International Journal of
Regional Anaesthesia

Review Article

Regional Anaesthesia for Cancer Surgery and Its Impact on Recurrence and Metastasis: What Is the Evidence?

Anju Grewal[1], Revanth Babu Challa[2], Jyoti Sharma[1]

[1]Department of Anaesthesiology, All India Institute of Medical Sciences, Bathinda, Punjab, India.

[2]Department of Anaesthesiology, All India Institute of Medical Sciences, Nagpur, Maharashtra, India.

Abstract

Regional anaesthesia (RA) is thought to potentially affect cancer recurrence and metastasis by reducing the perioperative stress response, supporting immune function, and decreasing the use of opioids and volatile agents. This review examines the mechanistic evidence and clinical results across eight major cancer types. Although RA reliably enhances pain management and perioperative recovery, its impact on cancer outcomes remains uncertain. The most notable reductions in recurrence are observed in bladder and oesophageal cancers, while the effects on breast, colorectal, gastric, and gynaecological cancers are limited. Variability in study methods, confounding variables, and a scarcity of high-quality randomised controlled trials hinder definitive conclusions. Until more solid evidence is available, personalised anaesthetic strategies are essential.

Keywords: Regional Anaesthesia, Cancer Recurrence, Metastasis

Introduction

Cancer surgery can cure localised tumours, yet recurrence and metastasis—responsible for ~90% of cancer deaths—remain major concerns due to perioperative stress and immune suppression [1, 2]. Anaesthetic techniques may influence these outcomes, with regional anaesthesia (RA) potentially preserving anti-tumour immunity by reducing surgical stress and opioid use. RA also provides adequate analgesia and minimises opioid-related side effects [3], blunts neuroendocrine responses4, and enables the use of propofol over immunosuppressive inhaled agents [1, 4]. This review examines mechanistic and clinical evidence from the past two decades across eight major cancer types, highlighting limitations and implications of RA in oncologic surgery.

Methodology

A narrative review was performed using PubMed, Google Scholar, and Scopus. The keywords used included "regional anaesthesia," "cancer recurrence," "metastasis," "oncologic outcomes," along with relevant cancer-related terms. The review considered systematic reviews, meta-analyses and retrospective cohort studies published in English. Studies, such as editorials, case reports, and letters, were excluded. The literature search included articles published between 2000 and 2024, corresponding roughly to the past two decades of research.

Regional Anaesthesia Techniques in Cancer Surgery

Regional anesthesia (RA) is increasingly adopted in cancer surgeries to enhance pain management and reduce the surgical stress response. By blocking afferent pain pathways, RA can lessen stress-related immune suppression, decrease opioid use, and support recovery [3]. Various RA techniques are used during surgery, from traditional neuraxial methods to newer peripheral nerve blocks. This overview covers these techniques and the cancer surgeries where they are applied,

Address for Correspondence
Dr. Jyoti Sharma
Associate Professor, Department of Anaesthesiology, All India Institute of Medical Sciences, Bathinda, Punjab, India.
Email- drjyotisharma1014@gmail.com

Submitted: 15-01-2025; Reviewed: 08-02-2025; Accepted: 22-04-2025; Published: 10-06-2025

DOI: https://doi.org/10.13107/ijra.2025.v06.i01.118 | www.ijrajournal.com |

emphasizing their intraoperative pain-relief role. Any influence on tumor recurrence is noted only for context.

Neuraxial Anaesthesia: Epidural Analgesia in Major Cancer Surgeries

Epidural anaesthesia is a cornerstone technique in major cancer surgeries, offering continuous intraoperative and postoperative analgesia. It is commonly used in thoracic (e.g., lung, esophageal) and abdominal (e.g., colorectal, gastric) surgeries, providing bilateral pain relief, blunting the neuroendocrine response, and aiding recovery of pulmonary and gastrointestinal function.5–8 In hepatic and gallbladder surgeries, epidurals improve immune markers. Combined with general anaesthesia, they are used in gynecologic cancer surgeries for large abdominal incisions, enhancing pain control and early mobilization, despite no proven survival benefit [9, 10]. Overall, epidural RA using dilute solutions of local anaesthetics reduces opioid use and supports recovery across cancer surgeries.

