ISSN: 2457-0400

Impact Factor: 7.675

WORLD JOURNAL OF ADVANCE HEALTHCARE RESEARCH

www.wjahr.com

Volume: 10, Issue: 5

Page N. 271-281

Year: 2026

Review Article

Coden USA: WJAMA3

COMPARATIVE OUTCOMES OF LAPAROSCOPIC AND ROBOTIC INGUINAL HERNIA REPAIR: A NARRATIVE REVIEW

Amulya Akula*[1], Dr. M. Sai Venkata Pavan[2], Madhuri Routhu[3], Srujana Poloju[4], Sreemantula Divya[5], Dr. P. Sharath Chandra Kaushik[6]

*[1]Pharm.D VI Year, Sarojini Naidu Vanita Pharmacy Maha Vidyalaya (CO-ED.), Tarnaka, Hyderabad, Telangana, India - 500017.
[2]MBBS, DNB PG (General Surgery), Medicover Hospitals, Hitech-City, Hyderabad, Telangana, India -500081.
[3]Pharm.D VI Year, Sarojini Naidu Vanita Pharmacy Maha Vidyalaya (CO-ED.), Tarnaka, Hyderabad, Telangana, India - 500017.
[4]Pharm.D VI Year, Sarojini Naidu Vanita Pharmacy Maha Vidyalaya (CO-ED.), Tarnaka, Hyderabad, Telangana, India - 500017.
[5]Assistant Professor, Department of Pharmacy Practice, Sarojini Naidu Vanita Pharmacy Maha Vidyalaya (CO-ED.), Tarnaka, Hyderabad, Telangana, India - 500017.
[6]MBBS, MS, FMBS (RGUHS), FIAGES, FALS(Bariatrics), FISCP, Consultant Minimal Invasive & Bariatric Surgeon, Consultant Proctologist, Medicover Hospitals, Hitech-City, Hyderabad, Telangana, India -500081.

Article Received: 07 April 2026 **Article Revised:** 28 April 2026 **Article Published:** 01 May 2026

***Corresponding Author: Amulya Akula**

Pharm.D VI Year, Sarojini Naidu Vanita Pharmacy Maha Vidyalaya (CO-ED.), Tarnaka, Hyderabad, Telangana, India - 500017.

DOI: https://doi.org/10.5281/zenodo.20019991

How to cite this Article: Amulya Akula*[1], Dr. M. Sai Venkata Pavan[2], Madhuri Routhu[3], Srujana Poloju[4], Sreemantula Divya[5], Dr.P.Sharath Chandra Kaushik[6] (2026). Comparative Outcomes Of Laparoscopic And Robotic Inguinal Hernia Repair: A Narrative Review. World Journal of Advance Healthcare Research, 10(5), 271–281.

ABSTRACT

Repair of an inguinal hernia continues to be among the most frequent surgical procedures performed by general surgeons around the globe. Patients are still seeking for a method that will minimize their postoperative discomfort and accelerate their recovery. The question remains whether the traditional laparoscopic approach is better than the contemporary robotic technique. The objective of this review is to evaluate and compare the outcomes of laparoscopic versus robotic inguinal hernia repair focusing primarily on postoperative events such as the onset of pain following surgery, including pain during the first days post-surgery, pain that persists in the groin area months later, recurrence of hernia both early and late after the operation, any complications, hospital stay duration, ability to return to work, and quality of life. Both procedures produce fairly similar results on the patients' side. In terms of operation time, robotic surgery takes roughly 15-27 minutes longer than open surgery but is more expensive; nonetheless, the pain results are virtually identical in most of the review studies. The rate of recurrence remains very low, around 1-2 percent, and there is no clear evidence of either technique being superior. Other complications such as seroma formation, retention of urine, and wound problems happen equally frequently, yet in one extensive meta-analysis, a slightly higher risk of surgical site infections was associated with the robotic procedure. Hospital length of stay and recovery time are equal, and the quality of life improves relatively quickly irrespective of the selected technique. There is some evidence that, in more complicated cases, the robotic method may show a slight early edge regarding the need for fewer opioid pills and greater comfort on the part of the patient; however, randomized trials fail to prove this conclusively. Clinical implications and future perspectives: In terms of simple clinical indications such as routine cases of abdominal wall hernia, both methods are still safe procedures that can be trusted; however, it is important to mention the potential benefits that the use of robots brings in cases when there is an increased body mass index (BMI) and in recurring hernias due to improved 3D vision and suture placement assistance. It should be noted that the cost associated with the procedures and the increased time required for preparation makes it necessary to conduct further analysis.

KEYWORDS: Inguinal Hernia Repair, Laparoscopic Repair, Robotic Repair, Postoperative Pain, Chronic Groin Pain, Hernia Recurrence, Hospital Stay, Quality of Life, Minimally Invasive Surgery, Surgical Outcomes, Patient reported outcomes.

1. INTRODUCTION

Consider a 52-year-old man running his own small family enterprise in the same city, and this man has been having issues with a disturbing groin bulge for many months. The discomfort gets worse especially when he lifts the heavy packages from time to time during his work, and even affects his cricket games during the weekend with his children, and occasionally causes some trouble for him to have a sound sleep at night as well. Inguinal hernia cases are affecting millions of people throughout the globe, and it is an extremely frequent procedure among the surgeries for the surgeons, yet the dilemma of choosing which surgical technique is best whether laparoscopy or robotic technique is quite important since this decision may help to determine the speed of recovery, amount of postoperative pain, and risk of recurrence. This paper attempts to analyse the issue from a neutral perspective, mainly concentrating on patient-oriented outcomes postoperatively.[1]

The incidence of inguinal hernia turns out to be rather high, affecting around 27% of men and 3% of women during their lifetimes. This results in more than 20 million surgeries being performed every year around the world. In India, for instance, general surgeons are performing many thousands of surgeries yearly, making it one of the most common surgical procedures performed in urban hospitals as well as in rural areas. But apart from the sheer frequency, the cost incurred by the patient is extremely subjective, taking into account not only the discomfort associated with the hernia itself but also reduced productivity and restricted physical activity. Furthermore, the ever-present concern of a potentially life-threatening complication such as strangulation adds to the psychological toll of having an inguinal hernia. In addition, the financial burden imposed on the patient, in terms of loss of income, increased expenses related to medical costs, and additional strain placed on underfunded healthcare facilities, cannot be overlooked. The aforementioned points remain relevant even at present, corroborated by the pioneering research on the subject matter.[1]

Indeed, for many decades, the open surgery using Lichtenstein mesh placement technique was the main procedure available with excellent results in many cases. However, it still had a number of drawbacks such as bigger incisions, higher risks of post-operative pains, higher chances for surgical site infections, and chronic groin pain appearing in 10 to 15 percent of patients. Patients required taking weeks of rest from work, besides requiring stronger pain medications for a longer period than necessary. All this changed dramatically in the first years of 1990s when laparoscopy appeared in this field. Such techniques as TAPP – transabdominal preperitoneal surgery, and TEP – totally extraperitoneal one enabled placing the mesh into the proper preperitoneal space via smaller keyhole incisions. The outcomes were rather impressive: smaller pains, quicker recovery, smaller risks of wound infections, and chances for chronic pains decreasing to 5 to 8 percent with recurrence rate standing close to 2 percent in hands of experienced specialists. Patients could leave the hospital on the very day of surgery or next morning returning to regular life in about a week. As a result, laparoscopy became an established norm in many high-volume centres due to better patient outcomes and perfect safety.

