

SURGICAL TECHNOLOGY

INTERNATIONAL XXVIII

International
Developments
in Surgery and
Surgical
Research



Edited by:

Zoltán Szabó, PhD, FICS, Harry Reich, MD, FACOG, Manabu Yamamoto, MD, PhD,
Harold Brem, MD, FACS, Steven F. Harwin, MD, FACS, Michael T. Manley, PhD, FRSA
Michael A. Mont, MD, Prof. Arnaud Wattiez, MD

A Complete Sutureless Hernia Repair for Primary Inguinal Hernia The Trabucco Repair: A Tribute to Emanno Trabucco

GIAMPIERO CAMPANELLI, MD
PROFESSOR OF SURGERY
INSUBRIA UNIVERSITY
VARESE/ COMO, ITALY
DIRECTOR

GENERAL AND DAY SURGERY UNIT
CENTER OF RESEARCH AND HIGH SPECIALIZATION FOR THE
PATHOLOGIES OF ABDOMINAL WALL AND SURGICAL
TREATMENT AND REPAIR OF ABDOMINAL HERNIA
ISTITUTO CLINICO SANT'AMBROGIO
MILAN, ITALY
PRESIDENT
EUROPEAN HERNIA SOCIETY
PARIS, FRANCE

PIERO GIOVANNI BRUNI, PHD
RESEARCHER
INSUBRIA UNIVERSITY
VARESE/ COMO, ITALY
CONSULTANT

GENERAL AND DAY SURGERY UNIT
CENTER OF RESEARCH AND HIGH SPECIALIZATION FOR THE
PATHOLOGIES OF ABDOMINAL WALL AND SURGICAL
TREATMENT AND REPAIR OF ABDOMINAL HERNIA
ISTITUTO CLINICO SANT'AMBROGIO
MILAN, ITALY

MARTA CAVALLI, PHD
RESEARCHER
UNIVERSITY OF CATANIA
CATANIA, ITALY
CONSULTANT

GENERAL AND DAY SURGERY UNIT
CENTER OF RESEARCH AND HIGH SPECIALIZATION FOR THE
PATHOLOGIES OF ABDOMINAL WALL AND SURGICAL
TREATMENT AND REPAIR OF ABDOMINAL HERNIA
ISTITUTO CLINICO SANT'AMBROGIO
MILAN, ITALY

ANDREA MORLACCHI, MD
RESIDENT
GENERAL SURGERY DEPARTMENT
INSUBRIA UNIVERSITY
VARESE/ COMO, ITALY
RESIDENT

GENERAL AND DAY SURGERY UNIT
CENTER OF RESEARCH AND HIGH SPECIALIZATION FOR THE
PATHOLOGIES OF ABDOMINAL WALL AND SURGICAL
TREATMENT AND REPAIR OF ABDOMINAL HERNIA
ISTITUTO CLINICO SANT'AMBROGIO
MILAN, ITALY

ABSTRACT

Since 1989, the authors have been using the Trabucco tension-free and sutureless technique for the repair of primary groin hernia with a pre-shaped mesh in more than 8,000 surgical procedures for complex and "simple" abdominal and inguinal hernias; over 4,000 cases have been considered in this study. The great majority of these procedures were performed under local anaesthesia and with a complete and careful nerve sparing.

Compared to the Lichtenstein's technique, which is currently the golden standard treatment worldwide, there are no significant differences in the observed recurrence rate (below 2%).

For the Law of Pascal, the pre-shaped prosthesis developed by Trabucco remains stretched uniformly in the inguinal canal, without the need to be secured with sutures and without forming dead space, which is a cause of infections, pain, and recurrence.

The main advantage of a tension-free and sutureless repair is given by the relevant reduction in postoperative chronic neuralgia, which is not an uncommon complication and, depending on its intensity, can also potentially jeopardize a patient's work and social activities.

The identification and the sparing of the three nerves of the inguinal region is of crucial importance to reduce the rate of neuralgia in the short and long term. Furthermore, the use of a local anaesthesia imposes the surgeon to properly recognize those nerves and to respect them during the repair. It goes without saying that the complete exposition of the right anatomy of inguinal canal is mandatory.

The intentional section of one or more nerves, when it is not technically possible to achieve a satisfactory nerve sparing, or special tricks to create proper fenestrations (small window) on the edge of the prosthesis to prevent the scar tissue to involve the spared nerves, ensures a further reduction of the rate of neuralgia and excellent patient outcomes.