Spinal anaesthesia (intrathecal block) is commonly used for lower abdominal and pelvic cancer surgeries, providing rapid, dense, short-duration anaesthesia. In urologic procedures like TURBT, it avoids airway instrumentation and offers adequate anaesthesia, with retrospective studies suggesting lower recurrence rates than general anaesthesia [11, 12]. It is also employed in select prostate and gynecologic surgeries, often with sedation. Due to limited duration, it suits shorter procedures or is supplemented with spinal opioids. In gynecologic oncology, combined spinal-epidural techniques offer immediate anaesthesia and extended postoperative pain relief. Spinal blocks typically cover T4–L1 dermatomes, reducing intraoperative opioid needs and enhancing analgesia.

Truncal Blocks: Paravertebral Block for Breast and Thoracic Surgery

Paravertebral nerve blocks (PVB) involve injecting local anaesthetic into the paravertebral space to create a unilateral segmental block, commonly used in breast and thoracic cancer surgeries. In breast surgery, PVBs (T2–T6) provide chest wall analgesia, reduce opioid use, and lower chronic post-mastectomy pain, sometimes serving as the primary anaesthetic with sedation. A large randomized controlled trial by Sessler et al. found that paravertebral–propofol anaesthesia was comparable to sevoflurane–opioid general anaesthesia, with no significant difference in breast cancer recurrence [13].

Newer Peripheral Nerve Blocks for Cancer Surgery Analgesia

Pectoral nerve blocks (PECS I and II) and Serratus Anterior Plane blocks (SAP) are ultrasound-guided techniques for breast and lateral thoracic wall surgeries. PECS II anaesthetizes pectoral and intercostal nerves, providing effective pain relief for mastectomies, lumpectomies, and axillary dissections. Serratus blocks target the lateral thoracic nerves for anterolateral chest wall pain relief [14, 15]. Both reduce opioid use and improve comfort when epidural or paravertebral blocks are unsuitable. A trial showed better pain control and less morphine use with PECS blocks during mastectomy [16].

Transversus Abdominis Plane (TAP) and Quadratus Lumborum (QL) blocks are ultrasound-guided peripheral techniques for analgesia in abdominal and pelvic cancer surgeries. TAP blocks anesthetize T6–L1 segmental nerves and are effective in colorectal, gynecologic, and urologic surgeries, reducing morphine use and pain scores, especially in laparoscopic procedures [17]. QL blocks, deposited near the thoracolumbar fascia, offer broader T7–L1 analgesia with some visceral coverage, suitable for ovarian, bladder, prostate, and hepatobiliary surgeries [18, 19]. Both blocks aid early recovery and are preferred when epidurals are contraindicated, though often combined with systemic or neuraxial analgesia for optimal effect.

Erector spinae plane (ESP) block is an ultrasound-guided interfascial block first described by Forero et al. in 2016 [20]. In cancer surgeries (thoracic, breast, abdominal), ESP blocks are increasingly used for postoperative pain relief and lower opioid needs. For example, in breast cancer surgery, an ESP block reduced 24-hour morphine use and pain scores versus general anesthesia alone [21]. In thoracic (lung cancer) surgery, continuous ESP blocks have nearly halved 48-hour opioid use relative to intercostal nerve blocks while improving pain relief [22], and a propensity-score analysis found ESP blocks yielded lower 24-hour pain scores than thoracic paravertebral blocks, supporting ESP as a safe and effective alternative for oncologic thoracic analgesia [23]. Likewise, in major abdominal cancer surgeries, adding a pre-incisional ESP block to standard analgesia has produced significantly lower postoperative pain scores and opioid consumption, highlighting the ESP block's analgesic benefits and its role in enhancing recovery [24].

Mechanism linking regional anaesthesia and cancer recurrence

Several biological mechanisms have been proposed to explain how regional anaesthesia and analgesia may reduce cancer recurrence or metastasis compared to general anaesthesia (GA) techniques, as outlined in Table 1.