But even with these benefits, laparoscopic surgery comes with a unique set of disadvantages that any surgeon will know firsthand. Working from flat screens using long, rigid instruments in confined spaces and having to stand for hours in front of the patient at the surgical table, especially when dealing with bilateral or recurrent hernias, are some of the drawbacks associated with this surgery. It was these drawbacks that brought about the next leap forward in hernia surgery, that of robotic assisted surgery. The da Vinci surgical system was adopted for hernia surgeries starting from the early 2000s, but it became widely popular post-2015.

The robotic inguinal hernia repair surgery which is referred to as rTAPP is still performed based on the same anatomical considerations including meticulous dissection of the myopectineal orifice, gentle manipulation of the spermatic cord and nerves, and large mesh coverage to reduce the chances of recurrence. The only thing that will change is the experience of the surgeon. Rather than being on their feet for hours in front of a small monitor, the surgeon will sit comfortably at a console, enjoying the advantage of 3D visualization with wristed instruments that mimic the movements of the human hand, with seven degrees of freedom, tremor filtration, and motion scaling. Real-time fluorescence imaging with indocyanine green dye can assist in identifying sensitive structures and allow for the creation of accurate peritoneal flaps; mesh suture using barbed stitches rather than tacks can minimize trauma; and protection of the nerves which might otherwise result in chronic pain issues.[4][5]

In theory certainly these procedures done via robotics definitely seem like an obvious step forward from regular laparoscopy. The improvements in ergonomics will result in decreased fatigue for the surgeon in lengthy or difficult cases and improved accuracy will lead to gentle handling of tissues reduced damage to nerves and easier placement of mesh. Many surgeons who now regularly perform surgery with the assistance of the robot claim that they feel a lot more comfortable when operating on complicated recurrent hernias as well as in obese patients in whom the workspace is cramped. On the other hand, it would be foolish to overlook the various practical drawbacks that are associated with the use of robotics; firstly, the process of docking increases the total procedure time by ten to twenty minutes the machinery is costly and the learning curve although faster than expected does take 20-50 cases.[4][5][8]

For the same reason the scope of this particular review paper will be strictly limited to postoperative consequences because, though the duration of operation and ergonomic conditions during the procedure are also quite significant, what concerns both patients and those surgeons who perform operations, what is really of great significance is what happens after the patient leaves the operating room. How much pain is he or she supposed to suffer after the procedure? how likely it is that he or she will experience persistent pain in the groin area afterwards ? how long will it take to resume normal working life and will there be any risk of hernia reappearance?

By focusing on these practical real-world recovery strategies, including acute pain, chronic pain, recurrence rates, early and late complications, hospitalization time, return to activity, and quality of life, this narrative review seeks to provide a pragmatic view for busy clinicians who will need to rely on this information to make practical decisions while working in the operating theatre. The scope is deliberately kept very pragmatic and includes randomized controlled trials, large cohort studies, meta-analyses, and recent systematic reviews published within the timeframe from 1970 to 2026, especially those released in the last five years due to the rapid uptake of robotics technology.[3][5][6][25]

This type of literature review, since it is not strictly systematic, leaves a lot of room for practical clinical applications, for understanding the mechanisms behind the results, and for looking ahead to new directions. We accept our limitations openly at the very beginning, in that despite the fact that 2026 has come, many of the studies conducted to date suffer from relatively short follow-up times and patient selection biases, while good-quality, long-term randomised trials are hard to find.

The treatment of inguinal hernia has truly progressed from the traditional open surgical procedure via the laparoscopic keyhole technique all the way to the modern-day robotic technique with all interventions being carried out via minute incisions. The critical question here is not about which procedure will be more appealing to watch when the operation is underway but which one will guarantee the quickest recuperation period for the patient with the least amount of postoperative complications.

The following sections will analyse the evidence and help to determine in what cases laparoscopy should continue to be chosen and used by surgeons, and in what cases the employment of robotic techniques may have more value for a particular patient. The introduction to this topic was prepared through the analysis of fundamental evidence obtained in epidemiological reviews and studies on technique development to prove how postoperative outcomes play an essential role in the entire discussion.[1][3][4]

If you consider the issue from the perspective of the patient – the 52-year-old businessman – then it is no longer an issue of which surgical technique to use but rather about being able to lift crates again without any pain, play cricket with his children, and sleep at night without that nagging pain that constantly reminds him of his hernia. This is why we pay such close attention to the recovery aspect during our literature review since this is what the patients want to know about after the procedure.[1]

2. LITERATURE SEARCH STRATEGY

This review focuses on bringing together the latest and most pertinent evidence that is currently available. This has been achieved by conducting a thorough literature search using five main databases: PubMed, Medline, Embase, Scopus, and the Cochrane Library. The reason for selecting these particular databases is that they provide the majority of the literature on surgical, general medicine, and minimally invasive surgery that surgeons use in their day-to-day practice. While it was not intended to conduct a systematic review with a full meta-analysis, it was important to compile high-quality research articles that provide a direct comparison of the results of laparoscopic and robotic inguinal hernia repairs.[5][6]

The date range was carefully selected, extending from January 2010 through April 2026, since 2010 is the year in which robot-assisted inguinal hernia repair began to show up in the literature more consistently, whereas 2026 contains the most recent articles available by the time of this review's publication. The inclusion criteria consisted of primary research articles comparing both methods, with an emphasis on postoperative patient outcomes.

