

# Does anatomical recognition of the innervation of the inguinal region during hernioplasty prevent inguinodynia? A systematic review

*O reconhecimento anatômico da inervação da região inguinal durante hernioplastia previne a inguinodinia? Uma revisão sistemática*

Ana Júlia Ribas Sigwalt<sup>1</sup>, Gabriella Micheten Dias<sup>2</sup>, Lívia Dala Déa Ferreira Pocay<sup>3</sup>, Mahara Freitas dos Santos<sup>3</sup>, Tailla Cristina de Oliveira<sup>3</sup>, Marcos Fabiano Sigwalt<sup>2,3</sup>, Fernando Issamu Tabushi<sup>3,4</sup>, Leonardo Wanderloff Franco<sup>3</sup>, Fernando Weiss Guerra<sup>5</sup>, Abdo Imad El Tawil<sup>3</sup>, Osvaldo Malafaia<sup>3</sup>

## ABSTRACT

**Introduction:** The inguinal canal is a region prone to hernias that may require surgery. Although videosurgery may be less aggressive, the identification of nerve branches is necessary to reduce the incidence of inguinodynia that can occur even with this minimally invasive route.

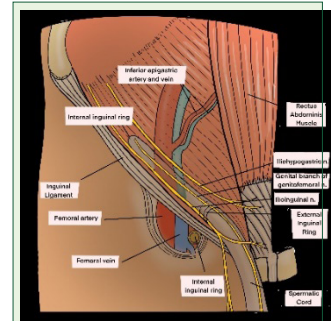
**Objective:** To review the incidence and reasons for inguinodynia in laparoscopic surgical procedures for the correction of inguinal hernias.

**Method:** Systematic review, carried out in the PubMed, BVS and Google Scholar databases from 2018 to 2024, including articles in Portuguese and English. From initial number of 1,758 articles 10 were selected.

**Result:** The main findings of the research proved that the recognition and proper anatomical identification of the main nerves of the inguinal region during the operation - iliohypogastric, ilioinguinal and genital branch of the genitofemoral - are able to reduce the chances of patients developing chronic pain in the inguinal region after hernioplasty. The surgeon's expertise and experience in avoiding trauma to local nerves guarantees quality of life for patients and reduces their exposure to possible new subsequent interventions to treat inguinodynia.

**Conclusion:** Prevention is the most important measure when it comes to eradicating inguinodynia. Therefore, the professional must have sufficient knowledge of the most frequent topography of the passage of the main nerves and their branches to avoid iatrogenic injuries

**KEYWORDS:** Inguinal hernia. Nerve identification. Inguinodynia. Surgery.



Visualization of the inguinal nerves

## Central Message

The inguinal canal is a region prone to hernias that may have surgical indication. Although videosurgery may be less aggressive, identification of nerve branches is necessary to decrease the incidence of inguinodynia that can occur even with this minimally invasive route. The objective of this article was to investigate the incidence and reasons for inguinodynia in laparoscopic surgical procedures for the correction of inguinal hernias. This topic is pertinent to the daily routine of the general surgeon because he can, with his knowledge, avoid nerve injuries that cause inguinodynia

## Prospective

Surgeons' knowledge of the nervous anatomical region by laparoscopic surgery is capable of preventing inguinodynia. The identification, recognition, and preservation or dissection when necessary of the main nerves in the region prevents chronic groin pain. Therefore, it is understood that with the surgical techniques currently available for hernioplasty, added to the expertise of the professional who performs the procedure, inguinal hernia repair can be mostly effective and without sequelae of chronic pain.

## RESUMO

**Introdução:** O canal inguinal é região propensa a hérnias que podem ter indicação cirúrgica. Embora a videocirurgia possa ser menos agressiva, a identificação dos ramos nervosos é necessária para diminuir a incidência de inguinodinia que pode ocorrer mesmo com essa via minimamente invasiva.

**Objetivo:** Revisar a incidência e os motivos da inguinodinia nos procedimentos cirúrgicos laparoscópicos na correção das hérnias inguinais. **Método:** Revisão sistemática, realizada nas bases de dados PubMed, BVS e Google Scholar no período de 2018 a 2024, incluindo artigos em português e inglês. De 1.758 artigos, 10 foram selecionados.

**Resultado:** Os principais achados da pesquisa comprovaram que o reconhecimento e a devida identificação anatômica dos principais nervos da região inguinal durante a operação - ílio-hipogástrico, ílioinguinal e ramo genital do genitofemoral - são capazes de diminuir as chances de os pacientes desenvolverem dor crônica na região inguinal após hernioplastia. A perícia e experiência do cirurgião ao evitar trauma nos nervos locais garante qualidade de vida aos pacientes e reduz a exposição deles a eventuais novas intervenções subsequentes para tratamento de inguinodinia.

