Review article

Patient Safety in Minimal Invasive Surgeries – A Real Concern

Dr. Jatin Kapadiya,¹ Dr. Katari Sindhu,² Dr. Vijayakumar Ranganathan,^{3*} Dr.Kunjan Kumar.⁴ Dr. Suraj S Doshi ⁵

- 1. Senior Resident, Dept of General and Minimal Invasive Surgery, SKIMS, Srinagar, J&K, India
- 2. Consultant Dentist, Dr. Godvines Clinique, Hanumasai Nagar, Vijayapuri colony, Uppal, Hyderabad, Telangana, India
- 3. Chief cardiac Anaesthetist, KG Hospital and Postgraduate Medical Institute, Coimbatore, Tamil Nadu, India
- 4. Assistant Professor, Department of Surgery, Netaji Subhas Medical College, Amhara, Bihta, Patna, Bihar, India.
- 5. Consultant, Department of Orthopedics, Sudarshan Hospital, Nimgaon Ketki, Pune, Maharashtra, India.

*Corresponding Address:

Dr. Vijayakumar Ranganathan, Chief cardiac Anaesthetist, KG Hospital and Postgraduate Medical Institute, Coimbatore, Tamil Nadu, India. **Email id:** <u>drrvijayakumar@gmail.com</u>

Abstract:

Patient safety in laparoscopic and other minimally invasive surgeries (MIS), including laser surgeries, is a significant concern as these procedures become more common, offering advantages like smaller incisions, reduced pain, and quicker recovery. However, they also introduce specific risks that require attention from both surgeons and anesthesiologists. In laparoscopic surgery, the use of carbon dioxide (CO₂) to create working space in the abdomen can cause anesthesia-related challenges, such as impaired ventilation, reduced venous return, and changes in cardiovascular function. Close monitoring is essential to prevent complications like hypercapnia and hemodynamic instability, often requiring general anesthesia with controlled ventilation.

In laser surgeries, while precision is a key benefit, there are risks of thermal injuries to surrounding tissues, making it important for surgeons to manage laser use carefully. Anesthesiologists play a critical role in ensuring the patient remains stable, particularly when dealing with laser-related risks like burns or unintended tissue damage. Coordination between the surgical and anesthesia teams is vital to address any complications, such as organ damage or thermal injuries from energy-based devices.

A multidisciplinary approach is key to enhancing safety. Preoperative evaluations by both surgeons and anesthesiologists help identify potential risks, ensuring that the team is prepared. During surgery, standardized safety protocols, including checklists and clear communication, reduce the chances of complications. Advances in anesthesia techniques, like real-time monitoring and non-invasive ventilation, further contribute to patient safety during both laparoscopic and laser surgeries.

Key words: Anesthesia, laser, Minimally Invasive Surgery, Patient Safety, Pneumoperitoneum **Introduction:**

Minimally invasive surgery (MIS) has significantly transformed the landscape of surgical interventions, offering patients a range of procedures that prioritize comfort, reduced recovery time, and improved outcomes. This category encompasses various techniques, including laparoscopic surgery, endoscopic procedures, and laser surgery, each contributing to a more patient-centered approach in modern medicine.^[1-6] By minimizing the size of incisions, these methods not only reduce postoperative pain but also promote faster healing and shorter hospital stays, making them the preferred choice across multiple medical specialties.^[7,8]

Laser surgery, in particular, represents a notable advancement within the realm of MIS. Utilizing focused light beams, laser technology enables surgeons to perform intricate tasks with

remarkable precision and minimal damage to surrounding tissues. This technique is employed in diverse fields such as ophthalmology for procedures like LASIK, dermatology for skin lesion removal, and urology for the treatment of urinary stones. The versatility of laser surgery showcases its effectiveness in addressing various conditions while aligning with the principles of minimally invasive practices.^[9-12]

Despite the many benefits that MIS offers, it also introduces specific challenges that necessitate a strong focus on patient safety. The use of specialized equipment, such as laparoscopes and laser devices, requires advanced surgical skills and meticulous attention to detail. For example, the creation of pneumoperitoneum during laparoscopic procedures can significantly affect respiratory and cardiovascular function. This change mandates careful monitoring and management by anesthesia teams to ensure patient stability and prevent complications such as hypercapnia or hemodynamic instability.