BACKGROUND

"Traditional methods" of repairing inguinal hernias are characterized by tension along the suture line, which is the main cause of recurrence and post-operative pain. In 1974, Lichtenstein adopted a new "tension-free" approach using a polypropylene prosthesis to improve results.^{1,2} Ermanno Ennio Trabucco (August 15, 1926 to March 9, 2015; Fig. 1) improved on the tension-free concept by introducing his complete "sutureless" technique for all primary groin hernia repair which is based on the utilization of an universal pre-shaped mesh that will virtually



Figure 1. Ermanno Ennio Trabucco (August 15, 1926–March 9, 2015).

always fit into the subaponeurotic inguinal space of every individual.^{3,4} In effect, it had been observed that the size and shape of this anatomical space has minimal variations from one individual to another.

A rigid pre-shaped mesh with controlled memory,⁵ like a monofilament polypropylene prosthesis (middle weight), does not need to be sutured once placed into a closed space. Based on Pascal's principle, the intra-abdominal pressure is evenly distributed over a large surface area of mesh: the prosthesis will remain stretched uniformly in the inguinal box (Fig. 2) without a tendency to wrinkle or curl and without the need to be secured with sutures. In other words, such a mesh, thanks to its optimum rigidity and memory shape, is positioned without sutures and will always lie flat and will not move or form dead space.^{3,4,5} This avoids complications such as seroma, haematoma, or even relapse, remaining flat and adhering to the underlying tissue during the fibroblastic infiltration into its pores, a process that seals the mesh into place.^{3,5}

Ideated and developed by Trabucco in 1988, the Hertra[®] meshes (Herniamesi[®], S. R. L., Chivasso, Italy) pre-shaped prosthesis (n. 1-6; from most rigid meshes to the softest ones, which are ideal for athletes and for young

patients; Fig. 3) are time saving and easy to implant. The Hertra[®] meshes were never found to curl or shrink after implantation⁵ and, in our experience, are the best choice for all simple, uncomplicated, primary inguinal hernias.^{6,7}

We clearly believe that the main advantage of a tension-free and sutureless repair is given by the relevant reduction in postoperative pain and neuralgia.^{8,9} The chronic postoperative inguinodynia occurs in about 10% of patients undergoing inguinal hernioplasty with prosthesis and sutures^{8,10-16}; it is not an uncommon complication and, depending on its intensity, can also potentially jeopardize patient's work and social activities.

The Trabucco repair, which requires a perfect knowledge of the inguinal anatomy, maximizes the preservation of the physiology of the abdominal wall, through the correct recognition and respect of the noble structures and the sparing of the three nerves of the groin region (iliohypogastric, ilioinguinal and genitofemoral; Fig. 4 and Fig. 5), minimizing postoperative pain in order to ensure the best patient comfort with a more rapid and efficient recovery of his usual daily activities.

The intentional section of one or more nerves, when it is not possible to achieve a satisfactory nerve sparing, or

special tricks to create tailored fenestrations in the prosthesis to prevent the scar tissue to involve the spared nerves during fibroblastic processes, ensure a further reduction of the rate of neuralgia^{8,13,16}

Moreover, the Trabucco repair can be easily and routinely performed under local anaesthesia^{6,7} and permits some useful tricks during surgery, like the hydro-dissection of infiltrated tissues for a less traumatic and more safe isolation of the hernia sac (Fig 6), the spermatic cord components, and the nerves from the adjacent structures within the inguinal region.

The mastery of this technique under local anaesthesia also gives a further advantage, helping the surgeon to discover any hidden and unknown hernia defect (Spigelian included) simply by asking the patient to give a cough during the intraoperative exploration of both the inguinal box and the femoral canal (that always should be explored). It also allows the patients to return home just a few hours after the intervention (keeping down hospitalization costs), go back to sedentary work the day after, and to their full activities rapidly.^{6,7,11-13,16}

MATERIALS AND METHODS

Since 1989, the authors have been using the Trabucco tension-free and sutureless technique for the repair of primary groin hernia with a pre-shaped mesh in more than 8,000 surgical procedures for complex and "simple" abdominal and inguinal hernias; over 4,000 cases have been considered in this study. The great majority of these procedures (93%) were performed under local anaesthesia and with a complete and careful nervesparing.