**Conclusão:** A prevenção é a medida mais importante tratando-se de erradicar a inguinodinia. Dessa maneira, o profissional deve ter conhecimento suficiente da topografia mais frequente da passagem dos principais nervos e seus ramos para evitar lesões iatrogênicas.

**PALAVRAS-CHAVE:** Hérnia inguinal. Identificação do nervo. Inguinodinia. Cirurgia.

<sup>1</sup>Pontifical Catholic University of Paraná, Curitiba, PR, Brazil;

<sup>2</sup>Positivo University, Curitiba, PR, Brazil;

<sup>3</sup>Mackenzie Presbyterian Institute, São Paulo, SP, Brazil;

<sup>4</sup>Federal University of Paraná, Curitiba, PR, Brazil;

<sup>5</sup>Celso Ramos Hospital, Florianópolis, SC, Brazil.

Conflict of interest: None | Funding: None | Received: 07/010/2024 | Accepted: 09/12/2024 | Publication date: 11/02/2025 Correspondence: [marcossigwalt@yahoo.com.br](mailto:marcossigwalt@yahoo.com.br) | Associate Editor: Luiz Fernando Kubrusly

## How to cite:

Sigwalt AJR, Dias GM, Pocay LDDF, dos Santos MF, de Oliveira TC, Sigwalt MF, Tabushi FI, Franco LW, Guerra LW, El Tawil AI, Malafaia O. O reconhecimento anatômico da inervação da região inguinal durante hernioplastia previne a inguinodinia? Uma revisão sistemática. *BioSCIENCE*. 2025;83:e00002

## INTRODUCTION

The inguinal canal is defined as an area delimited by 3 muscles: external oblique, internal oblique and transversus abdominis. Different structures pass through it, depending on the sex, such as the spermatic cord in men and the round ligament of the uterus in women. Hernia is a common finding in this canal, which occurs due to the weakening of local elastic fibers and collagen.

Inguinal hernia can be classified as direct or indirect, depending on whether its position is medial or lateral in relation to the inferior epigastric vessels.<sup>1</sup> Its repair is the most commonly performed procedure in the surgical environment and widely used laparoscopically, as it has demonstrated significant advantages in the postoperative period, such as rapid recovery, lower occurrence of postoperative pain, and better scores that represent quality of life for patients.<sup>2</sup> In addition, video hernioplasty has been considered superior to open procedures when analyzing the lower risk of trauma to the locoregional innervation, being less invasive and having less traumatic fixation of the mesh in order to reduce postoperative discomfort.<sup>3</sup> However, it does not exclude them, because approximately 6-8% of the 20 million hernioplasties performed annually are associated with problems that affect quality of life, especially chronic post-surgical pain.<sup>4</sup>

During the video procedure, it is possible to observe the various nerves that cross the inguinal canal. The main ones found, and possible to be affected during surgical manipulation, are the iliohypogastric nerve, ilioinguinal nerve and the genital branch of the genitofemoral nerve. These branches come from the lumbar plexus, which is responsible for innervating the lower abdomen; however, when they are distributed individually, they are subject to anatomical variations.<sup>5,6</sup> Although videosurgery has good results, there are postoperative complications such as osteitis pubis, ischemic orchitis, local hematomas, seroma, and, especially, nerve pain. This can be of direct neurological and non-neurological cause (such as periostitis, recurrent hernia and spermatic cord injury). Among them, the most common is due to iatrogenic injury, justified, in most cases, by the failure to identify the nerves of the inguinal region during the procedure, primarily involving the aforementioned nerves.<sup>7-9</sup> After causing trauma or damage to the local innervation, through excessive dissection, crushing, stretching, or mesh placement, the patient usually complains of pain that may be accompanied by other sensory disorders such as dysesthesia, hyperesthesia, hypoesthesia, among others. In addition, this chronic pain, called inguinodynia, affects quality of life and has been associated with psychological and mental disorders after the procedure.<sup>5</sup>

The objective of this review was to analyze whether the anatomical recognition of the sensory innervation of the inguinal region during laparoscopic inguinal hernia repair is able to help prevent chronic postoperative pain, i.e., inguinodynia.

## METHOD

This systematic review was based on the guidelines of the PRISMA method (Main Items for Reporting Systematic Reviews and Meta-Analyses), and the guiding question was structured by the acronym PICO: "Is anatomical recognition of the sensory innervation of the inguinal region capable of assisting in the prevention of chronic postoperative pain for laparoscopic inguinal hernia repair?" (Table 1).