Moreover, the limited tactile feedback and visibility inherent in many minimally invasive techniques can lead to potential risks if not adequately addressed. Therefore, close collaboration between surgical and anesthesia teams is crucial for effective intraoperative decision-making, especially in complex or prolonged surgeries. An emphasis on standardized protocols and communication can help mitigate the risk of errors, ultimately enhancing patient safety. As the field of minimally invasive surgery continues to evolve, incorporating advancements in robotic surgery and high-definition imaging technologies, a structured, multidisciplinary approach becomes increasingly essential. Continuous training and education for both surgeons and anesthesiologists, thorough preoperative assessments, and a culture of safety where all team members feel empowered to voice concerns are fundamental to optimizing surgical outcomes.^[13-17]

Patients' safety by the anaesthesiologists during minimal access surgery:

Laparoscopic surgery has become increasingly popular due to its benefits, including reduced postoperative pain, shorter recovery times, and minimal scarring. However, the unique challenges associated with these procedures raise several concerns for anesthesiologists, who play a critical role in ensuring patient safety throughout the surgical process. This article explores the key concerns anesthesiologists face during laparoscopic surgeries and strategies to mitigate risks, ultimately enhancing patient safety.

Understanding the physiological impact of pneumoperitoneum:

One of the primary concerns for anesthesiologists during laparoscopic surgery is the creation of pneumoperitoneum, which involves insufflating the abdomen with carbon dioxide (CO₂) to create a working space for the surgeon. While this technique is essential for visibility and manoeuvrability, it can significantly alter a patient's physiological status. Increased intraabdominal pressure can lead to decreased venous return, resulting in reduced cardiac output and potential hemodynamic instability.

Anesthesiologists must monitor vital signs closely during this phase, watching for changes in blood pressure, heart rate, and oxygen saturation. The use of advanced monitoring techniques, such as cardiac output monitoring and capnography, can provide real-time data to help anesthesiologists manage any hemodynamic changes effectively. Furthermore, preoperative assessments that evaluate a patient's cardiovascular status can guide anesthetic management and help identify those at higher risk for complications.^[18]

Managing respiratory function:

The insufflation of CO_2 can also impact respiratory function. Increased intra-abdominal pressure can impair lung mechanics, leading to decreased lung volumes and potential hypoventilation. This situation is particularly concerning in patients with pre-existing respiratory conditions such as asthma or chronic obstructive pulmonary disease (COPD).

To counteract these effects, anesthesiologists may need to adjust ventilation strategies. Using controlled ventilation can help maintain adequate oxygenation and prevent respiratory complications. Additionally, intraoperative positioning can influence respiratory mechanics, and anesthesiologists should ensure optimal positioning to facilitate lung expansion and ventilation. Regular assessment of end-tidal CO₂ levels can also provide insight into the patient's ventilation status, allowing for timely interventions if necessary.^[19-21]

Monitoring for complications

While laparoscopic surgery is often associated with fewer complications than open surgery, the potential for specific complications still exists. Anesthesiologists must be vigilant for intraoperative issues such as CO_2 embolism, visceral injuries, and bleeding. CO_2 embolism, though rare, can occur if CO_2 enters the vascular system during insufflation or instrument insertion, leading to serious cardiovascular effects.

To manage such risks, anesthesiologists should maintain a high index of suspicion for symptoms indicative of complications. These may include sudden changes in hemodynamic status, decreased oxygen saturation, or altered neurological status. Immediate access to resuscitation equipment and protocols is essential for prompt intervention if complications arise.

The importance of team communication

Effective communication among surgical teams is paramount to patient safety. Anesthesiologists must work closely with surgeons and nursing staff to ensure a coordinated approach to care. This collaboration is especially important during critical phases of surgery, such as insufflation and the introduction of instruments.

Implementing a structured communication strategy, such as a surgical safety checklist, can enhance team coordination. These checklists help ensure that all team members are aware of their roles and responsibilities, promote situational awareness, and facilitate discussion about potential risks and patient safety measures.^[22]

Preparing for emergencies

Anesthesiologists must also be prepared for emergencies that may arise during laparoscopic surgery. While the overall risk of major complications is low, the potential for unexpected events requires readiness and an effective response plan. Emergencies can range from severe allergic reactions to anesthesia drugs to unexpected bleeding or cardiac events.

