Compared to open techniques, laparoscopic procedures are considered less invasive. Similarly, regional anesthesia (RA) could provide further benefits in terms of postoperative analgesia and surgical stress compared to general anesthesia (GA). However, in clinical practice, RA is considered less reliable and safer than GA for laparoscopic surgery in a conscious patient. The major concerns of using RA in this situation are related to the cardiovascular and ventilatory consequences of laparoscopic procedures and their potential worsening with a neuraxial block. Are all these concerns justified or do they result from false myths? Is spinal anesthesia a reliable option for laparoscopic surgery?

Yes, it is:

Laparoscopic surgery had been performed exclusively under GA until 1998, when Pursnani published a case series of video-laparoscopic cholecystectomies performed with thoracic epidural anesthesia.

In the span of a few years, spinal anesthesia (SA) were used more and more in both adult and pediatric cases, demonstrating that neuraxial techniques could be successfully and effectively applied in the different settings.

In a prospective observational study on 369 patients undergoing laparoscopic cholecystectomies under SA, Imbelloni showed that thoracic approach is feasible and that it has potential advantages over the more frequently used lumbar one.

Interestingly, SA could potentially avoid some of the respiratory complications often related to GA, such as atelectasis, aspiration, bronchospasm and exacerbation of existing lung diseases and infection. Furthermore, in patients undergoing SA, a reduced incidence of postoperative cognitive dysfunction, nausea and vomiting, sore throat, dental damage, delayed discharge and readmission has been observed when compared to GA. Additional potential benefits could include a reduction in blood loss and transfusion rates, as well as a reduction in the incidence of deep vein thrombosis and pulmonary embolism, operating room and postoperative care unit time and overall length of hospital stay, faster recovery of gastrointestinal motility and transit, earlier refeeding and early patient mobilization, putting SA in a favorable position for use in laparoscopic surgeries.

Hypotension has been noted in up to 20.5% of patients undergoing SA and could be worsened by both reverse Trendelenburg position and the increased intra-abdominal pressures. To reduce such risks, the use of low-pressure pneumoperitoneum, adequate volume preloading avoiding extreme positions and the use of vasopressors may all limit the hemodynamic impact of spinal anesthesia.

Significant increases in PaCO$_2$ during laparoscopic surgery under RA has never been demonstrated. On the other hand, a well-calibrated block should cover all the metameres involved without interfering with the patient’s diaphragmatic function and spontaneous breathing. Various reports support non-significant changes in either PaO$_2$ or PaCO$_2$ during laparoscopic surgery under SA. In fact, available literature shows there may be lower PaCO$_2$ levels with RA compared to those usually achieved with mechanical ventilation for the same duration of pneumoperitoneum. Furthermore, it has been shown that SA levels up to C4 do not impair respiratory drive.

For these reasons, we conclude that with proper knowledge and adequate skills, it is possible to successfully and safely perform laparoscopic interventions under SA with several advantages when compared to GA.

No, it isn’t:

RA for laparoscopic procedures has been advocated as an alternative to GA. Although laparoscopic surgery has demonstrated several advantages over open surgery, the overall advantages provided by RA compared to GA are still a matter of debate. A careful evaluation of the risk–benefit ratio does not encourage the use of RA in the laparoscopic procedures for general practitioners.

One of the main concerns is the hemodynamic impact as result from the combination of spinal anesthesia with a...
laparoscopic procedure. Insufflation of gas and the creation of an artificial pneumoperitoneum causes the compression of the vena cava and the displacement of the diaphragm, which raises intrathoracic pressure and leads to a decrease in preload. In certain situations, for example, in hypovolemic patients, the impairment of cardiac output could be particularly significant and harmful.[9] Simultaneously, laparoscopic surgery with RA requires a high neuraxial block, potentially leading to an extensive sympathetic block and a consequent reduction of mean arterial pressure and systemic vascular resistances.[9]

Another major concern is related to gas exchange and carbon dioxide retention. Literature is inconsistent on the respiratory effects of SA. Even if Dohi et al.[10] showed that sympathetic denervation up to C4 did not impair respiratory function, other papers have shown that rostral spread of pharmacological agents, particularly opioids, could potentially provoke the impairment of the respiratory drive.[11] Additionally, the simultaneous use of intravenous sedative agents could synergize and increase the risk for respiratory depression. Unfortunately, given the wide range of laparoscopic procedures, it is difficult to predict exact length of surgery, exposing the patient to a risk of respiratory failure and/or conversion to GA.