In addition, an intraoperative sedation has been used in some complicated cases (5.2%).

We have used a general anaesthesia in 2% of all the cases for the repair of those primary inguinal hernias that were too oversized or not reducible (1.2%) and for those patients who specifically had requested it in the pre-operative phase for psychological reasons (0.6%).

Every repair was started with a small horizontal left/right supra pubic incision, with the aim of respecting the cutaneous

sensory nerves of the inguinal region that would be more traumatized by a classical transverse incision because of their line of metameric distribution through the skin at that precise level (Fig 7).

After the ligation of subcutaneous vessels and the incision of the external oblique aponeurosis (Fig 8), a blunt dissection of the subaponeurotic space was made to accommodate the sutureless prosthesis; it goes without saying that the complete exposition of the right anatomy of the inguinal canal is mandatory.

"Normal" structures, such as a conjoint tendon and rectus sheath, a pubic tubercle with the horizontal portion of the pubic bone, an inguinal ligament till anterior inferior iliac spine, and an internal ring, all must be not only recognized, but carefully prepared in order to have the "bed" on which to lie the mesh. With the same attention, all the external oblique aponeurosis subspace must be fully prepared from above to below in order to cover the prosthesis completely and uniformly, from pubic tubercle to its upper opening. Only if this closure—putting the cord in the subcutaneous space—is perfectly realized from the point 1.5 cm on the pubic bone to the upper part, can the mesh be completely stable without stitches or sutures.

The iliohypogastric, ilioinguinal, and genitofemoral nerves were always detected, carefully isolated and, when



Figure 2. The "inguinal box" (original drawings supplied by E. E. Trabucco).^{3,4}

possible, well preserved (over 99% of the cases), paying particular attention to never leaving them in direct contact with the prosthesis, by practicing in some specific cases (24%), some small tailored out-outs on the edge of the pre-shaped mesh itself (small window), with the aim to protect each single nerve from possible entrapment in the later fibroblastic processes. In a minority of cases (0.04%), we have executed an intentional section of nerves showing an

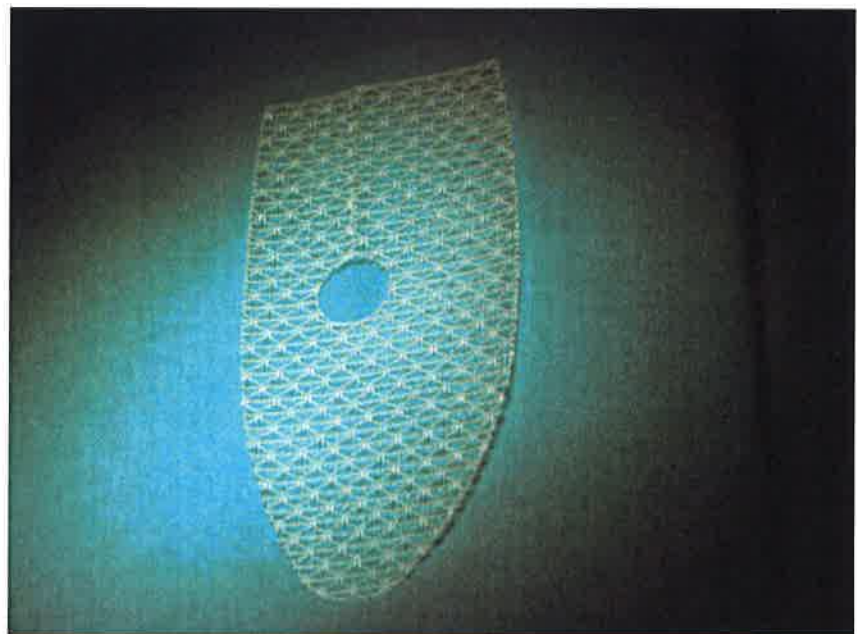


Figure 3. Universal pre-shaped polypropylene mesh developed by Trabucco.