The following sections review the clinical evidence for this

Sr. No	Mechanism	How it Works
1	Reducing Surgical Stress Response and Preserving Immune Function [25-31]	↓ Afferent pain signals & sympathetic outflow
		↓ Catecholamines, cortisol, IL-6, TNF-α
		↓ VEGF and ↓ Tumor Angiogenesis
		↓ Systemic inflammation & ↑ NK cell, T-cell activity
		↓ Risk of postoperative metastases
2	Opioid-Sparing and the Link to Cancer [32-37]	↓ Systemic opioid requirement
		↓ EMT and tumor proliferation
		↓ Tumor progression and recurrence
3	Direct Anti-Tumor Effects of Local Anesthetics [38-45]	↓ VGSC blockade on tumor cells
		↓ Cell migration & invasion
		↑ Apoptosis induction
		↓ Viability of micro metastatic tumor cells

Table 1: Proposed Biological Mechanisms

hypothesis across different surgical oncology specialties.

A. Head and Neck Cancer Surgeries

Head and neck cancer surgeries rely on general anaesthesia, with limited use of regional techniques. Cervical epidural or nerve blocks may reduce stress and opioid use, as seen in a small trial [47], but evidence on recurrence or survival remains scarce [48, 49]. While RA aids pain control, its impact on oncologic outcomes is unproven, warranting further research.

B. Breast Cancer Surgeries

Research on anaesthetic management in breast cancer surgery investigates whether regional anaesthesia (RA) improves oncologic outcomes. Early retrospective studies, such as Exadaktylos et al. [50] suggested reduced recurrence with RA, but larger trials failed to confirm this. A major RCT by Sessler et al. (2019) involving over 2,100 women found no significant difference in recurrence between those receiving a paravertebral block with propofol and those given sevoflurane with opioids [13]. A 2022 sub-study in ER-negative patients showed a non-significant trend toward reduced early recurrence with RA [51], while a 2021 Taiwanese study reported lower locoregional recurrence with paravertebral block and propofol [52]. In contrast, a study conducted by Huang YH et al found no difference between RA and propofol [53]. Lu et al. (2021) observed better 5-year disease-free survival with epidural anaesthesia in node-negative patients, though confounding limits its reliability [54]. A 2023 review found no clear RA benefit, though lidocaine showed potential [55]. A 2024 meta-analysis by Xie et al. showed a slight recurrence reduction with RA across 24,000 patients, mostly in prostate cancer, not breast cancer [56]. Thus, RA improves pain management but shows limited oncologic benefit in breast cancer surgery.

C. Gastrointestinal Cancer Surgeries

1. Colorectal Surgery:

A 2022 Danish study of over 11,000 patients undergoing curative colorectal cancer resection found no association between epidural analgesia and recurrence or mortality [57]. Similarly, Wu et al. (2021) reported no significant difference between epidural and intravenous analgesia in 1,282 rectal cancer patients [58]. Gottschalk et al. (2010) also observed no benefit of epidural analgesia in reducing recurrence in 669 colorectal cancer patients [6]. Gupta et al. (2011) found reduced mortality in rectal but not colonic cancer with epidural use [5]. While epidurals improve perioperative pain, stress response, and gastrointestinal recovery, most studies do not support a long-term oncologic benefit.

2. Gastric Cancer:

Retrospective studies show inconsistent results. Wang et al. [7] suggested a survival benefit with epidurals in patients under 65, but not in older patients—conversely, Cummings et al.8 and Shin et al. [59] reported no significant effect of epidural analgesia on recurrence or survival. Meta-analyses remain inconclusive due to heterogeneity and methodological variability.

3. Esophageal Cancer:

Hiller et al. (2014) found longer epidural use (>36 hours)

linked to improved recurrence-free and overall survival [60]. Heinrich et al. (2021) reported better short-term outcomes but no significant difference in 3-year survival [61]. A review by Pérez-González et al. (2018) concluded that current evidence is insufficient to confirm survival benefits [62].

D. Urological Cancer Surgeries

1. Bladder Cancer Surgeries:

A 2023 systematic review by Wang et al. [11] of 8 retrospective studies found spinal anaesthesia associated with lower recurrence in bladder cancer compared to general anaesthesia (GA). Jang et al. (2016) [12] reported higher 5-year survival in TURBT patients under RA (96.3%) vs. GA (87.5%), though not statistically significant. Meta-analyses suggest RA, particularly spinal anaesthesia, may reduce recurrence in non-muscle-invasive bladder cancer (NMIBC), but no apparent effect on progression or overall survival is established.