TABLE 1 – PICO Survey

P (patient)	Patients with chronic pain
I (intervention)	Submitted to the operation for correction videolaparoscopic inguinal hernia
C (control)	Patients without chronic pain for correction videolaparoscopic inguinal hernia
The (outcome)	Post-corrective operation

The search was carried out in the period from 2018 to 2024. The descriptors used were chosen from the Health Sciences Descriptors (DeCS) dictionary, considering articles in Portuguese and English, with the descriptors and booleans being: inguinal hernia repair; nerve identification, inguinodynia. Priority was given to selecting the articles that had the highest degree of qualification by the EQUATOR Network. In addition, the types of study chosen were: randomized controlled trials, cohort studies, case-control studies, and systematic reviews.

The inclusion criteria were: articles that addressed chronic pain after inguinal hernia repair with the laparoscopic technique, complete articles, free texts and high academic relevance. The exclusion criteria were: studies with the objective exclusively of nerve structures, pediatric population (under 16 years of age) and elderly population (over 60 years of age) exclusively and operations with open techniques.

The final evaluation of the selected articles was carried out using the eligibility criterion using, as a reference, the guiding question of the work. To reduce the risk of bias, the evaluation was done in pairs (in which 2 researchers evaluate and qualify the article, if there was disagreement, the article would be excluded).

The search was carried out on the VHL, Google Scholar and PubMed platforms, following the inclusion and exclusion criteria already described. In the VHL, the initial search resulted in 135 articles, 106 were filtered with the full text, after applying the language filter, 99 remained and only 42 with the filter of the last 5 years. Of these, 19 were used to read the titles and 19 were selected to read abstracts, 5 of which were systematic reviews. In PubMed, 107 appeared with the full-text filter, 97 remained and 34 with the years filter; of these, 11 were selected by reading the titles, 10 by the abstracts, 3 were read in full and only 2 to compose the systematic review. Google Scholar, the initial search resulted in 1,758 articles, after applying the language filter, 1,665 remained and 664 with the filter of the last 5 years; of these, 78 were used after reading the titles and 26 were selected for reading abstracts and only 6 texts remained for this search. In

all, 12 articles were selected; 10 remained for the final reference of this study and 2 were discarded due to duplicity (Figure 1, Table 2).

In the evaluation of the GRADE system (Table 3), the article Caserta et al.<sup>1</sup> because it is iconographic in which information is taken from the graphs, it had serious indirect evidence, being unreliable. The article Carrillo et al.<sup>4</sup> the sample size was low.

## DISCUSSION

### Inguinodynia after videosurgical inguinal hernia repair

Inguinodynia has become the most common long-lasting complication of inguinal hernioplasty. With a prevalence of approximately 20 million hernioplasties performed annually,