Training and simulation exercises can play a vital role in preparing anesthesiologists for such situations. Regular drills that involve the entire surgical team can enhance familiarity with emergency protocols and improve response times in real-life scenarios. Furthermore, having emergency equipment readily available, such as resuscitation devices and medications, is crucial for effective management.^[23]

Patient-specific considerations

Each patient presents unique challenges and concerns during laparoscopic surgery. Anesthesiologists must conduct thorough preoperative evaluations to identify any patient-specific factors that may increase the risk of complications. This assessment should include a

comprehensive review of the patient's medical history, including any comorbidities, previous anesthetic experiences, and medication use.

For example, patients with obesity may face additional challenges related to ventilation and positioning during laparoscopic procedures. Anesthesiologists should tailor their approach to accommodate these factors, ensuring adequate airway management and minimizing risks associated with respiratory compromise.^[15]

Postoperative care and pain management

Effective postoperative care is critical to ensuring patient safety after laparoscopic surgery. Anesthesiologists play a key role in managing postoperative pain, which can significantly impact recovery and patient satisfaction. The use of multimodal analgesia, combining different analgesic techniques, can help optimize pain control while minimizing the use of opioids.

In addition to pain management, anesthesiologists must monitor patients for any postoperative complications, such as respiratory distress, nausea, and vomiting. Early recognition of these issues allows for timely interventions, contributing to better overall patient outcomes.

Patient safety in minimal invasive surgeries from surgeon point of view:

Achieving patient safety in both laparoscopic and laser surgeries involves a comprehensive and systematic approach that integrates surgical precision, advanced technology, and multidisciplinary collaboration. The role of the surgeon is pivotal in managing every stage of the procedure, from preoperative evaluation to intraoperative vigilance and postoperative care. This section explores how surgeons can ensure patient safety through each phase of the surgical process, employing both laparoscopic and laser techniques.^[16]

Preoperative Assessment and Patient Selection

Patient safety begins well before the first incision or laser application, starting with a thorough preoperative assessment. For both laparoscopic and laser surgeries, selecting the appropriate candidate is critical in reducing the risk of complications. Surgeons must consider a range of factors including the patient's age, comorbid conditions (such as cardiovascular disease, diabetes, or obesity), history of previous surgeries, and specific anatomical considerations.

In laparoscopic surgery, patients with severe adhesions from previous abdominal surgeries or those with extensive obesity may face greater risks during the procedure. Adhesions can make it difficult to achieve proper visualization and access through small incisions, increasing the likelihood of inadvertent organ damage. Similarly, patients with high body mass indexes (BMI) may have altered anatomy that makes intra-abdominal navigation more challenging, elevating the risk of complications like bleeding or organ perforation. Surgeons must assess these factors through imaging studies, physical exams, and detailed patient history. ^[24]

In laser surgeries, patient selection is equally crucial. Surgeons must evaluate the tissue characteristics to determine whether laser technology is appropriate for the specific procedure. Lasers offer advantages such as precise cutting, reduced bleeding, and minimal tissue trauma. However, improper use or inappropriate patient selection can lead to thermal damage, excessive tissue scarring, or inadvertent injury to nearby structures. For instance, patients with certain skin types or those taking photosensitizing medications may have an increased risk of burns or complications from laser exposure. Understanding these nuances ensures that the benefits of laser surgery are maximized while minimizing risk.^[25]

Intraoperative Techniques and Visualization

The intraoperative phase is where the surgeon's technical skill and knowledge directly influence patient safety. Laparoscopic surgery, which utilizes a camera inserted through small incisions to visualize the surgical field, demands exceptional hand-eye coordination, depth perception, and instrument control. Unlike open surgery, where the surgeon has direct access to the operative site, laparoscopic surgery limits tactile feedback. Surgeons must rely heavily on visual cues and the indirect manipulation of instruments.

A crucial aspect of ensuring patient safety is maintaining optimal visualization throughout the procedure. Insufficient lighting, poor camera positioning, or obstruction of the view by blood or other fluids can increase the risk of injury to surrounding organs. Surgeons must ensure proper placement of the laparoscope, utilize suction effectively to keep the field clear, and periodically adjust the camera angle as necessary. Advanced imaging techniques, such as high-definition cameras or 3D laparoscopy, can further enhance the surgeon's ability to navigate the complex anatomy with precision, improving outcomes and reducing the likelihood of complications.