2. Prostate Cancer:

Initial retrospective studies, like Biki et al. (2008) [63], hinted at a reduction in recurrence with RA. However, subsequent studies by Tsui et al. [64], Ehdaie et al. [65], Wuethrich et al. [66], and Forget et al. [67] found no significant differences in recurrence or survival. A 2015 meta-analysis by Lee et al. [68] confirmed no oncologic benefit with RA during radical prostatectomy, but noted a significantly lower mortality risk. Overall, while early data were promising, current evidence does not support RA's impact on prostate cancer outcomes.

E. Thoracic Cancer Surgeries

A 2021 RCT by Xu et al. [69] with 400 patients undergoing VATS for lung cancer, compared epidural-general anaesthesia versus general anaesthesia with opioids. After 32 months, no significant difference in survival. Du et al. (2021)[70] studied over 1,700 elderly patients undergoing major surgeries, mostly for cancer, and found no significant survival differences. To conclude, TEA helps reduce postoperative pain, improve pulmonary function, and aid early recovery, but doesn't seem to affect cancer recurrence or metastasis.

F. Gynecological Cancer Surgeries

1. Ovarian Cancer:

A Retrospective study in 2023 comparing perioperative epidural analgesia (EA) to GA in ovarian cancer patients found no significant survival benefit from epidural analgesia [10]. Lacassie et al. (2013) [9] analyzed 80 women with advanced ovarian cancer in Chile, finding no significant difference in recurrence or survival between the EA and non-EA groups. To conclude, despite promising mechanistic rationale, the current body of evidence does not support a definitive oncologic benefit from the use of RA in gynecologic cancer surgeries.

G. Hepatocellular, Pancreatic, and Gallbladder Cancer Surgeries

1. Hepatocellular Carcinoma (HCC):

The impact of regional anaesthesia on HCC recurrence remains inconclusive. Lai et al. found that patients under GA for small HCCs had a lower recurrence risk than those under epidural anaesthesia, indicating GA might be advantageous in some cases [71]. An extensive study from Sun Yat-Sen University reported higher recurrence and mortality with epidural morphine analgesia post-resection versus intravenous fentanyl, questioning epidural analgesia's oncologic benefit [72]. Despite conflicting outcomes, Sun et al. showed that combined epidural and general anaesthesia can reduce perioperative immunosuppression by maintaining T-cell and interferon-γ responses, potentially improving oncologic control [73].

2. Pancreatic Cancer:

Lin et al [74] and Alexander et al. [75] found no significant difference in recurrence or survival between patients who received epidural anaesthesia and those who did not receive it. Overall, regional anaesthesia may benefit immune preservation and pain relief, but doesn't appear to improve long-term outcomes.

3. Gallbladder Cancer:

Zhu et al. compared GA with combined epidural-general anaesthesia in gallbladder cancer surgery. The combined group had better intraoperative stability and higher postoperative T-cell counts, indicating immune preservation [76]. Despite these immune benefits, survival rates showed no significant differences, implying that improved perioperative immunity may not impact long-term outcomes. To conclude, the impact of regional anaesthesia on recurrence in HCC, pancreatic, and gallbladder cancers is unclear.

Ongoing Prospective Trials:

Currently, no prospective trials studying the effect of regional anesthesia on cancer recurrence are registered in the clinical trials database. Several trials are currently in the recruitment phase (NCT05494502, NCT06082141), primarily investigating the impact of regional nerve blocks on pain in patients undergoing breast cancer surgery.

Limitations

Much of the evidence that links regional anaesthesia to decreased recurrence rates for cancer is from observational studies, which can be influenced by other factors, including patient selection, the tumor's stage at diagnosis, and perioperative treatment factors such as type of postoperative pain management and use of adjuvants. Due to the heterogeneity of studies included in meta-analyses, there are limitations related to the sample size and follow-up variability of RCTs. Furthermore, due to publication bias and variations in how recurrence was defined, it is difficult to accurately interpret the results of the data. Although RA has been shown to improve recovery and provide better pain control, the ability to consistently show a benefit of RA on cancer outcomes has been lacking.