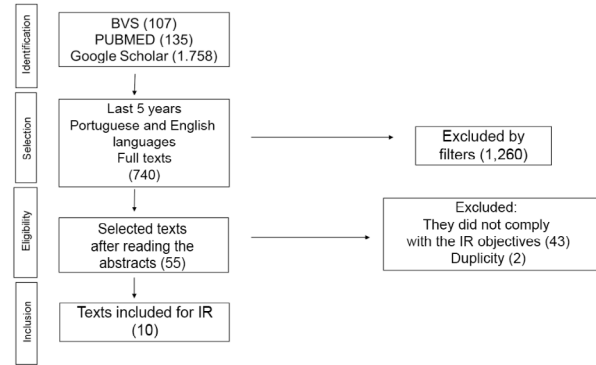


FIGURE 1 – Synthesis of the research

TABLE 2 – Results compiled from the selected articles

AUTHOR AND YEAR	DESIGN OF STUDY	SAMPLE POPULATION	TYPE OF INTERVENTION	CONCLUSIONS
1 - Caserta N. (2021) <sup>1</sup>	Iconographic essay			Knowledge of the presentation of inguinal hernias, their different contents and possible complications is essential for the correct diagnosis and appropriate management.
2 - Dop LMVD. (2022) <sup>2</sup>	Prospective study	Patients undergoing inguinal hernia repair with a minimum of 2 years follow-up. n=4016	TAPP, TIPP, TOE	Postoperative pain after 1 month was a higher risk factor for the development of PIPC than preoperative pain. PIPC at 1 year appears to be a different cause of pain than PIPC at 2 years. Patient and surgical factors influence its onset at 1 year, but the natural course of these complaints shows a large decline at 2.
3 - Mitura K. (2018) <sup>3</sup>	Prospective study	Patients undergoing TAPP repairs n=146	TAPP approach with 3D screen using glue fixation.	TAPP inguinal hernia repair with glue fixation significantly decreased the frequency and intensity of pain compared to that felt preoperatively. Patients younger than 40 years of age have frequent and severe preoperative and postoperative pain. In addition, hernias of longer duration before the operation cause increased pre- and postoperative pain.
4 - Carrillo GG. (2023) <sup>4</sup>	Retrospective study	Patients undergoing transperitoneal neurectomy. age ≥41 years and ≤ 54 years n = 7	Laparoscopic and robotic triple neurectomy for chronic inguinodynia.	Laparoscopic retroperitoneal triple neurectomy is a reproducible, low-morbidity technique that improves symptoms and quality of life of chronic inguinal pain after hernioplasty.
5 - Graham D. (2018) <sup>5</sup>	Review Article			Prevention is the most important measure in mitigating neuropathic PIPC. Recognition of the typical neuroanatomy of the lumbar plexus, the highly variable nature of these nerves, and the operation-specific mechanisms for nerve entrapment will limit the potential for injury and improve outcomes in inguinal hernia repair.
6 - Cirocchi R. (2019) <sup>6</sup>	Systematic review	Articles evaluating the anatomical variations of the inguinal nerves according to PRISMA standards n = 26		The identification rates of inguinal nerves in this study were lower than those reported in the literature. The smallest was found for the genitofemoral nerve, suggesting that this nerve was the most difficult to identify. Knowledge of the anatomy of inguinal nerves can facilitate their proper identification and reduce the risk of iatrogenic injury and postoperative pain.
7 - George T. (2019) <sup>7</sup>	Retrospective review	Patients with persistent groin pain, with relief after preoperative nerve block and failed attempt at external denervation of the groin or pain after hernia repair. n=16	Primary laparoscopic inguinal hernia repair TAPP or PTE.	A combined open surgical procedure to identify the lateral femoral cutaneous nerve and 1 laparoscopic procedure in the retroperitoneum demonstrated the feasibility of this approach to correctly identify the nerve to be resected to relieve disabling groin pain.
8 - Farquharson BJ. (2021) <sup>8</sup>	Retrospective review	District general hospital patients Age ≥18 years and <80 years n = 100	Open inguinal hernia repair with prosthetic mesh.	Further analysis of the implications for chronic postoperative pain, along with best practices and forensic medical litigation, would be beneficial in improving documentation standards.
9 - Pedersen, RF. (2020) <sup>9</sup>	Prospective study	Patients for chronic posthernia repair pain operation. n= 66	Open triple neurectomy with total mesh removal or laparoscopic retroperitoneal triple neurectomy.	Pain-related functional impairment can be improved with clinical relevance by approximately 70% through a simplified clinical algorithm for surgical treatment of severe chronic pain after inguinal hernia repair.
10- Furtado M. (2019) <sup>10</sup>	Original article		Dissection of the preperitoneal space using the TAPP approach.	The concept of "Inverted Y" and the anatomical didactics "Five Triangles" associated with the dissection proposal based on "Three Zones", meets the need to establish standardization of the TAPP technique, seeking excellence in the results of inguinal treatment.

IPFC = chronic postoperative inguinal pain; TAPP=Lichtenstein; TIPP=transinguinal preperitoneal repair; PTE=totally extraperitoneal

TABLE 3 – Evaluation of the quality of the articles by the GRADE scale

AUTHORS/ CRITERIA	1 - Caserta N. (2021) <sup>1</sup>	2 - Dop LMVD. (2022) <sup>2</sup>	3 - Mitura K. (2018) <sup>3</sup>	4 - Carrillo GG. (2023) <sup>4</sup>	5 - Graham D. (2018) <sup>5</sup>	6 - Cirocchi R. (2019) <sup>6</sup>	7 - George T. (2019) <sup>7</sup>	8 - Farquharson BJ. (2021) <sup>8</sup>	9 - Pedersen, RF. (2020) <sup>9</sup>	10 - Furtado M. (2019) <sup>10</sup>
RISK OF BIAS	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
INCONSISTENCY	NG	NG	NG	G	NG	NG	NG	NG	NG	NG
INDIRECT EVIDENCE	G	NG	NG	NG	NG	NG	NG	NG	NG	NG
INACCURACY	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG

NG=not severe; G=severe

between 6-8% of them are associated with problems that affect the patient's quality of life.<sup>4</sup> The onset of inguinodynia is influenced by gender and age, and the nature of the operation, including the type of fixation and management of the nerves.<sup>2</sup> However, chronic postoperative inguinal pain can develop after all hernia repair methods and is independent of the technique, and can be nociceptive or neuropathic in nature. Nociceptive pain is caused by actual damage to non-neural tissue, such as musculoskeletal inflammation, while neuropathic pain is defined as injury or damage to the nervous system. Thus, research has already concluded that the main cause related to this pain is the failure to identify the inguinal nerves.<sup>5</sup>

Inguinal neuroanatomy is complex and very variable, from the retroperitoneal lumbar plexus to the terminal branches that exit through the inguinal canal. The most commonly affected in this pain are the iliohypogastric, ilioinguinal, and genital branches of the genitofemoral nerve. Although not so frequent, the lateral femoral cutaneous nerve, the femoral branch of the genitofemoral nerve, and the obturator nerve can also be injured in the preperitoneal space.<sup>5</sup> Thus, success in the surgical identification of the 3 nerves is associated with surgical skills, but sometimes some anatomical variations make it difficult to identify them, regardless of the skill level, especially in cases where some of the inguinal nerves are not present. For these reasons, it is necessary to standardize education and training in the identification of nerves in hernioplasty.<sup>6</sup>

### Neuroanatomy of the inguinal region

The inguinal canal is defined as 2 openings with 1 deep inner ring at the midpoint of the inguinal ligament and 1 superficial outer ring that is superior to the pubic tubercle. The posterior wall of this canal is defined by the lateral transverse fascia and the conjunct tendon medially, and the anterior wall is composed of an external oblique aponeurosis reinforced laterally by the internal oblique muscle.<sup>5</sup> The lower portion of the floor is composed of the inguinal ligament, which is reinforced medially by the lacunar and pectineal ligaments. The content of this canal is the spermatic cord (male) and the round ligament (female), and it is also crossed by the iliohypogastric and ilioinguinal nerves and the genital branch of the genitofemoral nerve. These nerves are the terminal branches of the lumbar plexus, which is located in front of the transverse processes of the lumbar and posterior vertebrae or within the psoas muscle, and innervate the abdominal muscle and skin of the genitals, buttocks, and hypogastric region. The schematic drawing of the inguinal region and its nerves can be seen in Figure 2.

The iliohypogastric nerve is a mixed sensorimotor nerve and originates from the ventral branch of L1, emerging from the superior lateral border of the psoas major muscle, passing over the quadratus lumborum, and entering the transversus abdominis muscle above the iliac crest. It divides into 1 lateral cutaneous branch, which passes between the internal and external oblique muscles, above the iliac crest, and innervates the posterolateral gluteal skin, and 1 anterior branch, which runs between the transversus and the internal oblique, responsible for the innervation of both muscles, between the transverse and internal oblique muscles. Then, when it exits the internal oblique muscle, it passes inside the

inguinal canal, prior to its exit through the external oblique, approximately 3 cm above the superficial outer ring in the inguinal sickle.<sup>5</sup>

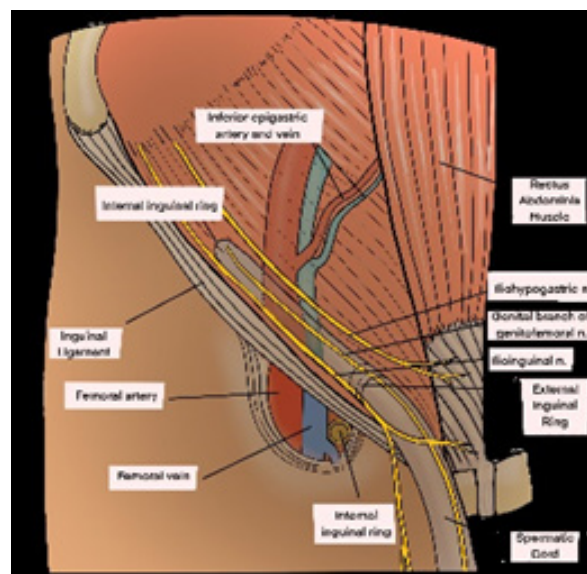
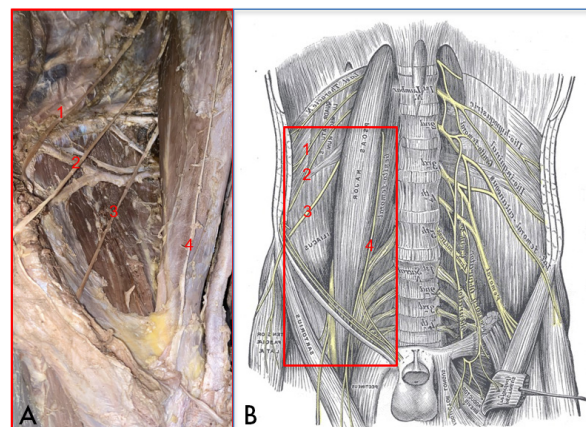