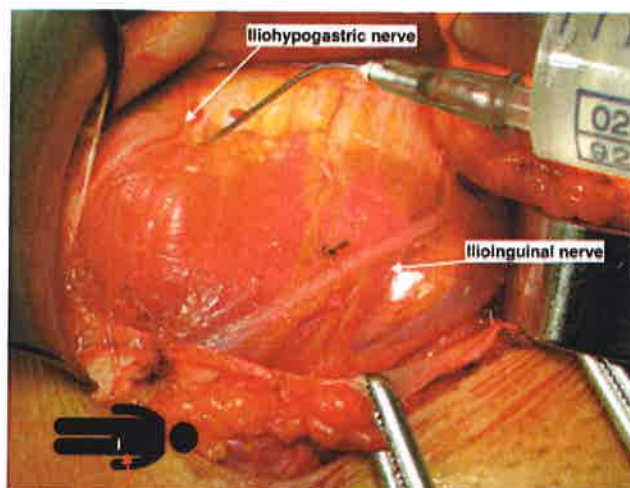


Figure 4. Local anaesthesia during Trabucco primary hernia repair: sub-fascial infiltration of ilio-hypogastric and ilioinguinal nerves.

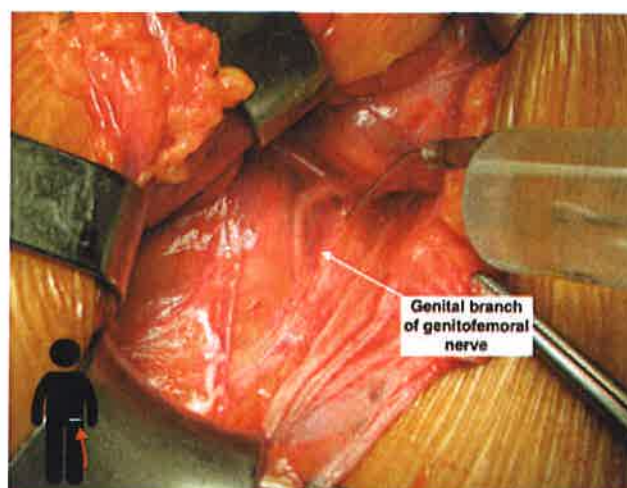


Figure 5. Local anaesthesia during Trabucco primary hernia repair: infiltration of genital branch of genitofemoral nerve on the flattened floor of the inguinal box.

abnormal position within the inguinal box, but only when, after careful thought by the operator on the surgical anatomy of that particular individual, have we seen no other solutions for their spring.

Small indirect hernias (874) were repaired by careful isolation and reduction of the sac into the deep ring, which was then narrowed with sutures. A sutureless Hertra® Herniamesh® was implanted and the external oblique aponeurosis was closed over the mesh and under the spermatic cord.

Medium (1.732) and large (519) indirect hernias were repaired by dissection and reduction of the sac, followed by implantation and fixation, with absorbable suture to the internal inguinal ring, or a polypropylene plug

in the shape of a "parachute" (from 1989 to 1999). Alternatively, hernias were repaired using a T1 baseless dart-plug (arrow-shaped edge with four wings, realized during surgical interventions in different dimensions in conformity with inguinal internal ring size), or an absorbable plug inserted in the deep ring and fixed with a single absorbable suture around the internal ring itself, or, lastly, (more recently) by implantation of a T4 flat plug (Fig 9) positioned around the spermatic cord in the preperitoneal space (Fig 10). This is all dependent on the real size of the defect that was found case by case, through a very careful and tailored process. In most cases, the posterior wall was closed over the T4 plug. A pre-shaped Hertra® Herniamesh® was then implant-

ed on the flattened posterior wall of the inguinal canal.

Direct hernias with partial (1.185) or total (423) wall involvement were repaired by reduction of the sac with a continuous absorbable running suture, which flattened the floor of the inguinal canal, thus allowing for a better apposition with a pre-shaped Hertra® Herniamesh®. The distal tip of the mesh must be placed upon the pubic tubercle with enough overlap, laterally to the hollow of the inguinal ligament, and medially at the sheath of abdominal rectus muscle. With an absorbable stitch, we approach the two tails of the mesh: in this way we recreate a new internal inguinal ring and no stitches are positioned on surrounding tissues (Fig 11).