Future perspectives

Regional anaesthesia will continue to influence post-operative recovery, and while it is believed to offer benefits during this period, many questions remain about how regional anaesthesia affects metastasis or cancer recurrence. Currently, there are no large-scale, ongoing studies on this topic. Therefore, due to limited data, its role in impacting oncologic outcomes should be carefully considered. Future research should investigate how biomarkers can guide regional anaesthesia (RA) treatment, the effects of RA on the immune system (immunological profiling), and establish criteria for patient selection to identify those who may benefit more from RA based on their individual circumstances. Until then, RA's primary value will be in providing effective pain relief and maintaining immune function during the perioperative period.

Conclusion

Regional anaesthesia (RA) can improve perioperative recovery, but its direct impact on cancer outcomes remains unclear. While RA may support immune function, evidence of increased disease-free survival is inconclusive across various types of cancer. Some early signs of benefit in bladder and esophageal cancers exist, but findings are inconsistent. Variability in study designs and confounding factors hinders definitive conclusions about RA reducing cancer recurrence. More high-quality trials are needed, with personalized anaesthetic approaches. Prospective studies with biomarkers are essential to determine if RA can lower recurrence rates and enhance long-term survival.

References

1. Li T, Meng X, Wang D, Wang Q, Ma J, Dai Z. Regional anesthesia did not improve postoperative long-term survival of tumor patients: a systematic review and meta-analysis of randomized controlled trials. Vol. 21, World Journal of Surgical Oncology. BioMed Central Ltd; 2023.

2. Zhang D, Jiang J, Liu J, Zhu T, Huang H, Zhou C. Effects of Perioperative Epidural Analgesia on Cancer Recurrence and Survival. Vol. 11, Frontiers in Oncology. Frontiers Media S.A.; 2022.

3. Bhuyan S, Bhuyan D, Rahane S. Optimizing Regional Anesthesia for Cancer Patients: A Comprehensive Review of Current Practices and Future Directions. Cureus. 2024 Sep 13;

4. Sessler DI. L'anesthésie régionale et la récidive du cancer de la prostate. Vol. 57, Canadian Journal of Anesthesia. 2010. p. 99–102.

5. Gupta A, Björnsson A, Fredriksson M, Hallböök O, Eintrei C. Reduction in mortality after epidural anaesthesia and analgesia in patients undergoing rectal but not colonic cancer surgery: A retrospective analysis of data from 655 patients in Central Sweden. Br J Anaesth. 2011;107(2):164–70.

6. Gottschalk A, Ford JG, Regelin CC, You J, Mascha EJ, Sessler DI, et al. PERIOPERATIVE MEDICINE Association between Epidural Analgesia and Cancer Recurrence after Colorectal Cancer Surgery What We Already Know about This Topic [Internet]. Vol. 113, Anesthesiology. 2010. Available from: www.anesthesiology.org.

7. Wang J, Guo W, Wu Q, Zhang R, Fang J. Impact of combination epidural and general anesthesia on the long-term survival of gastric cancer patients: A retrospective study. Medical Science Monitor. 2016 Jul 8;22:2379–85.

8. Cummings KC, Patel M, Htoo PT, Bakaki PM, Cummings LC, Koroukian S. A comparison of the effects of epidural analgesia versus traditional pain management on outcomes after gastric cancer resection: A population-based study. Reg Anesth Pain Med. 2014;39(3):200–7.

9. Lacassie HJ, Cartagena J, Brañes J, Assel M, Echevarría GC. The relationship between neuraxial anesthesia and advanced ovarian cancer-related outcomes in the chilean population. Anesth Analg. 2013 Sep;117(3):653–60.

10. Balakrishnan K, Chockalingam P, Ramasamy T, Venkateswaran M, Sundaram M, Sridevi V. Association of Perioperative Use of Epidural Analgesia with Disease Free Survival in Epithelial Ovarian Cancer: A Retrospective Cohort Observational Study with Propensity Score Matched Analysis [Internet]. Vol. 9, Archives of Anesthesiology and Critical Care. 2023. Available from: http://aacc.tums.ac.ir

11. Wang Y, Song Y, Qin C, Zhang C, Du Y, Xu T. Effect of regional versus general anesthesia on recurrence of non-muscle invasive bladder cancer: a systematic review and meta-analysis of eight retrospective cohort studies. BMC Anesthesiol. 2023 Dec 1;23(1).