FIGURE 2 — Nerves of the inguinal region: anatomical schematic drawing

The ilioinguinal nerve is a mixed sensorimotor nerve that arises from the first ventral lumbar branch and emerges from the superolateral border of the psoas muscle. It runs through the quadratus lumborum muscle and the upper part of the iliacus and finally enters the transversus abdominis muscle near the iliac crest. It innervates the internal oblique muscle and perforates below the iliohypogastric, approximately 1 cm medial to the anterior superior iliac spine. It normally runs along the spermatic cord, exiting through the superficial outer inguinal ring to supply the proximal medial skin of the thigh and inguinal fold in both sexes, and the superior scrotal region and lateral base of the penis.<sup>5</sup>

The iliohypogastric and ilioinguinal nerves can be clearly visualized in Figure 3.



Source: adp. Henry Gray's Anatomy of the Human Body

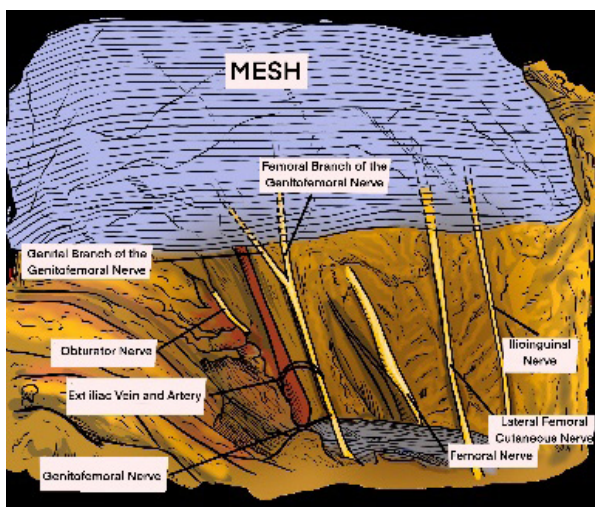
FIGURE 3 — A) Cadaveric visualization: iliohypogastric nerve (1), ilioinguinal nerve (2), lateral cutaneous femoral nerve (3) and genitofemoral nerve (4); B) drawing demonstrating their relationship with the abdominoinguinal region

The genital branch of the genitofemoral nerve, in turn, is a mixed sensorimotor branch originating from the ventral

branches L1 and L2 and forms within the psoas muscle, emerging at its medial border between the L3 and L4 levels. It descends below the peritoneum, passes posteriorly to the ureter, and moves towards the inguinal ligament. The genital branch typically passes over the external iliac artery and crosses the deep internal inguinal ring to join the structures of the cord or round ligament before entering the inguinal canal. In men, it provides motor innervation to the cremaster muscle and cutaneous sensation of the upper scrotum. In women, it follows the round ligament and innervates the skin of the mons pubis and labia majora.<sup>5</sup> The femoral branch, which is rarely affected, descends laterally to the medullary structures and iliac vessels, passing under the inguinal ligament. It enters the femoral sheath lateral to the femoral artery and then pierces the femoral sheath and fascia latae to supply the skin of the upper anterior thigh over the femoral triangle.<sup>5</sup>

The lateral femoral cutaneous nerve is a sensory nerve with great variability in its origin and course. It usually originates from the posterior division of the 2nd and 3rd lumbar nerve roots, emerges from the lateral border of the psoas muscle below the iliac crest, and passes behind the peritoneum over the iliac muscle obliquely towards the anterosuperior iliac spine. The nerve then passes behind or through the inguinal ligament approximately 1 cm medial to the anterosuperior iliac spine, travels anteriorly or through the sartorius muscle before dividing into superficial anterior branches, which irrigates the anterior and lateral thigh to knee level, and posterior, which pierces the fascia lata higher than the anterior ramus and divides to innervate the skin on the lateral surface of the thigh, from the greater trochanter to the middle of the thigh, with occasional extension to the gluteal skin.<sup>5</sup>

Finally, the obturator nerve is a sensorimotor nerve that arises from the anterior division of the 2nd to the 4th ventral lumbar ramus and supplies the medial compartment of the thigh, descends through the psoas major and emerges from the medial border at the pelvic border, crosses the posterior sacroiliac joint to the iliac vessels and runs along the lateral pelvic wall medial to the obturator innerum and anterosuperior to the obturator vessels.<sup>5</sup> Figure 4 highlights, in a video-assisted surgery drawing, the anatomy of the nerves.