More emphasis was put on randomized controlled trials, propensity score-matched cohort studies, large registry analysis, and impactful meta-analyses that provided us with credible figures. In addition, narrative reviews and expert consensus opinions that had been published within the past three years were considered for inclusion whenever they provided useful clinical information or synthesized the data in a meaningful manner. Research papers that were excluded were those whose findings were limited to intra-operative parameters without follow-up assessments, paediatric subjects, and one-arm case series that lacked a comparison group.[5][6][25]

The use of this method, which was selective but clearly transparent, ensured that the search not only covered the extensive amount of information found within the literature, but also the subtler aspects of the clinical message conveyed when comparing the papers together rather than merely focusing on their respective p-values. Any flaws in the literature search, such as potential publication bias in Favor of robotic surgery or the fact that much of the research originates from high-volume Western centres rather than lower volume centres like

those found in India, will be addressed in greater depth later in the review.[3][25]

While some studies tend to focus on the immediate pain problem, others consider the recurrence aspect of the long-term implications of hernia surgery or cost concerns. For example, the extensive meta-analysis performed by Kheworthy et al. provides thousands of patients' data to consider. In turn, the randomised trial conducted by Brucchi et al. in 2026 offers better-quality evidence even if it includes a smaller sample. It is also useful to combine the findings of the technical analysis with the conclusions made in the narrative review by Barranquero et al.[3][4][5][6]

In the end, the searching process remained realistic and narrow enough so that the literature review does not get lost in technicalities of statistics and other methods and becomes more relevant for surgical application based on real evidence.

3. OVERVIEW OF SURGICAL TECHNIQUES

The laparoscopic and robot-assisted methods for performing an inguinal hernia repair attempt to accomplish essentially the same objective by implanting a prosthesis within the preperitoneal space covering the whole myopectineal orifice of Fruchaud, but they employ entirely distinct means to accomplish their respective objectives and provide the operating surgeon a completely different experience when operating within the theatre. The following discussion will outline the steps involved in each surgical procedure with some detail in order to provide insight into why such a decision might affect the patient's experience post-operationally.[3][4]

3.1 STEPS INVOLVED IN TAPP AND TEP

Inguinal herniorrhaphy Instrumentation used for laparoscopic inguinal hernia repair Two common types of surgery used to treat inguinal hernias are laparoscopic hernioplasty techniques, and these are classified as either transabdominal preperitoneal, or TAPP and totally extraperitoneal, or TEP techniques. Both types of laparoscopy surgeries are carried out using general anesthesia, whereby the patient lies supine with a slight inclination to the Trendelenburg position. The TAPP technique involves placement of a 10 mm cannula at the site of the umbilicus and then placement of one 5 mm ports on the mid-clavicular line. The insufflation of carbon dioxide is done at a pressure of 12 to 15 mmHg into the peritoneal cavity.

A big peritoneal flap is then raised, beginning from the ASIS region till the Median Umbilical Ligament. The hernial sac is carefully returned into the abdominal cavity and the cord structures are skeletonised; the three possible sites for herniation, i.e., the direct site, the indirect one and femoral area are revealed. It is important not to damage some nerves during surgery, like iliohypogastric and genital branch of genitofemoral nerve to prevent future problems with pain and importance. An artificial large mesh, which can be made of polypropylene or polyester, 3D anatomical mesh is used based on size of respective side, is placed, covering completely the whole myopectineal orifice with 3 to 4 cm excess of its edges and being fastened by tacks or glue or self-gripping mesh.

Finally, closure of the peritoneal fold with a continuous stitch or extra tacks occurs to avoid adhesion of the intestine to the mesh. With skilled surgeons, the average duration of operation is 60–90 minutes if performed only on one side and 100–120 minutes if performed on both sides simultaneously.[3][4][25]

TEP approach involves a slight variation in that it is fully extraperitoneal. A balloon dissector is introduced via a mini infraumbilical incision, and the preperitoneal space is created. Two additional working ports are subsequently introduced. This method does not enter the peritoneal cavity at all; thus, many surgeons consider it superior to TAPP due to the decreased likelihood of intra-abdominal complications and subsequent adhesions. The procedure itself is similar to TAPP.

Both procedures depend on traditional laparoscopic tools, two-dimensional high-definition visual perception, and the surgeon standing throughout the operation while working at the table. Such an approach requires good coordination of the hands and eyes and may even turn physically exhausting, particularly when the surgery is extensive or complex.[3][4]

3.2 Specifics of the r TAPP system, docking, instruments the robotic technique is performed virtually exclusively through the transabdominal preperitoneal approach called r TAPP and uses da Vinci Xi or Si surgical robot. Patient positioning is similar to that during a laparoscopic procedure. After pneumoperitoneum is secured, the robotic ports are deployed via a transversely curved line in the lower part of the abdomen.

The robotic system is docked on either the side of the patient or between the patient’s legs, and the surgeon is ready to move to the console to operate from there. From the console, the surgeon can have stereo three-dimensional view, wristed instruments with seven full degrees of freedom, tremor filtration, and motion scaling.

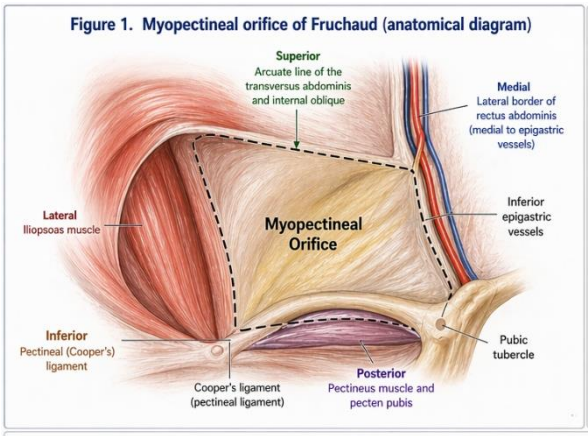
Such characteristics permit easy construction of the peritoneal flap, less aggressive manipulation of the spermatic cord, and facilitate intracorporeal suture of the mesh with absorbable barbed sutures, which are often considered to be less traumatic than staples. Real-time fluorescence visualization with indocyanine green can be performed to identify the vessels and nerves to make the procedure even more precise.