12. Jang D, Lim CS, Shin YS, Ko YK, Park S Il, Song SH, et al. A comparison of regional and general anesthesia effects on 5year survival and cancer recurrence after transurethral resection of the bladder tumor: A retrospective analysis. BMC Anesthesiol. 2016 Mar 12;16(1).

13. Sessler DI, Pei L, Huang Y, Fleischmann E, Marhofer P, Kurz A, et al. Recurrence of breast cancer after regional or general anaesthesia: a randomised controlled trial. The Lancet. 2019 Nov 16;394(10211):1807–15.

14. Blanco R, Parras T, McDonnell JG, Prats-Galino A. Serratus plane block: A novel ultrasound-guided thoracic wall nerve block. Anaesthesia. 2013 Nov;68(11):1107–13.

15. Landoni G, Granell M, Zhang W, Copyright fanes, Liang W, Wu Y, et al. Efficacy and safety of ultrasound-guided serratus anterior plane block for postoperative analgesia in thoracic surgery and breast surgery: A systematic review and meta-analysis of randomized controlled studies.

16. Bashandy GMN, Abbas DN. Pectoral nerves I and II blocks in multimodal analgesia for breast cancer surgery: A randomized clinical trial. Reg Anesth Pain Med. 2015;40(1):68–74.

17. Zhao X, Tong Y, Ren H, Ding XB, Wang X, Zong JY, et al. Transversus abdominis plane block for postoperative analgesia after laparoscopic surgery: a systematic review and meta-analysis [Internet]. Vol. 7, Int J Clin Exp Med. 2014. Available from: www.ijcem.com/

18. Dhanjal ST, Affiliations ST. Quadratus Lumborum Block Continuing Education Activity [Internet]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK537212/?report=printable

19. Liu X, Song T, Chen X, Zhang J, Shan C, Chang L, et al. Quadratus lumborum block versus transversus abdominis plane block for postoperative analgesia in patients undergoing abdominal surgeries: A systematic review and meta-analysis of randomized controlled trials. Vol. 20, BMC Anesthesiology. BioMed Central Ltd.; 2020.

20. Bonvicini D, Boscolo-Berto R, De Cassai A, Negrello M, Macchi V, Tiberio I, et al. Anatomical basis of erector spinae plane block: a dissection and histotopographic pilot study. J Anesth. 2021 Feb 1;35(1):102–11.

21. Zhang Y, Liu T, Zhou Y, Yu Y, Chen G. Analgesic efficacy and safety of erector spinae plane block in breast cancer surgery: a systematic review and meta-analysis. BMC Anesthesiol. 2021 Dec 1;21(1).

22. Gams P, Bitenc M, Danojevic N, Jensterle T, Sadikov A, Groznik V, et al. Erector spinae plane block versus intercostal nerve block for postoperative analgesia in lung cancer surgery. Radiol Oncol. 2023 Sep 1;57(3):364–70.

23. Durey B, Djerada Z, Boujibar F, Besnier E, Montagne F, Baste JM, et al. Erector Spinae Plane Block versus Paravertebral Block after Thoracic Surgery for Lung Cancer: A Propensity Score Study. Cancers (Basel). 2023 Apr 1;15(8).

24. Dubilet M, Gruenbaum BF, Semyonov M, Ishay SY, Osyntsov A, Friger M, et al. Erector Spinae Plane (ESP) Block for Postoperative Pain Management after Open Oncologic Abdominal Surgery. Pain Res Manag. 2023;2023.

25. Choi H, Hwang W. Anesthetic Approaches and Their Impact on Cancer Recurrence and Metastasis: A Comprehensive Review. Vol. 16, Cancers. Multidisciplinary Digital Publishing Institute (MDPI); 2024.

26. Sekandarzad MW, Van Zundert AAJ, Lirk PB, Doornebal CW, Hollmann MW. Perioperative anesthesia care and tumor progression. Vol. 124, Anesthesia and Analgesia. Lippincott Williams and Wilkins; 2017. p. 1697–708.