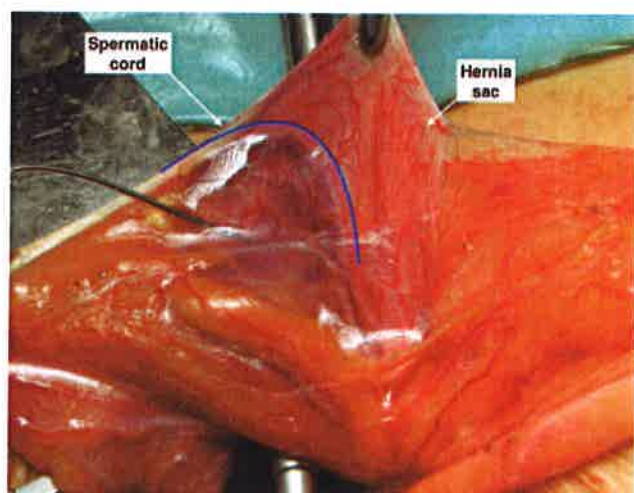


Figure 6. Isolation by hydro-dissection of an indirect external oblique hernia sac.

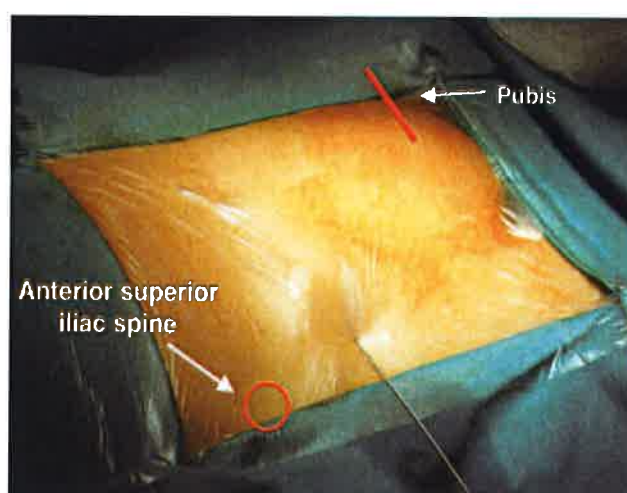


Figure 7. Local anaesthesia before a horizontal supra-pubic right inguinal incision at the beginning of the procedure.

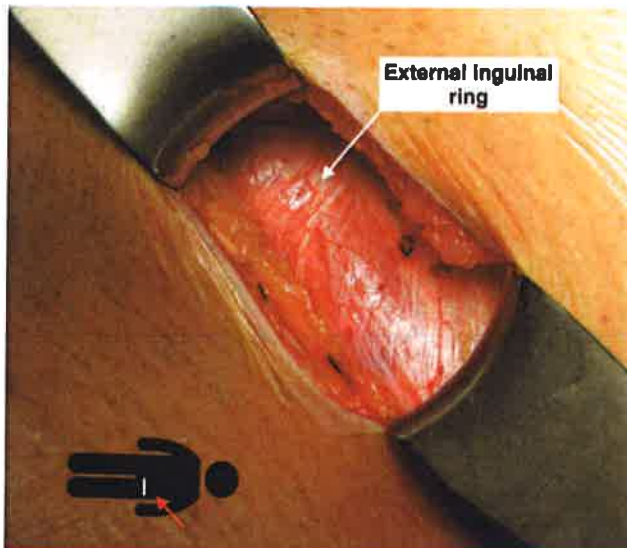


Figure 8. Exposure of the external oblique aponeurosis.

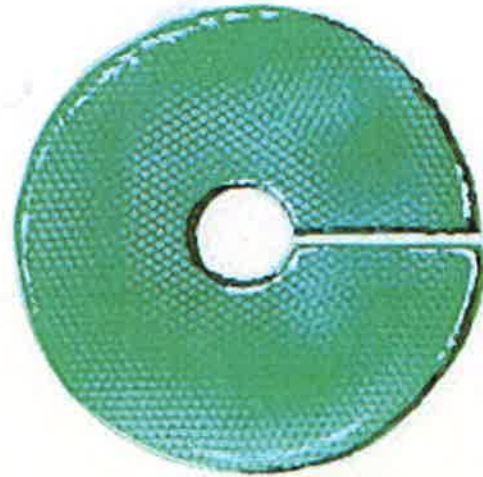


Figure 9. T4 flat plug developed by Trabucco.

RESULTS

We have performed 4,018 surgical operations for primary inguinal hernia adopting the complete sutureless Trabucco repair. Among them, 3,851 were acquired (95.8%) and 167 were congenital (4.2%).