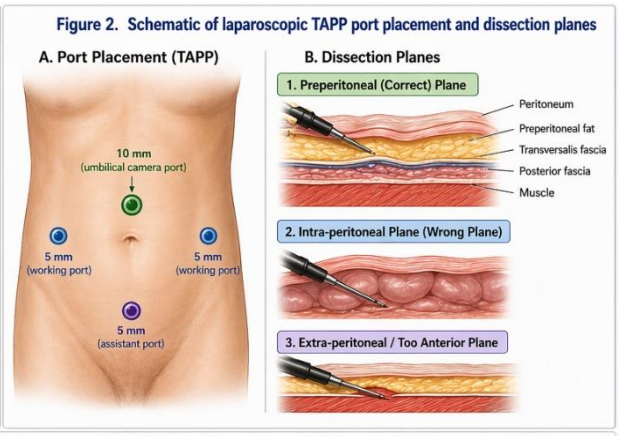
The peritoneal flap is sutured using running barbed sutures which provide a good watertight seal. The

docking and undocking of the robotic system adds up to 10 to 20 minutes to the entire duration of the surgery; however, after docking, the surgeon finds the dissection process automatic and posture ergonomically sound. Some institutions have begun to experiment with single port robotic systems; nevertheless, they are not yet the standard procedure for repairing inguinal hernias as of 2026.[4][5][6][27]

3.3 Intraoperative comparison between the two techniques (operative time, ergonomics, conversion rate) The major difference between the two surgical methods, when compared in operation room, is operative time. The meta-analysis of hundreds of procedures shows that robotic procedure is always longer due to the time required to dock the machine and due to wider port positioning required for robotic arms. Conversion to an open procedure rarely occurs, being below 1 percent both when using a conventional and robotic technique, however, in some recurrent or scarred cases, a robotic technique can be much more favourable due to its better visualization and increased dexterity of instruments.[5][8][25]

However, the field of ergonomics is a completely different story. Laparoscopic surgeons commonly complain of neck pain and shoulder strain during prolonged surgical procedures. On the other hand, the robot console allows the surgeon to assume a seated position with arm rests and thus minimize discomfort and even enhance accuracy especially during bilateral reconstructions and obesity surgeries.[4][5]





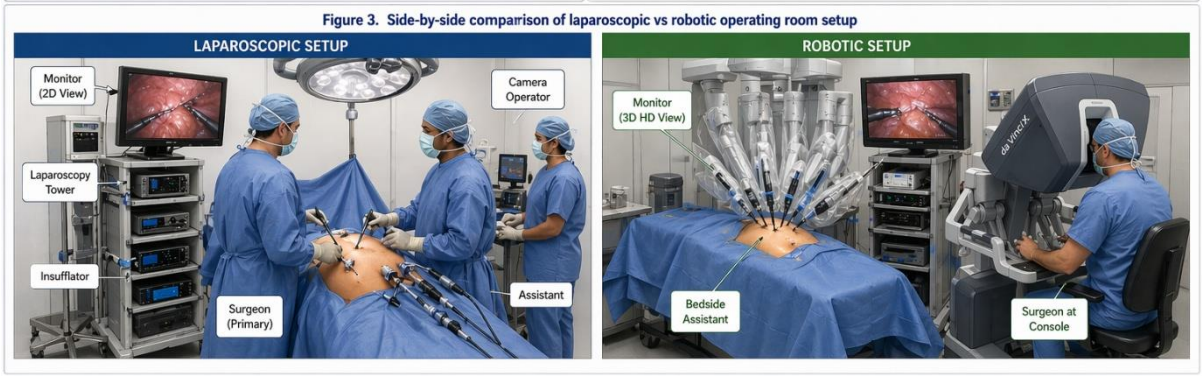


Figure 1 Myopectineal orifice of Fruchaud the anatomical highway every inguinal hernia repair must cover. Understanding this space helps explain why both approaches aim for the same goal even though they use different tools to get there.
Figure 2 Schematic of laparoscopic TAPP port placement and dissection planes.
Figure 3 Side by side comparison of laparoscopic versus robotic operating room setup showing the seated console and articulated instruments in the robotic method.

4. IMPACT ON POSTOPERATIVE OUTCOMES

Having established an understanding of how each procedure is carried out, the next thing that concerns both doctors and their patients is the effect of surgery once the procedure has been completed. From among the meta-analyses of randomized trials and the findings of large cohorts, the emphasis will now be placed on the outcome that matters most to the patient: pain experienced during the immediate postoperative period, discomfort experienced in the long term, recurrence of the hernia, possible complications and overall quality of life.[3][5][6][25]

4.1 ACUTE POSTOPERATIVE PAIN AND THE DEMAND FOR PAINKILLERS

The first week postoperatively is considered by patients to be the most important period in terms of pain due to the influence it may have on their activities. Patients having laparoscopic and robotic procedures recover much more easily than patients undergoing an open

procedure; however, the comparison between laparoscopic and robotic patients shows small advantages of one technique over the other. In a study of Brucchi et al., which included the results of three randomised controlled trials conducted to determine the difference between these two minimally invasive approaches, the pain ratings on the numerical rating scale upon coughing and at rest at 24 hours, one week, and 30 days were similar.[6]

According to a propensity-matched cohort study conducted by Wadhawan et al. in 2025, patients who underwent robotic surgery required slightly fewer opioids in the first week; however, the number was insignificant, and even the researchers did not consider the difference clinically significant for the vast majority of patients.[9]

Other research studies have postulated that the use of wristed instruments in robotic surgery results in less traumatic dissection of tissues surrounding the cord, and many surgeons perform closure of the peritoneal flap using barbed sutures, rather than tacks; both measures may contribute somewhat to reduction of tissue trauma. Nevertheless, the intensity of acute pain remains very low with either approach, and patients have VAS scores under 3 by Day 7 and are able to return to light physical activity in 3 to 5 days.[5][20][24]

However, if we go ahead to look at bigger studies such as the study done by Khewaha et al., the results will be the same, i.e., that laparoscopy repair is slightly faster while the pain management is quite similar and both patients require almost equal amount of analgesia.[5] Observational studies done on cohorts from the year 2025 do provide a slight advantage to robots when it comes to early stages, probably because of low inflammatory response, however, randomized data does not have enough weight to suggest otherwise.[4][23]

4.2 CHRONIC GROIN PAIN / NEUROPATHIC PAIN

Chronic pain lasting over three months is the complication that scares most of the patients as it can negatively impact their life quality. Pooling data from various meta-analyses, there appears to be no significant difference between robotic repair, which is around 2.1%, and laparoscopic repair, which stands between 1.3% and 6.8%.[5][3]

It was highlighted in the literature review conducted by Barranquero in 2025 that while high-level randomized evidence was lacking in this regard, however, some observational studies showed promising results regarding the use of robotic surgery to decrease the occurrence of neuropathic pain due to more accurate mesh fixation without entrapment of nerves.[4] Data related to long-term follow up for more than two years was not available; however, there were some studies indicating that 85 percent of the patients using robots experienced no pain after 35 months.[3][11]

4.3 HERNIA RECURRENCE RATES

Recurrent hernias Recurrence rate can be considered the final indicator of efficacy in any type of hernia repair, since if the hernia recurs, the entire procedure must be repeated. Large scale meta-analyses reveal recurrence rates of 0.7-1.6% for robot-assisted repairs and 0.9-2.7% for laparoscopic repairs at one to three years, with no statistically significant difference between the two modalities.[3][5][8] A single centre study showed a trend towards fewer recurrences in robotic repair 1.2% compared to laparoscopic repair 9.4%, but such results have never been confirmed by randomised studies and could be attributed to selection bias and surgical skill.[3] The follow-up period of more than five years remains rare for both techniques, so at this moment it is impossible to claim superiority regarding recurrence prevention.[3][22]