In laser surgeries, precision in the application of laser energy is critical to patient safety. Surgeons must have a deep understanding of the laser's wavelength, energy settings, and how these factors interact with different tissues. Different types of lasers, such as carbon dioxide (CO₂) lasers or Nd lasers, are selected based on the desired depth of penetration and tissue type. For example, CO₂ lasers are excellent for cutting and vaporizing superficial tissues with minimal thermal damage to adjacent structures. However, if not carefully controlled, the laser's energy can spread beyond the targeted area, leading to unintended burns or damage to nearby healthy tissues.^[18]

During laser surgery, the surgeon must also take steps to protect the patient and the surgical team from potential hazards. This includes the use of protective eyewear to guard against accidental laser exposure and ensuring that flammable materials, such as certain anesthetics or oxygen, are kept away from the laser field. Proper calibration and testing of the laser device before the surgery is essential to avoid malfunction that could compromise patient safety.

Managing Intraoperative Complications

Despite the advancements in both laparoscopic and laser surgery, complications can arise during the procedure, and the surgeon's ability to quickly recognize and manage these issues is critical to maintaining patient safety. In laparoscopic surgery, one of the most common complications is injury to surrounding organs, such as the intestines, bladder, or major blood vessels. The risk is particularly high in procedures involving complex anatomy or significant inflammation, where visualization may be compromised.

To mitigate these risks, surgeons must be prepared to convert to an open procedure if necessary. This decision should not be viewed as a failure but as a measure to ensure patient safety. Conversion allows for better access and visualization when laparoscopic methods are insufficient. Additionally, the use of intraoperative adjuncts such as real-time imaging or laparoscopic ultrasound can help the surgeon avoid critical structures and reduce the risk of complications.

In laser surgery, the primary intraoperative risks include thermal injury and uncontrolled tissue damage. Surgeons must constantly monitor the tissue response to the laser energy, adjusting the power and duration of exposure as needed. For example, in eye surgeries using lasers, millimeter-level precision is required to prevent damage to delicate ocular structures, and

surgeons must work within a very narrow safety margin. In these high-risk environments, intraoperative monitoring and careful control of laser parameters are crucial to avoiding irreversible complications. ^[1,16]

Postoperative Care and Monitoring

The postoperative period is another critical phase where patient safety can be ensured. Surgeons play an essential role in the monitoring and management of patients following laparoscopic and laser surgeries. Although these procedures are minimally invasive and generally have fewer postoperative complications compared to traditional open surgeries, vigilance is still necessary. For laparoscopic surgeries, complications such as infections, bleeding, or delayed bowel function can occur postoperatively. Surgeons must establish clear postoperative care protocols that include regular monitoring of vital signs, wound care, and pain management. Early mobilization of the patient is encouraged to reduce the risk of deep vein thrombosis (DVT) and promote faster recovery. Surgeons must also ensure that patients are well-informed about signs of complications, such as fever, severe pain, or unusual discharge, which would necessitate immediate medical attention.

Similarly, in laser surgeries, postoperative care is focused on ensuring that the treated tissues heal without complications. Depending on the nature of the laser surgery (e.g., skin resurfacing, eye surgery, or tumor ablation), the surgeon must provide clear instructions regarding wound care, the use of topical medications, and protection from sunlight or other environmental factors that could affect healing. Postoperative monitoring may also include follow-up imaging studies to assess the success of the laser treatment and to ensure there are no delayed adverse effects. ^[12]

Team Communication and Multidisciplinary Collaboration

An essential aspect of ensuring patient safety in both laparoscopic and laser surgeries is effective communication within the surgical team. The surgeon, anesthesiologist, nurses, and other team members must work in close coordination to respond to any changes in the patient's condition during surgery. For instance, in laparoscopic surgery, the use of carbon dioxide (CO_2) for insufflation can lead to cardiovascular and respiratory complications if not carefully monitored. The anesthesiologist must be in constant communication with the surgeon to manage these potential risks.^[6]

In laser surgeries, precise timing and coordination between the surgical team members are vital, particularly in procedures involving delicate or highly specialized areas such as the eyes or brain. Surgeons must work closely with specialists in these fields to ensure that all aspects of the patient's care, from laser calibration to postoperative management, are seamlessly integrated.