Further concern regarding Trendelenburg position that is usually necessary to obtain an optimal surgical field; however, such position has been shown to increase intracranial pressure by the impaired venous return with a corresponding increase in cerebral blood volume and CSF volume. Trendelenburg position associated with pneumoperitoneum reduces the lung’s functional reserve capacity, decreases pulmonary compliance and predisposes to atelectasis. Further reductions in the functional reserve capacity and pulmonary compliance are caused by the increase in pulmonary blood volume and gravitational forces on the mediastinal structures, which cannot be counteracted in any way by a conscious patient spontaneously breathing.[12]

The overall incidence of complication (e.g., bleeding and infections) after neuraxial blocks has been estimated in two to four cases every 100,000 patients.[13] In laparoscopic surgery, an effective thoracic spinal anesthesia could require a more cranial approach, higher than the expected termination of the spinal cord (which is from T11 to L3)[14] with an increased risk for complication, moreover emergent conversion to GA have to be considered. Recent studies show no significant advantages on short-term outcome (both intraoperative and postoperative)[15] or even long-term outcomes, such as the postoperative quality of life when comparing SA and GA.[16]

In conclusion, the use of SA for laparoscopic procedures has not been sufficiently investigated. There is scarce literature and further studies are deemed necessary. We hope that our analysis of current knowledge will be useful to create a constructive debate on this topic and promote high-quality research to find the evidence that is currently missing.

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**Submitted:** 11‑May‑2022, **Revision:** 12‑May‑2022, **Accepted:** 14‑May‑2022, **Published:** 03‑Sep‑2022

**References**

1. Carr BM, Lyon JA, Romeiser J, Talimini M, Shroyer ALW. Laparoscopic versus open surgery: A systematic review evaluating Cochrane systematic reviews. Surg Endosc 2019;33:1693‑709.
2. Pursnani KG, Bazza Y, Calleja M, Mughal MM. Laparoscopic cholecystectomy under epidural anesthesia in patients with chronic respiratory disease. Surg Endosc 1998;12:1082‑4.
3. De Cassai A, Bertoncello F, Correale C, Sandei L. Spinal anesthesia is a viable option for emergent laparoscopic procedure in high‑risk patients. Saudi J Anaesth 2020;14:115‑6.
4. Imbelloni LE. Spinal anesthesia for laparoscopic cholecystectomy: Thoracic vs. Lumbar Technique. Saudi J Anaesth 2014;8:877‑83.
5. Graff V, Gabutti L, Treglia G, Pascale M, Anselmi L, Cafarotti S, et al. Perioperative costs of local or regional anesthesia versus general anesthesia in the outpatient setting: A systematic review of recent literature. Braz J Anesthesiol 2021;S0104‑0014 (21) 00366‑3 (In press). doi: 10.1016/j.bjane.2021.09.012.
6. Magnusson L, Spahn DR. New concepts of atelectasis during general anaesthesia. Br J Anaesth 2003;90:61‑72.
7. Modig J. Influence of regional anesthesia, local anesthetics, and sympathicomimetics on the pathophysiology of deep vein thrombosis. Acta Chir Scand Suppl 1989;550:119‑27.
8. Echeverria‑Villalobos M, Stoica N, Todeschini AB, Fiorda‑Diaz J, Uribe AA, Weaver T, et al. Enhanced Recovery After Surgery (ERAS): A perspective review of postoperative pain management under ERAS pathways and its role on opioid crisis in the United States. Clin J Pain 2020;36:219‑26.
9. Bajwa SJ, Kulshrestha A. Anaesthesia for laparoscopic surgery: General vs regional anaesthesia. J Minim Access Surg 2016;12:4‑9.
10. Dohi S, Takeshima R, Naito H. Ventilatory and circulatory responses to carbon dioxide and high level sympathectomy induced by epidural
blockade in awake humans. Anesth Analg 1986;65:9-14.

11. Negre I, Gueneron JP, Ecoffey C, Penon C, Gross JB, Levron JC, et al. Ventilatory response to carbon dioxide after intramuscular and epidural fentanyl. Anesth Analg 1987;66:707-10.

12. Gainsburg DM. Anesthetic concerns for robotic-assisted laparoscopic radical prostatectomy. Minerva Anesthesiol 2012;78:596-604.

13. Cook TM, Counsell D, Wildsmith JAW; Royal College of Anaesthetists Third National Audit Project. Major complications of central neuraxial block: Report on the Third National Audit Project of the Royal College of Anaesthetists. Br J Anaesth 2009;102:179-90.

14. Macdonald A, Chattrath P, Spector T, Ellis H. Level of termination of the spinal cord and the dural sac: A magnetic resonance study. Clin Anat 1999;12:149-52.

15. Della Corte L, Mercorio A, Morra I, Riemma G, De Franciscis P, Palumbo M, et al. Spinal anesthesia versus general anesthesia in gynecological laparoscopic surgery: A systematic review and meta-analysis. Gynecol Obstet Invest 2022;87:1-11.

16. Sarakatsianou C, Baloyiannis I, Perivoliotis K, Georgopoulou S, Tzovaras G. Quality of life after laparoscopic trans-abdominal pre-peritoneal inguinal hernia repair: Spinal vs general anesthesia. Hernia 2021;25:789-96.

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Website: www.saudija.org

DOI: 10.4103/sja.sja_380_22

How to cite this article: De Cassai A, Starnari R, Pullano C, Torrano V, Geraldini F, Costa F. This is why you should (not) use spinal anesthesia for laparoscopic surgeries. Saudi J Anaesth 2022;16;371-3.