) HERNIA REPAIR: A PROSPECTIVE COMPARATIVE STUDY FOCUSED ON POSTOPERATIVE OUTCOMES IN A GENERAL SURGERY UNIT. *Arq Bras Cir Dig ABCD*; 34: e1642.

[77] Sofi J, Nazir F, Kar I, et al. Comparison between TAPP & Lichtenstein techniques for inguinal hernia repair: A retrospective cohort study. *Ann Med Surg* 2021; 72: 103054.