Nurses and perioperative patient safety:

Nurses play a crucial role in ensuring perioperative patient safety in both laparoscopic and laser surgeries. Their responsibilities span across the preoperative, intraoperative, and postoperative phases, working collaboratively with the surgical team to minimize risks and enhance patient outcomes. In these minimally invasive procedures, the perioperative nurse's involvement is instrumental in managing the patient's care, coordinating the operating room environment, and ensuring that safety protocols are rigorously followed. Below is an exploration of how nurses contribute to patient safety during laparoscopic and laser surgeries.

Preoperative Responsibilities: Assessment and Preparation

The role of the nurse in the preoperative phase begins with patient assessment and preparation. Thorough preoperative assessment is vital to identify any factors that may increase the patient's risk during surgery. Nurses conduct a comprehensive review of the patient's medical history, including allergies, comorbidities, prior surgical experiences, and medications. These factors are particularly important for laparoscopic surgery, as patients with preexisting conditions such as respiratory or cardiovascular disease may face complications related to insufflation or positioning during surgery.

For laser surgery, the perioperative nurse evaluates factors such as skin type, tissue condition, or medication use that could affect the patient's response to laser treatment. For example, patients taking photosensitizing drugs may be at higher risk for burns or tissue damage during laser procedures, and this information must be communicated to the surgical team. The nurse ensures that all preoperative orders are completed, including fasting instructions, pre-surgical skin preparations, and the administration of prophylactic medications such as antibiotics to reduce the risk of infection.

Nurses also play a critical role in patient education, ensuring that the patient understands the procedure, the risks involved, and the postoperative recovery process. Effective communication between the nurse and the patient helps alleviate anxiety and ensures informed consent is properly obtained. Additionally, ensuring that patients adhere to preoperative instructions, such as discontinuing certain medications or avoiding food before surgery, is essential for safety during both laparoscopic and laser surgeries.

Intraoperative Responsibilities: Ensuring a Safe Surgical Environment

During the intraoperative phase, nurses are responsible for maintaining a safe and sterile environment, assisting the surgical team, and monitoring the patient's condition. In laparoscopic surgery, this involves tasks such as preparing the operating room, ensuring that all necessary equipment, such as the laparoscope, insufflation devices, and instruments, are available and functioning correctly. The perioperative nurse must perform a detailed equipment check before the surgery to confirm that all devices are calibrated and in proper working order. Instrument failure or malfunction during surgery can compromise patient safety and lead to complications.

For laser surgeries, the nurse's responsibilities also include managing laser safety. This involves ensuring that all safety protocols for laser use are followed, such as wearing protective eyewear, adjusting laser settings according to the surgeon's instructions, and maintaining a laser-safe environment by removing any flammable materials from the vicinity. The nurse acts as a laser safety officer, making sure that the surgical team is aware of the risks associated with laser use, and that appropriate precautions are taken to prevent accidental exposure to laser beams.

Nurses must also monitor the patient's physiological status throughout the surgery. In laparoscopic procedures, nurses track parameters such as the patient's oxygen levels, heart rate, and blood pressure, as the insufflation of the abdomen with carbon dioxide (CO₂) can affect cardiovascular and respiratory function. They work closely with anesthesiologists to ensure that any changes in patient status are addressed immediately. Furthermore, nurses are responsible for managing the patient's position on the operating table, particularly in laparoscopic surgeries where the patient's body may need to be tilted (Trendelenburg position) to facilitate access to the surgical site. Proper positioning is crucial to avoid complications such as nerve injury or pressure sores.

Communication during surgery is vital, and nurses act as intermediaries between the surgeon and the rest of the team. They ensure that instruments are passed efficiently and sterile technique is maintained, reducing the risk of surgical site infections. In both laparoscopic and laser surgeries, the nurse's vigilance in maintaining sterility and handling instruments properly directly impacts the patient's safety by preventing contamination or infection.

Managing Complications and Emergency Situations

Another critical role of the perioperative nurse is to be prepared for emergencies. In laparoscopic surgery, intraoperative complications such as bleeding, gas embolism, or organ perforation may arise. The nurse must be able to recognize the signs of these complications quickly and alert the surgical team to respond appropriately. For example, in the case of a gas embolism (a rare but serious complication where CO_2 enters the bloodstream), the nurse must assist in immediately ceasing insufflation, adjusting patient positioning, and initiating emergency protocols to stabilize the patient.