5. DISCUSSION

However, when one pulls away and takes a look at all the findings that have been presented within this review regarding laparoscopic and robotic inguinal hernia repairs, there is actually quite an accurate and unexpectedly coherent message coming through for patients in terms of what they should expect after undergoing the procedure. All the data collected from the studies analysed, even the extensive meta-analyses and randomized controlled trials, show that both techniques yield virtually identical post-operative outcomes across nearly all patient-relevant parameters such as pain, incidence of hernia recurrence, and return to Post-surgical activities.[3][5][6][25]

It seems to be the case that regardless of whether the surgeon selects the robot or not, the outcome of the procedure for the patient who lies on the operating table will remain pretty much the same, and this is rather reassuring considering all the efforts and finances being pumped into robotic technology nowadays. While the small discrepancies in terms of slightly lower opioid consumption in the very first stages or better results in terms of quality of life in the first stages of recovery are indeed intriguing, one needs to bear in mind that they do not always remain valid under more advanced conditions of randomised studies.[4] [9] [20] [23]

5.1 SUMMARY OF KEY FINDINGS

we have analysed substantial parity between laparoscopic and robotic inguinal hernia repairs in terms of what matters most to patients. Specifically, both procedures provide consistently high-quality patient outcomes, including low postoperative recurrence rates of approximately 1-2% percent, satisfactory levels of discomfort, rapid healing times, and overall high levels of patient satisfaction following the procedure.[3] [5] [8] [15] [22]

After analysing the vast pool of data obtained by the 2024 meta-analysis carried out by Khewater which involved more than sixty-four thousand patients and comparing it to the data generated by Brucchi in 2026 regarding randomized trials, it is evident that there is no major difference between the two methods, since their figures continue to match each other.[5] [6]

While sure robotic repair can be said to take between fifteen and thirty minutes longer during surgery and is very expensive due to the cost of consumables and increased preparation time, these factors do not appear to provide any benefits to the patient postoperatively.[5] [13] [31] [32]

Chronic groin pain, which is the complication everyone worries about the most, sits at roughly two point one per cent for robotic and between one point three and six point eight per cent for laparoscopic with no statistically significant difference across the pooled analyses.[4][5] [3]

One to three-year recurrence rates have also been found to be more or less similar and so have been the immediate complications such as seroma and urinary retention. A meta-analysis has pointed out that the risk of developing surgical site infections with robotic surgery may be marginally high, which could be due to the extended duration of surgery with robots.[5][25][26] Postoperative hospital stay, return to work, and quality of life assessments have also been observed to be equally similar for both types of surgeries. It is noteworthy that the only thing our patient who is a fifty-two-year-old businessman wants is to go back to picking up boxes and playing cricket without being preoccupied by his hernia.[9] [3] [20]

When compared side by side, as seen in Barranquero's 2025 narrative review and Huerta's systematic review, the conclusion remains consistent: robotic technology holds an advantage over laparoscopic techniques in some complex cases, but not to an extent that would lead to altering the recommendation for most uncomplicated hernia cases.[4] [3] [22] [35]

This review can be considered reliable as it is based on a pool of several thousand patients worldwide and yet arrives at similar conclusions: both techniques have advantages and disadvantages, but no clear advantage can be found for either, leaving surgeons to make their decision based on their preference and hospital capabilities.[11] [16] [17] [18]

5.2 MECHANISTIC EXPLANATIONS FOR OBSERVED SIMILARITIES/DIFFERENCES

The explanation of any similarity between the two surgical techniques lies in the way how both the robotic and laparoscopic procedures are designed to achieve exactly the same purpose, namely to cover the whole area of the myopectineal orifice of Fruchaud with overlapping mesh and carefully manipulating the cord structures.[3] [4] Thus, after the surgical procedure is completed, it becomes clear for the surgeon inside what really matters for achieving the desired result, regardless of the exact instruments used by the surgeon during the surgery and his or her posture at the operating table. The slight superiority of robots noted from time to time in the form of lower usage of opioids or improved patient comfort in the first months after the procedure is likely to stem from the following factors: enhanced visualization, no hand tremor, and easier intracorporeal suturing.[4] [5] [23] [24]

Indocyanine green fluorescence imaging in the robotic approach enables the surgeon to visualize the anatomical structures more precisely; therefore, there may be fewer chances of injury to any structure inadvertently, which explains the absence of neuropathic pain in some groups despite the fact that it may not always be evident in the large randomized trials.[4] [6] Conversely, the relatively higher rate of postoperative infection with the robotic approach as shown by Khewater's meta-analysis may have something to do with the longer surgical procedure and multiple dockings that allow bacteria ample time to colonize or the large port sites required for robotic arms.[5] [25] [8]

However, when looking into ergonomics, the obvious advantage of lessening surgeon fatigue through robotic surgery is evident, and the latter would probably contribute to better precision during dissection in long bilateral and recurrent operations which in turn would benefit the patient; but again, the statistics related to patient outcome in terms of the results do not present any considerable differences which indicate that the benefit might be for the doctor rather than the patient.[4] [5] [10] [29] For obese patients and patients who had scars from previous surgeries, greater precision might also mean a lower chance of converting an endoscopic procedure into an open one due to the additional dexterity provided by the robotic system. However, this does not change the outcome.[17] [18] [21]

So the mechanistic story is that both approaches reach the same anatomical endpoint and any small differences come from subtle improvements in visualisation and instrument control rather than a fundamental change in how the body heals.[3] [25]

5.3 STRENGTHS AND WEAKNESSES OF THE EXISTING EVIDENCE BASE

The strengths of the existing evidence base include the existence of large meta-analyses that include more than ten thousand patients from different countries, along with the inclusion of relatively recent articles from 2025 and 2026, giving the literature review an up-to-date feel.[5][6][3][14][15] The use of randomised trials by researchers like Brucchi allows for better comparison of data, while propensity matched cohorts help deal with the selection bias that inevitably appears in surgical studies.[6][9][26] Narrative reviews like the one done by

Barranquero offer insights and understanding of the issue that cannot be gained only through statistics.[4][35] Nevertheless, the following weaknesses need to be considered.