27. Tavare AN, Perry NJS, Benzonana LL, Takata M, Ma D. Cancer recurrence after surgery: Direct and indirect effects of anesthetic agents. Vol. 130, International Journal of Cancer. 2012. p. 1237–50.

28. Huh J, Hwang W. The Role of Anesthetic Management in Lung Cancer Recurrence and Metastasis: A Comprehensive Review. Vol. 13, Journal of Clinical Medicine. Multidisciplinary Digital Publishing Institute (MDPI); 2024.

29. Pérez-González O, Cuéllar-Guzmán LF, Soliz J, Cata JP. Impact of Regional Anesthesia on Recurrence, Metastasis, and Immune Response in Breast Cancer Surgery: A Systematic Review of the Literature. Vol. 42, Regional Anesthesia and Pain Medicine. Lippincott Williams and Wilkins; 2017. p. 751–6.

30. Lin EJ, Prost S, Lin HJ, Shah S, Li R. Combined General/Epidural Anesthesia vs. General Anesthesia on Postoperative Cytokines: A Review and Meta-Analysis. Vol. 17, Cancers. Multidisciplinary Digital Publishing Institute (MDPI); 2025.

31. Wang Y, Song Y, Qin C, Zhang C, Du Y, Xu T. Effect of regional versus general anesthesia on recurrence of non-muscle invasive bladder cancer: a systematic review and meta-analysis of eight retrospective cohort studies. BMC Anesthesiol. 2023 Dec 1;23(1).

32. Kim R. Effects of surgery and anesthetic choice on immunosuppression and cancer recurrence. Vol. 16, Journal of Translational Medicine. BioMed Central Ltd.; 2018.

33. Shavit Y, Ben-Eliyahu S, Zeidel A, Beilin B. Effects of fentanyl on natural killer cell activity and on resistance to tumor metastasis in rats: Dose and timing study. Neuroimmunomodulation. 2004;11(4):255–60.

34. Singleton PA, Moss J. Effect of perioperative opioids on cancer recurrence: A hypothesis. Vol. 6, Future Oncology. 2010. p. 1237–42.

35. Sacerdote P, Bianchi M, Gaspani L, Manfredi B, Maucione A, Terno G, et al. The Effects of Tramadol and Morphine on Immune Responses and Pain After Surgery in Cancer Patients. Vol. 90, Anesth Analg. 2000.

36. Das J, Kumar S, Khanna S, Mehta Y. Are we causing the recurrence-impact of perioperative period on long-term cancer prognosis: Review of current evidence and practice. Vol. 30, Journal of Anaesthesiology Clinical Pharmacology. Journal of Anaesthesiology Clinical Pharmacology; 2014. p. 153–9.

37. Gao M, Sun J, Jin W, Qian Y. Morphine, but not ketamine, decreases the ratio of Th1/Th2 in CD4-positive cells through T-bet and GATA3. Inflammation. 2012 Jun;35(3):1069–77.

38. Lucchinetti E, Awad AE, Rahman M, Feng J, Lou PH, Zhang L, et al. Antiproliferative Effects of Local Anesthetics on Mesenchymal Stem Cells Potential Implications for Tumor Spreading and Wound Healing [Internet]. 2012. Available from: www.anesthesiology.org

39. Chang YC, Liu CL, Chen MJ, Hsu YW, Chen SN, Lin CH, et al. Local anesthetics induce apoptosis in human breast tumor cells. Anesth Analg. 2014 Jan;118(1):116–24.

40. Yardeni IZ, Beilin B, Mayburd E, Levinson Y, Bessler H. The effect of perioperative intravenous lidocaine on postoperative pain and immune function. Anesth Analg. 2009;109(5):1464–9.

41. Sakaguchi M, Kuroda Y, Hirose M. The antiproliferative effect of lidocaine on human tongue cancer cells with inhibition of the activity of epidermal growth factor receptor. Anesth Analg. 2006;102(4):1103–7.

42. Zhang C, Xie C, Lu Y. Local Anesthetic Lidocaine and Cancer: Insight Into Tumor Progression and Recurrence. Vol. 11, Frontiers in Oncology. Frontiers Media S.A.; 2021.