Concerning all types of detected inguinal defects, contemporary or not, we have found a total of 3,125 external oblique hernias (77.7% of the cases), 1,608 direct hernias (40.0%), and 33 internal oblique hernias (0.82%). In greater detail, we have encountered

external oblique defects in 2,390 cases (59.5%), direct defects in 891 cases (22.2%) and 2 internal oblique defects (0.05%). Among those cases with more than one defect intraoperatively detected, we found 704 cases (17.5%) with a contemporary presence of external oblique and direct defect, in 18 cases (0.45%) the presence of external oblique and internal defect, and in 13 cases (0.32%) we found all the three components.

We have treated 129 inguino-scrotal hernias (3.21%) and have found 49 sliding hernias (1.21%) and 87 primary femoral hernias during the interven-

tions (2.16%).

All 4,018 patients were treated surgically with a complete sutureless repair sac. In regard to the Trabucco repair, there were intraoperatively only two cases of vagal fit (0.04%) with hypotension and severe bradycardic rhythm, both of which cleared up without consequences after selective drugs supply. In the early postoperative period, we have found seven peri-operative vagal fits (0.17%) and five postoperative haemorrhages (0.12%) that did not require a second look, for a total of 12 cases (0.29%).

All patients were submitted one

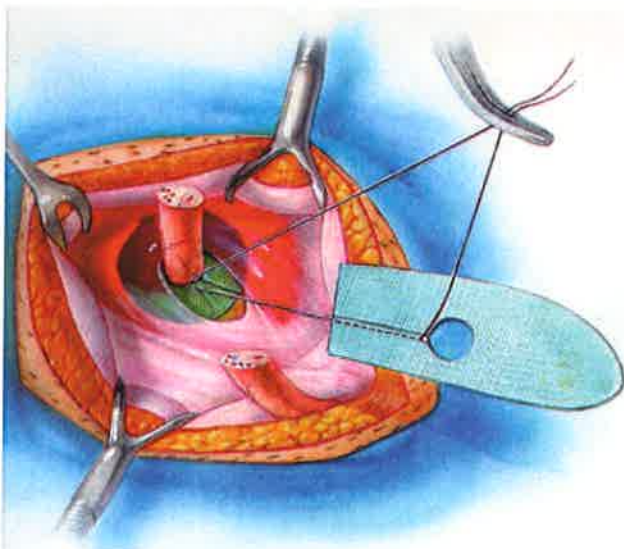


Figure 10. T4 flat plug into a large internal inguinal ring, anchored to the pre-shaped onlay mesh (original drawings supplied by E. E. Trabucco).^{3,4}

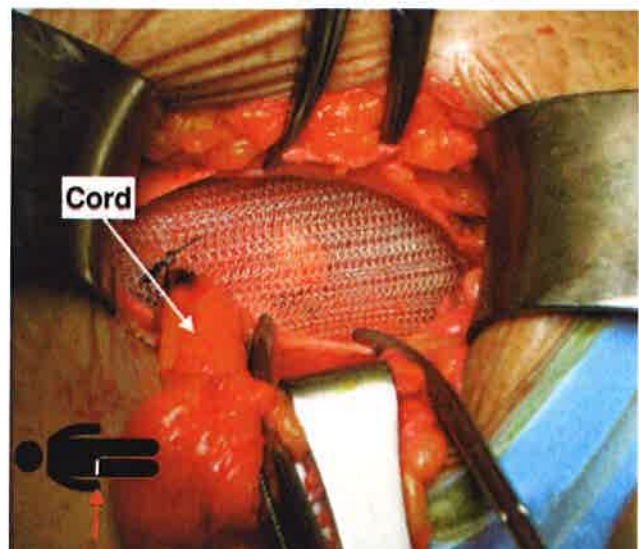


Figure 11. Final view of a polypropylene pre-shaped mesh implanted in the inguinal box.

week after their control visit and we found: 10 inguino-scrotal edema (0.24%), 3 infections of the wound (0.07%), 16 seroma (0.39%), and 9 haematomas (0.22%) for a total of 38 cases (0.94%).

1,072 patients (26.7%) were controlled with a specific follow-up visit (12 to 96 months after surgery) and only 31 patients (2.89%) had a postoperative neuralgia for two to three months and spontaneous remittance. At the time of publication, there were two recurrences (0.18%).

CONCLUSIONS

With the complete sutureless repair ideated by Trabucco (eventually performed with minor modifications regarding the choice of an absorbable plug for indirect large defects), the postoperative discomfort was minimal, the nerve injury was rare, and the recurrence rate was very low. The identification and the respect of the three nerves of the inguinal region is of crucial importance to reduce the rate of neuralgia in the short- and long-term.