Most researches have a relatively brief follow-up period, usually ranging from one to three years, which makes it difficult for us to fully evaluate the recurrence or chronic pain rate for more than five years.[3][22] Another problem is patient selection bias, as most cases using robotic surgery are conducted in large Western hospitals on comparatively healthy patients, whereas laparoscopic surgery is widely practiced. This creates difficulty in making a comparison between both methods.[3][25] Publication bias may also occur since centres that extensively utilize robots will tend to publish their favourable experience or no adverse effects.[5][23]

However, the information on how these findings apply to countries such as India and others with lower and middle levels of income is insufficient because studies have only been conducted in developed countries.[1] [19] Finally, the experience effect of robotics suggests that the initial studies conducted by beginners in this technique may not be representative of more experienced surgeons' performances and adds yet another dimension to analysis of available literature.[4] [5] [29] Taking all of this into account, the data presented here is quite persuasive but not entirely convincing and must be considered as such.[3] [25]

5.4 CLINICAL RELEVANCE AND PRACTICAL RECOMMENDATIONS

Given that from a practical perspective there is wide equivalency surgeons should have confidence in offering laparoscopic repair to most straightforward primary unilateral inguinal hernia cases as a safe and cost-effective option.[3][5][4] Laparoscopy setup time is faster than robotics doesn't use costly robotic disposable items and provides the patient with the same low-pain and low-risk benefits that one would typically get from minimally invasive surgery.[5][13] On the other hand robots can be used effectively in some complex cases including obesity recurrent hernia bilaterality and training of surgeons where visualization and wristing of the instrument become very important.[4][5][17][21]

In cases where there is an existing da Vinci robot in place together with experienced surgeons, robotic surgery may prove to be more advantageous; however, in hospitals lacking a robotic system and in patients requiring the cheapest approach, the laparoscopic technique remains the best approach.[13] [31] [32] While advising a patient such as the 52-year-old man, it is important to note that while both approaches are equally effective, with little variations, robotic surgery has a slight advantage in terms of early comfort but with increased costs and slightly longer operative times.[9] [20]

This suggests that practical solutions would involve using laparoscopy for regular cases and reserving robotics for selected cases only, ensuring that if robotics is used, it is done under an experienced and well-maintained program so that its advantages do not become a disadvantage due to lack of expertise.[4] [5] [25] The hospital would need to keep its own records regarding local experiences and costs since what works for one place may not work for another.[3] [26]

5.5 UNRESOLVED QUESTIONS AND FUTURE RESEARCH DIRECTIONS

Future research and unresolved issues Although there is plenty of data available, it does not stop there being several other questions for which answers are needed in the years to come.[3] [22] [11]

Cost-effectiveness analyses that focus on more than just the cost of performing the procedure but also consider other costs such as the loss of working days and quality-adjusted life years would aid hospitals and health systems to purchase better equipment.[13] [31] [32] The current generation of single-port robotic surgical systems and other innovative equipment need assessment to determine whether they can cut down docking times and costs without compromising the safety aspect.[27]

Reporting on patient outcomes in more diverse groups such as women, older adults, and individuals from varied socio-economic statuses remains underrepresented and should be addressed.[24] [19] Ultimately, direct comparisons between varying types of robotics and methods of fixation within the realm of robotics will assist surgeons to tailor their technique in order to achieve optimal results on a per-patient basis.[4] [5] [25] Until such research comes about, it appears that both approaches can be utilized effectively but with consideration of cost and appropriate patient selection.[3] [6]

Ultimately, the debate ends up coming back to the same balanced approach that was taken from the beginning laparoscopic and robotic inguinal hernia repairs are both outstanding minimally invasive approaches, providing good results and with the decision made according to surgeon skill, patient suitability, and institutional considerations, not because one approach is objectively better than another.[3] [4] [5] This is the practical message that surgeons can take into the operating room today, while still leaving open the possibility of further development in the future.

6. CONCLUSION

After going through all literature and assessing the significance of the findings in relation to surgeons and patients, it has become quite obvious that both procedures [laparoscopic and robotic inguinal hernia repairs] have undergone some progress. In addition, both procedures have comparable outcomes in terms of the

significant parameters that have been assessed postoperatively.[3] [5] [6]

Both techniques seem to maintain recurrence rates quite low, ranging from one to two percent. They control acute pain effectively, ensuring that patients recover and return to light activities after about a week. Moreover, both have proven successful in preventing chronic groin pain, which used to plague many open surgery patients.[4] [9] [20]

The length of hospitalization is minimal, with a range of zero to two days, while same-day discharge is common practice in numerous settings, and there are rapid improvements in quality-of-life measurements regardless of whether robotic or conventional surgery is chosen.[3] [5] [26] The minor variations observed in the observational literature, including a slight reduction in opioid analgesic medication usage in the early postoperative period or a somewhat higher level of early comfort associated with the robot, are notable but fail to demonstrate sufficient consistency in the randomized trials to conclude that one procedure is superior to another.[6] [9] [23]

Of course, robotic surgery is slightly slower to perform in the operating room, it takes fifteen to thirty minutes more than conventional laparoscopic procedures and it is rather expensive due to special equipment and consumables. However, it appears that these factors do not result in any additional benefits for the patients who recover from surgery at home.[5] [13] [31] [32] Overall, taking all the information from meta-analyses including Khehewar's review, which involved more than sixty-four thousand cases, all the way down to randomized trials conducted in 2025 and 2026 into consideration, it can be concluded that the results remain highly similar regardless of whether laparoscopic or robotic techniques were used. The procedures are safe and effective and ensure that patients experience the desired postoperative period.[5] [6] [3] [22]

Reflecting on the hypothetical patient, namely the fifty-two-year-old male patient who operates his own family business and suffers from the groin bulge, which makes performing work-related tasks, playing cricket, and even sleeping difficult, it is comforting to know that he could return to his regular activities without any major issue by undergoing either procedure.[1] In all likelihood, he would be discharged the following day, or possibly even on the same day, experience minimal pain, which quickly subsides, and be at an extremely low risk of recurrence or chronic neuropathy.[4] [20]

The use of either laparoscopic technique or robot-assisted surgery would not have a great impact on his life, but it may slightly affect his comfort while dissecting in case of complicated cases or exhaustion after many consecutive surgeries on the schedule.[4] [5] However, in the case of uncomplicated and primary unilateral hernias, laparoscopic surgery appears to be the most reasonable choice for the time being due to its efficiency, cost-effectiveness, and clinical results.[3] [5] [25]

But for those harder cases where there are an obese patient, recurrent hernia, and bilateral repair, or where a young doctor is training to operate on his own, the additional vision and manipulation offered by the robot may prove advantageous, both for the procedure itself and possibly for reducing the stress of the surgeon, which, in turn, indirectly benefits the patient.[4] [17] [21] Those hospitals with robotic technology available to them can easily choose to opt for robotics in some specific cases while others can continue to do laparoscopy without hesitation.[13] [31] [32]