In laser surgeries, thermal injuries are a concern, as lasers can cause unintended damage to surrounding tissues if misused. The nurse monitors the patient and the laser equipment throughout the procedure, ensuring that any signs of tissue injury are identified early and that the surgeon is informed. In case of equipment failure or malfunction, nurses are also trained to manage these situations, switching to backup devices or assisting the surgeon in modifying the approach to safeguard the patient.

Postoperative Responsibilities: Monitoring and Education

Postoperatively, nurses continue to play a key role in ensuring patient safety during recovery. After laparoscopic surgery, patients are at risk for complications such as infection, venous thromboembolism, and respiratory issues due to the effects of anesthesia and the insufflation of CO₂ during surgery. The nurse closely monitors vital signs, manages pain control, and ensures that the patient is mobilized early to reduce the risk of blood clots. Nurses also assess the surgical site for any signs of infection, bleeding, or complications related to wound healing. For laser surgery, postoperative care involves assessing the treated area for signs of excessive inflammation, burns, or other tissue damage. Nurses provide patients with instructions on wound care, such as keeping the area clean, applying prescribed ointments, and protecting the site from excessive sunlight or trauma. Patient education is a fundamental part of postoperative care, as the nurse instructs the patient on how to manage their recovery at home, what signs of complications to look out for, and when to seek medical help. ^[14]

Effective communication during the handover from the surgical to recovery team is also vital. Nurses must ensure that any intraoperative complications or concerns are clearly communicated to the recovery team, enabling them to provide targeted care. Furthermore, nurses may coordinate follow-up appointments and ensure that the patient understands the next steps in their care plan, including any restrictions on activities or dietary modifications needed for optimal recovery.

Conclusion:

Patient safety in laparoscopic and laser surgeries relies on the coordinated efforts of surgeons, anesthesiologists, and perioperative nurses, each contributing essential expertise to different phases of care. Surgeons ensure the safe and precise conduct of the surgery, actively mitigating risks and managing any complications. Anesthesiologists focus on maintaining the patient's physiological stability, especially in response to challenges such as changes in ventilation and circulation during minimally invasive procedures. Nurses play a vital role in maintaining

sterility, preparing equipment, supporting intraoperative needs, and ensuring proper postoperative care. Through effective teamwork, communication, and adherence to protocols, these professionals collectively enhance patient outcomes and ensure safety throughout the surgical process.

References:

- 1. Han ES, Advincula AP. Safety in Minimally Invasive Surgery. Obstet Gynecol Clin North Am. 2019 Jun;46(2):389-398.
- 2. Geller EJ. Vaginal hysterectomy: the original minimally invasive surgery. Minerva Ginecol. 2014 Feb;66(1):23-33.
- 3. McCrory B, LaGrange CA, Hallbeck M. Quality and safety of minimally invasive surgery: past, present, and future. Biomed Eng Comput Biol. 2014 Apr 21;6:1-11
- de Laveaga AE, McCrory B, LaGrange CA, Hallbeck MS. Evaluation of instrument dexterity and static resistance of laparoendoscopic single-site (LESS) surgical ports. J Med Devices. 2012;6(2):7
- Brown-Clerk B, de Laveaga AE, LaGrange CA, Wirth LM, Lowndes BR, Hallbeck MS. Laparoendoscopic single-site (LESS) surgery versus conventional laparoscopic surgery: comparison of surgical port performance in a surgical simulator with novices. Surg Endosc. 2011;25(7):2210–2218
- Sodergren MH, Clark J, Athanasiou T, Teare J, Yang GZ, Darzi A. Natural orifice translumenal endoscopic surgery: critical appraisal of applications in clinical practice. Surg Endosc. 2009;23(4):680–687.
- 7. Romanelli JR, Roshek TB, Lynn DC, Earle DB. Single-port laparoscopic cholecystectomy: Initial experience. Surgical Endoscopy. 2010;24(6):1374–1379
- 8. Darzi SA, Munz Y. The impact of minimally invasive surgical techniques. Annu Rev Med. 2004;55:223-37.
- 9. Tria AJ Jr. Minimally invasive total knee arthroplasty: the importance of instrumentation. Orthop Clin North Am. 2004 Apr;35(2):227-34
- 10. Driessen SRC, Sandberg EM, Rodrigues SP, van Zwet EW, Jansen FW. Identification of risk factors in minimally invasive surgery: a prospective multicenter study. Surg Endosc. 2017 Jun;31(6):2467-2473.
- American Society for Reproductive Medicine Revised American society for reproductive medicine classification of endometriosis: 1996. Fertil Steril. 1997;67:817– 821
- 12. Wubben I, van Manen JG, van den Akker BJ, Vaartjes SR, van Harten WH. Equipmentrelated incidents in the operating room: an analysis of occurrence, underlying causes and consequences for the clinical process. Qual Saf Health Care. 2010;19:e64.
- 13. Verdaasdonk EG, Stassen LP, Hoffmann WF, van der Elst M, Dankelman J. Can a structured checklist prevent problems with laparoscopic equipment? Surg Endosc. 2008;22:2238–2243
- Pluyter JR, Buzink SN, Rutkowski AF, Jakimowicz JJ. Do absorption and realistic distraction influence performance of component task surgical procedure? Surg Endosc. 2010;24:902–907
- 15. Harris AM, Lewis IR, Averch TD. Patient Safety and Quality Improvement in Minimally Invasive Surgery. J Endourol. 2024 Feb;38(2):170-178.