**FIGURE 4** — Nerves of the inguinal region: anatomical schematic drawing of video-assisted operation

### Surgical description: the TAPP and PTE approaches

TAPP (preperitoneal transabdominal approach) is a type of laparoscopic correction for hernias. This repair requires general anesthesia<sup>3</sup> and the peritoneal incision is performed from the medial umbilical ligament, elliptically following the arch of the transverse muscle, extending to the anterosuperior iliac spine. The process can be performed from medial to lateral or lateral-to-medial. The dissection of the peritoneum and the preperitoneal space is complete when the component elements of the inverted Y are seen, as well as the iliopsoas, pubis, and pectineal ligament. Once properly dissected, the prosthesis is properly placed, so that it covers all areas of weakness in the inguinal region with an overlap of about 3-4 cm. Therefore, it is important to start the incision at least 4 cm above the deep edge of the inguinal ring, to allow the placement of the prosthesis, which should reach the pubic symphysis medially and the iliopsoas muscle laterally, and should also extend up to 2 cm below the pubis and cover at least 3 cm of the anterior abdominal wall in relation to the deep inguinal ring. Peritoneal closure should be done to cover the mesh and avoid its contact with the intraperitoneal structures. Another concern of the closure of the peritoneum is that it should not bend the lower portion of the mesh, a potential cause of hernia recurrence. The wide lower dissection of the peritoneum avoids this complication. It is important to note that the introduction of mesh reinforcement in inguinal hernia repair significantly reduces the recurrence rate, and the main clinical challenge is chronic pain.<sup>9</sup>

In the PTE approach (fully extraperitoneal laparoscopic technique), the peritoneal cavity is not penetrated and the mesh is used to seal the hernia from the outside of the peritoneum. It is important to be aware of the nerves when separating the hernial sac from the cord structures and when attaching the mesh, specifically when applying stitches to bring the mesh closer to the pubic tubercle and when attaching the inferior edge of the mesh to the inferior border of the inguinal ligament. The iliohypogastric nerve sits superior to the cord and ligament structures at groin dissection, and this structure should be identified by fixing the mesh superiorly.<sup>8</sup>

In laparoscopic repair, both this nerve and the ilioinguinal nerve have a lower risk of being injured. Meanwhile, the genital or femoral branches of the genitofemoral nerve may suffer injury in the open or laparoscopic preperitoneal space, either by thermal or electrical injury, by excessive dissection of the pain triangle (lateral to the inferior epigastric vessels, traction, entrapment or even injuries caused by sutures).<sup>5</sup>

### Ways to solve and prevent inguinodynia

The European Hernia Society guidelines recommend the identification of the 3 inguinal nerves (ilioinguinal, iliohypogastric, and genital branch of the genitofemoral) for the reduction of late postoperative pain due to nerve injuries,<sup>6</sup> which can be caused by intraoperative direct or indirect involvement secondary to mesh placement.<sup>8</sup> Knowledge of the anatomy of these nerves can thus facilitate their identification and proper management, reducing risks and significantly improving the safety

and success rate of surgical procedures, not only for inguinal hernia repair, but also for varicocele operations and ilioinguinal/iliohypogastric blocks with ultrasound-guided or landmark-based techniques.<sup>6</sup> Documentation of the presence or absence of innervation, and whether it was adequately protected during the procedure, provides evidence that the surgeon sought to identify it in order to avoid direct injury. Formal recording of nerve preservation or sacrifice may influence the future management of the patient if he or she develops inguinodynia. Without clear documentation, it is not possible to plan future therapeutic interventions if patients return with chronic postoperative pain in the groin area.<sup>8</sup>

In addition, studies have shown that the identification and management of inguinal nerves for inguinal hernia repair is deficient in current procedures, which suggests that inguinal nerves have not been considered a priority in patients undergoing surgery. This may be due to the lack of anatomical knowledge of the region on the part of surgeons who frequently perform these operations.<sup>8</sup> In this sense, in cases where it is not possible to prevent nerve injury, a method to reduce postoperative pain in patients undergoing laparoscopy is to fix a mesh with glue, which is used in areas where the mesh can fully adhere against another flat surface. Therefore, the best adhesion of the screen, and consequent its lower folding, can be achieved in the three-dimensional myopectineal hole with precast 3D screen.<sup>3</sup> Laparoscopic triple neurectomy or robotic neurectomy can also be used, which is considered a safe and effective technique in the treatment of refractory chronic inguinal pain.<sup>4</sup> However, it should be borne in mind that successful treatment usually requires surgical intervention, but that failure of an initial surgical attempt is not uncommon, occurring in up to 20% of patients.<sup>7</sup>

## CONCLUSION

Surgeons' knowledge of the nervous anatomical region by laparoscopic surgery is capable of preventing inguinodynia. The identification, recognition, and preservation or dissection when necessary of the main nerves in the region prevents chronic groin pain. Therefore, it is understood that with the surgical techniques currently available for hernioplasty, added to the expertise of the professional who performs the procedure, the correction of inguinal hernia can be mostly effective and without sequelae of chronic pain.