A fair summary would be that both techniques have their strengths, and the doctor should not feel bad about using either method since there is no loss in quality or efficacy in doing so.[3] [5] [6] The important thing is to align the chosen method with the patient's requirements, personal experience, and hospital facilities rather than blindly following new-age technology.[4] [25] Our business magnate should be told clearly that both techniques are good, there is little difference between them, and the ultimate decision should be made in collaboration with the doctor, depending upon the availability of facilities at his local hospitals.[9] [20]

Cost remains a real issue especially in places like India where healthcare budgets are tight and robotic consumables can add thousands of dollars per case so hospitals need to think carefully about when the extra expense actually buys something meaningful for the patient.[13] [31] [32] At the same time the ergonomic benefits for the surgeon the potential for teaching and the growing comfort level with complex cases mean robotics is here to stay and it will probably become even more common as the technology gets cheaper and the learning curve gets shorter.[4] [5] [27]

However, looking ahead into the future, there is much potential for growth within this area. With the development of newer single port robotic systems, there may be the possibility of reducing docking time and increasing the minimally invasive nature of this procedure.[27] In addition, further long-term studies, particularly those with a five-year or ten-year follow-up, can determine if the slight benefits provided by robotics with regard to mesh fixation and nerve protection are enough to provide a reduction in extremely late adverse events.[3] [11] [22] Additionally, cost-effectiveness analysis that takes into account indirect costs such as lost wages and quality-adjusted life years will assist health organizations in determining where to allocate resources efficiently.[13] [31] Finally, further research conducted in varied settings, including developing nations and among various demographics, will provide better evidence and generalizability to the population.[1] [19] [24]

Yet, pending the findings of these trials we have a strong body of evidence to base our conclusions on, and

surgeons are sure that the surgical techniques of repairing the hernia laparoscopically or using the robotics will produce equally good results.[3] [5] [6] [25]

In the last perspective, the management of inguinal hernias has undergone tremendous development starting from the large incisions of the old days to the laparoscopy era and now the robotic surgery era, but the real beneficiary is the patient in terms of precise techniques, wise choice of cases, and sincere counselling more than anything else in terms of technology.[3] [4] The 52-year-old businessman with his family company and weekend cricket games can be assured of making a great recovery with whichever technique used, and this is by far the greatest message for both surgeons and their patients from this review. Laparoscopic and robotic techniques are equally important as part of the surgeon's modern-day armamentarium, and the key art of medicine is knowing how to apply each one appropriately for each individual patient.[1] [3] [5] The message is quite clear that the differences between the two techniques are minimal, outcomes are excellent, and the future is definitely promising as we continue to advance in our skills.[6] [25] [4]

CONFLICT OF INTEREST

There was no funding or conflict of interest related to this work.

AUTHOR CONTRIBUTION

All the authors have played significant role in this work.

ACKNOWLEDGEMENT

We, the authors – Amulya Akula, M. Sai Venkata Pavan, Madhuri Routhu and Srujana Poloju, express our sincere gratitude to our guides Dr. Sharath Chandra Kaushik and Sreemantula Divya for their expert supervision and valuable feedback throughout this work.

The authors acknowledge the supervised use of AI-assisted writing tools for language refinement of selected sections. All the content was critically reviewed, edited and approved by the authors and guide to ensure scientific accuracy and originality.

REFERENCES

1. Zidan MH, AlSayed M, Maged M, Altabbaa H, Hadhoud AM, Hussein MA, et al. Short-term outcomes of robotic versus laparoscopic TAPP for inguinal hernia repair: a systematic review, meta-analysis, and GRADE assessment. J Robot Surg, 2026; 20(1): 419. doi:10.1007/s11701-026-03335-3.
2. Falola A, Satea M, Guillen PV, Oviedo RJ. Robotic and Laparoscopic Inguinal Hernia Repair in Africa: Current Adoption, Challenges, and Future Horizons. J Abdom Wall Surg, 2026; 5: 14775. doi:10.3389/jaws.2026.14775.
3. Chougala BS, Mittal O, Gupta S, Gopalakrishnappa R, Gupta T, Patil V. Robotic-assisted versus laparoscopic transabdominal preperitoneal inguinal hernia repair: A cross-sectional comparison of surgical outcomes. J Minim Access Surg, 2026. doi:10.4103/jmas.jmas_331_25.
4. Kim IK, Kim M, Moon JY, Yoo RN, Song J, Lim C, et al. Comparative perioperative outcomes of single-port laparoscopic ArtiSential versus da Vinci SP platform for totally extraperitoneal inguinal hernia repair: a multi-institutional, propensity score-matched analysis in Korea. J Minim Invasive Surg, 2026; 29(1): 3-10. doi:10.7602/jmis.2026.29.1.3.
5. Tanida T, Nakata K, Odagiri K, Tani N, Kitajiri S, Takayama H, et al. Novel "T-Incision" Method With Robotic-Assisted Transabdominal Preperitoneal Repair for Lateral Inguinal Hernia: An Operative Technique (With Video). Asian J Endosc Surg, 2026; 19(1): e70272. doi:10.1111/ases.70272.
6. Mun JY, Yoo N, Kye BH. From hands to handles: a modern duel between laparoscopic TEP and robotic TAPP. Hernia, 2026; 30(1): 109. doi:10.1007/s10029-025-03537-y.
7. Wang Y, Guo C, Zhang M, Guo X, Yang G, Song H, et al. Comparative outcomes of TouMai robotic and laparoscopic transabdominal preperitoneal inguinal hernia repair in a retrospective cohort. Sci Rep, 2026; 16(1): 9124. doi:10.1038/s41598-026-39829-1.
8. Nitta T, Ishii M, Sada A, Kubo R, Komiya A, Ishibashi T. Robotic Transabdominal Preperitoneal Repair Versus Laparoscopic Totally Extraperitoneal Repair for Inguinal Hernia. JSLS, 2026; 30(1): e2025.00119. doi:10.4293/JSLS.2025.00119.
9. Angehrn FV, Süsstrunk J, Schneider R, Baltzer K, Müller BP, Baur J, et al. Robotic versus laparoscopic minimally invasive inguinal hernia repair: randomized clinical trial (the ROGER trial). Br J Surg, 2026; 113(1): znaf283. doi:10.1093/bjs/znaf283.
10. Rath S, Mushahid Z, Javed J, Dadouche Y, Lohana R, Rehman N, et al. Robotic transabdominal preperitoneal versus laparoscopic total extraperitoneal inguinal hernia repair: a systematic review and meta-analysis with trial sequential analysis. J Robot Surg, 2026; 20(1): 116. doi:10.1007/s11701-025-03058-x.
11. Brucchi F, Sassun R, Lauricella S, Cirocchi R, Parati G, Dionigi G, et al. Robotic vs. laparoscopic TAPP: a systematic review and meta-analysis of randomized controlled trials on short-term outcomes. Hernia, 2026; 30(1): 36. doi:10.1007/s10029-025-03550-1.
12. Schiano di Visconte M. Cost-utility of robotic versus laparoscopic TAPP for inguinal hernia: a model-based analysis from a public payer perspective. Hernia, 2025; 30(1): 11. doi:10.1007/s10029-025-03513-6.
13. Rodriguez Valladares M, Pérez-Soto RH, Kothandaraman J, Romero-Velez G, Salas-Parra RD, Malcher F, et al. Robotic versus laparoscopic elective inguinal hernia repair: a NSQIP study. Hernia, 2025; 30(1): 6. doi:10.1007/s10029-025-03492-8.