- 16. Haynes AB, Weiser TG, Berry WR, Lipsitz SR, Breizat AH, Dellinger EP, Herbosa T, Joseph S, Kibatala PL, Lapitan MC, Merry AF, Moorthy K, Reznick RK, Taylor B, Gawande AA. A surgical safety checklist to reduce morbidity and mortality in a global population. N Engl J Med. 2009;360(5):491–499
- Lynch RJ, Englesbe MJ, Sturm L, Bitar A, Budhiraj K, Kolla S, Polyachenko Y, Duck MG, Campbell DA., Jr Measurement of foot traffic in the operating room: implications for infection control. Am J Med Qual. 2009;1:45–52
- 18. Moorthy K, Munz Y, Undre S, Darzi A. Objective evaluation of the effect of noise on the performance of a complex laparoscopic task. Surgery. 2004;1:25–30.
- Pluyter JR, Buzink SN, Rutkowski AF, Jakimowicz JJ. Do absorption and realistic distraction influence performance of component task surgical procedure? Surg Endosc. 2010;4:902–907
- 20. Parsons HM. What happened at Hawthorne? New evidence suggests the Hawthorne effect resulted from operant reinforcement contingencies. Science. 1974;4128:922–932
- 21. Rodrigues SP, Wever AM, Dankelman J, Jansen FW. Risk factors in patient safety: minimally invasive surgery versus conventional surgery. Surg Endosc. 2012 Feb;26(2):350-6.
- 22. Bottet B, Rivera C, Dahan M, Falcoz PE, Jaillard S, Baste JM, Seguin-Givelet A, et al. Reporting of patient safety incidents in minimally invasive thoracic surgery: a national registered thoracic surgeons experience for improvement of patient safety. Interact Cardiovasc Thorac Surg. 2022 Aug 3;35(3):ivac129
- 23. Steiner DL, Norman GR. Health measurement scales: a practical guide to their development and use. New York: Oxford University Press; 2008
- 24. Courdier S, Garbin O, Hummel M, Thoma V, Ball E, Favre R, Wattiez A. Equipment failure: causes and consequences in endoscopic gynecologic surgery. J Minim Invasive Gynecol. 2009;1:28–33
- 25. Arora S, Hull L, Sevdalis N, Tierney T, Nestel D, Woloshynowych M, Darzi A, Kneebone R. Factors compromising safety in surgery: stressful events in the operating room. Am J Surg. 2010;1:60–65

Submitted: 19/10/2024 Revised: 22/10/2024 Accepted: 23/10/2024 Published: 31/12/2024

Cite this article:

Dr. Jatin Kapadiya, Dr. Katari Sindhu, Dr. Vijayakumar Ranganathan, Dr. Kunjan Kumar, Dr. Suraj S Doshi. Patient Safety in Minimal Invasive Surgeries – A Real Concern. Jour Med Dent Fron 2024;1(2):25-34