## Authors' contributions

Ana Júlia Ribas Sigwalt: Conceptualization, Writing (review and editing)  
 Marcos Fabiano Sigwalt: Formal analysis, Methodology, Writing (review and editing)  
 Lívia Dala Déa Ferreira Pocay: Investigation, Writing (review and editing)  
 Mahara Freitas dos Santos, Investigation, Writing (review and editing)  
 Tailla Cristina de Oliveira: Investigation, Writing (review and editing)  
 Leonardo Wanderloff Franco: Investigation, Writing (review and editing)  
 Fernando Issamu Tabushi: Writing (original draft), Writing (review and editing)

## REFERENCES

1. Caserta N, Penachim TJ, Contardi EB, Barbosa RCF, Gomes TL, Martins DL. Contents of the inguinal canal: identification by different imaging methods. *Radiologia Brasileira*. 2021;54(1):56–61. <https://doi.org/10.1590/0100-3984.2020.0006>
2. Dop LMVD, Hartog FPD, Sneiders D, Kleinrensink G, Lange JF, Gillion JF. Significant factors influencing chronic postoperative inguinal pain: A conditional time-dependent observational cohort study. *International Journal of Surgery*. 2022;105:106837. <https://doi.org/10.1016/j.ijso.2022.106837>
3. Mitura K, Garnysz K, Wyrzykowska D, Michalek I. The change in groin pain perception after transabdominal preperitoneal inguinal hernia repair with glue fixation: a prospective trial of a single surgeon's experience. *Surgical Endoscopy*. 2018;32(10):4284-9. <https://doi.org/10.1007/s00464-018-6178-0>
4. Carrillo GG, Sanz MG, Alonso M de A, Fernandez AG, Prieto MAA. Robot-assisted laparoscopic triple neurectomy for chronic inguinal pain: Description of the technique, our experience and preliminary results. *Actas Urológicas Españolas (English Edition)*. 2023;47(9):605-10. <https://doi.org/10.1016/j.acuroe.2023.05.001>
5. Graham D, Macqueen IT, Chen DC. Inguinal neuroanatomy: Implications for prevention of chronic postinguinal hernia pain. *International Journal of Abdominal Wall and Hernia Surgery*. 2018;1(1):1. [https://doi.org/10.4103/ijawhs.ijawhs\\_6\\_18](https://doi.org/10.4103/ijawhs.ijawhs_6_18)
6. Cirocchi R, Henry BM, Mercurio I, Tomaszewski KA, Palumbo P, Stabile A, et al. Is it possible to identify the inguinal nerves during hernioplasty? A systematic review of the literature and meta-analysis of cadaveric and surgical studies. *Hernia*. 2018;23(3):569-81. <https://doi.org/10.1007/s10029-018-1857-2>
7. George T, Williams EH, Franklin R, Dellon AL. Two-Team Surgical Approach to Improve Retroperitoneal Nerve Identification in the Treatment of Groin Pain. *Annals of Plastic Surgery*. 2019;82(1):82-4. <https://doi.org/10.1097/sap.0000000000001662>
8. Farquharson BJ, Sivarajah V, Mahdi S, Bergman H, Jeyarajah S. Where is the nerve? Review of operation note documentation practice for inguinal hernia repair. *Annals of the Royal College of Surgeons of England*. 2021;103(9):651–5. <https://doi.org/10.1308%2Frcsann.2021.0024>
9. Pedersen KF, Chen DC, Kehlet H, Staaeager MW, Bisgaard T. A Simplified clinical algorithm for standardized surgical treatment of chronic pain after inguinal hernia repair: A quality assessment study. *Scandinavian Journal of Surgery*. 2020;110(3):359-67. <https://doi.org/10.1177/1457496920954570>
10. Furtado M, Claus CMP, Cavazzola LT, Malcher F, Bakonyi-Neto A, Saad-Hossne R. Sistematização do reparo da hérnia inguinal laparoscópica (TAPP) baseada em um novo conceito anatômico: Y invertido e cinco triângulos. *Arq Bras Cir Dig*. 2019;32(1):e1426. <https://doi.org/10.1590/0102-672020180001e1426>