14. Mirza W, Khan ME, Iqbal H, Khan A, Khan HM, Chatha HN, et al. Da Vinci Xi versus laparoscopic transabdominal preperitoneal (TAPP) repair of inguinal hernia: a GRADE-assessed systematic review and meta-analysis of randomized controlled trials. J Robot Surg, 2025; 19(1): 737. doi:10.1007/s11701-025-02940-y.
15. Brood R, Vierstraete M, De Mey D, Hermie E, Muysoms F. Prospective Comparative Cohort Study of the Initial Learning Curve of Hugo™ RAS for Inguinal Hernia Repair by a Proficient da Vinci Robotic Hernia Surgeon: The SUSHI Study. J Abdom Wall Surg, 2025; 4: 15214. doi:10.3389/jaws.2025.15214.
16. Rodrigues-Gonçalves V, Verdaguer-Tremolosa M, Martínez-López P, López-Cano M. Surgeon experience and patient selection influence the learning curve in robotic inguinal hernia repair. J Robot Surg, 2025; 19(1): 724. doi:10.1007/s11701-025-02910-4.
17. Huerta S, Garza AM. A Systematic Review of Open, Laparoscopic, and Robotic Inguinal Hernia Repair: Management of Inguinal Hernias in the 21st Century. J Clin Med, 2025; 14(3): 990. doi:10.3390/jcm14030990.
18. Khewater T, Al Madshush AM, Altidlawi MI, Faya H, Alanazi M, Alqahtani MMM, et al. Comparing Robot-Assisted and Laparoscopic Inguinal Hernia Repair: A Systematic Review and Meta-Analysis. Cureus, 2024; 16(5): e60959. doi:10.7759/cureus.60959.
19. de'Angelis N, Schena CA, Moszkowicz D, Kuperas C, Fara R, Gaujoux S, et al. Robotic surgery for inguinal and ventral hernia repair: a systematic review and meta-analysis. Surg Endosc, 2024; 38(1): 24-46. doi:10.1007/s00464-023-10545-5.
20. Solaini L, Cavaliere D, Avanzolini A, Rocco G, Ercolani G. Robotic versus laparoscopic inguinal hernia repair: an updated systematic review and meta-analysis. J Robot Surg, 2022; 16(4): 775-781. doi:10.1007/s11701-021-01312-6.
21. Qabbani A, Aboumarzouk OM, ElBakry T, Al-Ansari A, Elakkad MS. Robotic inguinal hernia repair: systematic review and meta-analysis. ANZ J Surg, 2021; 91(11): 2277-2287. doi:10.1111/ans.16505.
22. Zhao F, Wang B, Chen J. Comparison between robotic and laparoscopic inguinal hernia repair in Caucasian patients: a systematic review and meta-analysis. Ann Transl Med, 2021; 9(10): 885. doi:10.21037/atm-21-2126.
23. Lorenz WR, Holland AM, Adams AS, Mead BS, Scarola GT, Kercher KW, et al. Open versus laparoscopic versus robotic inguinal hernia repair: A propensity-matched outcome analysis. Surgery, 2025; 179: 108895. doi:10.1016/j.surg.2024.08.054.
24. Prabhu AS, Carbonell AM, Hope WW, Rosen MJ, Janczyk RJ, Goldblatt MI, et al. Robotic Inguinal vs Transabdominal Laparoscopic Inguinal Hernia Repair: The RIVAL Randomized Clinical Trial. JAMA Surg, 2020; 155(5): 380-387. doi:10.1001/jamasurg.2020.0034.
25. Chao TC, Tung HY, Tsai CH, et al. Laparoscopic versus robotic TAPP/TEP inguinal hernia repair: a multicenter, propensity score weighted study. Hernia, 2024; 28(1): 199-209. doi:10.1007/s10029-023-02916-7.
26. Reistrup H, Andresen K, Öberg S, Rosenberg J. Higher rate of chronic pain in young men after open mesh vs nonmesh repair of elective primary unilateral indirect inguinal hernia: a nationwide questionnaire study. Curr Probl Surg, 2024; 61(4): 101459. doi:10.1016/j.cpsurg.2024.101459.
27. Taslim A, Li M, Zhou W, Zhang Z, Wang S, Yang K. The Efficacy and Safety of Robotic Vs Laparoscopic Inguinal Hernia Repair, a Systematic Review and Meta-analysis. Int J Med Sci Health Res, 2022; 11(6): 630. doi:10.51505/ijmshr.2022630.4.
28. Okamoto N, et al. Comparison of short-term outcomes of robotic and laparoscopic transabdominal preperitoneal inguinal hernia repair: a propensity-score matched analysis. Hernia, 2023; 27(5): 1131-1138. doi:10.1007/s10029-022-02730-7.
29. Barranquero AG, Martín Ferrero L, Codina Corrons L, Maestre González Y, Gas Ruiz C, Escartín Arias A, et al. Robotic or laparoscopic inguinal hernia repair? A narrative review of the current literature. Laparosc Endosc Robot Surg, 2025; 9(1): 8-15. doi:10.1016/j.lers.2025.100075.
30. Wadhawan R, et al. Clinical and Patient-Reported Outcomes of Robotic Versus Laparoscopic Inguinal Hernia Repair. Cureus, 2025 (PMCID: PMC12057728).
31. Samkutty J, Mahmood WU, Lubbad O, Shafique S, Khera G, Sajid MS. A systematic review and meta-analysis exploring the effectiveness of robotic versus laparoscopic inguinal hernia repair. BJS, 2025; 112(Suppl13): znaf166.016. doi:10.1093/bjs/znaf166.016.
32. Thanawiboonchai T, et al. Single-port versus multi-port laparoscopic and robotic inguinal hernia repair: a systematic review and network meta-analysis. Surg Endosc, 2025.