The use of local anaesthesia forces the surgeon to properly recognize those nerves and to respect them during the repair, providing precious advantages, but certainly requiring more attention and care by the surgeon in order to avoid unnecessary discomfort to the patient. The Trabucco's technique can be routinely performed in a day surgery regimen, under local anaesthesia, obtaining the maximization of comfort for the patients while offering excellent results for the repair of any type of primary inguinal hernia.

Compared to the Lichtenstein's technique and transabdominal preperitoneal, which are at present the gold standard treatment for primary inguinal hernias worldwide, there are no significant differences in the observed recurrences and chronic pain rate.

In our experience with over 4,000 open-hernia repairs, the results of this safe technique (prospective database) have been extremely satisfactory and translate into an overall risk of developing chronic groin pain well below 1%.

Our personal approach to all hernia diseases is a very "tailored" approach using open and laparoscopic, anterior and posterior and combined, as well as synthetic and biologic meshes, with local, spinal, and general anaesthesia, with sutures, sutureless, and/or glue closure, for ambulatory or hospitalized patients. Ultimately, we choose the best options for each individual patient and, in our opinion, we think that the Trabucco technique for simple primary inguinal hernia should be in the armamentarium of each hernia/general surgeon. [\[51\]](#)

AUTHORS DISCLOSURES

The authors have no conflicts of interest to disclose.

REFERENCES

1. Lichtenstein IL, Shulman AG, Amid PK, et al. The tension-free hernioplasty. *Am J Surg* 1989; 157(2):188-93.
2. Lichtenstein IL, Shulman AG, Amid PK, et al. Cause and prevention of postherniorrhaphy neuralgia: a proposed protocol for treatment. *Am J Surg* 1988; 155(6):786-90.

3. Trabucco EE, Trabucco AF. Flat plug and mesh hernioplasty in the "inguinal box": description of the surgical technique. *Hernia* 1998;2:133-8.
4. Trabucco EE, Trabucco AF, Rollino R, et al. Ernioplastica inguinale tension-free con rete presagomata senza suture secondo Trabucco, vol II. Torino: Chirurgia Minerva Medica 1998.
5. Trabucco EE, Campanelli G, Bruni PG, et al. Nuove protesi erniarie in polypropylene. *Min Chir* 1998; 53:337-41.
6. Campanelli G, Cavagnoli R, Gabrielli F, et al. Trabucco's procedure and local anaesthesia in surgical treatment of inguinal and femoral hernia. *Int Surg* 1995;80(1):29-34.
7. Campanelli G, Cioffi U, Cavagnoli R, et al. Open sutureless tension-free repair for primary inguinal hernia. *Hernia* 1999;3(3):121-24.
8. Alfieri S, Amid PK, Campanelli G, et al. International guidelines for prevention and management of post-operative chronic pain following inguinal hernia surgery. *Hernia* 2011;15(3):239-49.
9. Amid PK. Classification of biomaterials and their related complications in abdominal wall hernia surgery. *Hernia* 1987;(1):15-21.
10. Simons MP, Aufenacker T, Bay-Nielsen M, et al. European Hernia Society guidelines on the treatment of inguinal hernia in adult patients. *Hernia* 2009;13(4):343-403.
11. Lichtenstein IL. The one-day inguinal herniorrhaphy: The American method. *Contemp Surg* 1982;20:17.
12. Wantz JE. Ambulatory hernia surgery. *Br J Surg* 1989;76(12):1228-9.
13. Simons MP, Aufenacker T, Bay-Nielsen M, et al. European Hernia Society guidelines on the treatment of inguinal hernia in adult patients. *Hernia* 2009;13(4):343-403.
14. Douek M, Smith G, Oshowo A, et al. Prospective randomised controlled trial of laparoscopic versus open inguinal hernia mesh repair: five year follow up. *BMJ* 2003;326:1012-3.
15. Gilbert AI. Sutureless repair of inguinal hernia. *Am J Surg* 1992; 163(13): 331-5.
16. Campanelli G, Sfedan C, Cavalli M, et al. Reducing postoperative pain: the use of Tisseel for mesh fixation in inguinal hernia repair. *Surg Technol Int* 2012;22:134-9.