43. Lirk P, Berger R, Hollmann MW, Fiegl H. Lidocaine time- and dose-dependently demethylates deoxyribonucleic acid in breast cancer cell lines in vitro. Br J Anaesth. 2012;109(2):200–7.

44. Cata JP, Ramirez MF, Velasquez JF, Di A, Popat KU, Gottumukkala V, et al. Lidocaine stimulates the function of natural killer cells in different experimental settings. Vol. 37, Anticancer Research. International Institute of Anticancer Research; 2017. p. 4727–32.

45. Bundscherer A, Malsy M, Gebhardt K, Metterlein T, Plank C, Wiese CH, et al. Effects of ropivacaine, bupivacaine and sufentanil in colon and pancreatic cancer cells in vitro. Pharmacol Res. 2015 May 1;95–96:126–31.

46. Nunez-Rodriguez E, Zhang H, Sah D, Cata JP. Intersection Between Local Anesthetics and Cancer Biology: What Now? Where Are We Going? Advanced Biology. John Wiley and Sons Inc; 2025.

47. Kochhar A, Banday J, Ahmad Z, Panjiar P, Vajifdar H. Cervical epidural analgesia combined with general anesthesia for head and neck cancer surgery: A randomized study. J Anaesthesiol Clin Pharmacol. 2020 Apr 1;36(2):182–6.

48. Cata JP, Zafereo M, Villarreal J, Unruh BD, Truong A, Truong DT, et al. Intraoperative opioids use for laryngeal squamous cell carcinoma surgery and recurrence: A retrospective study. J Clin Anesth. 2015 Dec 1;27(8):672–9.

49. Merquiol F, Montelimard AS, Nourissat A, Molliex S, Zufferey PJ. Cervical epidural anesthesia is associated with increased cancer-free survival in laryngeal and hypopharyngeal cancer surgery: A retrospective propensity-matched analysis. Reg Anesth Pain Med. 2013;38(5):398–402.

50. Exadaktylos AK, Buggy DJ, Moriarty DC, Mascha E, Sessler DI. Can Anesthetic Technique for Primary Breast Cancer Surgery Affect Recurrence or Metastasis? Anesthesiology. 2006 Oct 1;105(4):660–4.

51. Li M, Zhang Y, Pei L, Zhang Z, Tan G, Huang Y. Potential Influence of Anesthetic Interventions on Breast Cancer Early Recurrence According to Estrogen Receptor Expression: A Sub-Study of a Randomized Trial. Front Oncol. 2022 Feb 10;12.

52. Zhang J, Chang CL, Lu CY, Chen HM, Wu SY. Paravertebral block in regional anesthesia with propofol sedation reduces locoregional recurrence in patients with breast cancer receiving breast conservative surgery compared with volatile inhalational without propofol in general anesthesia. Biomedicine and Pharmacotherapy. 2021 Oct 1;142.

53. Huang YH, Lee MS, Lou YS, Lai HC, Yu JC, Lu CH, et al. Propofol-based total intravenous anesthesia did not improve survival compared to desflurane anesthesia in breast cancer surgery. PLoS One. 2019 Nov 1;14(11).

54. Lu Y, Liu T, Wang P, Chen Y, Ji F, Hernanz F, et al. Can anesthetic effects and pain treatment influence the long-term prognosis of early-stage lymph node-negative breast cancer after breast-conserving surgery? Ann Transl Med. 2021 Sep;9(18):1467–1467.

55. Yang Y, Zhang Y, Tang Y, Zhang J. Anesthesia-related intervention for long-term survival and cancer recurrence following breast cancer surgery: A systematic review of prospective studies. PLoS One. 2023 Dec 1;18(12 December).

56. Xie S, Li L, Meng F, Wang H. Regional anesthesia might reduce recurrence and metastasis rates in adult patients with cancers after surgery: a meta-analysis. BMC Anesthesiol. 2024 Dec 1;24(1).

57. Hasselager RP, Hallas J, Gögenur I. Epidural Analgesia and Recurrence after Colorectal Cancer Surgery: A Danish Retrospective Registry-based Cohort Study. Anesthesiology. 2022 Mar 1;136(3):459–71.

58. Wu HL, Tai YH, Lin SP, Yang SH, Tsou MY, Chang KY. Epidural analgesia does not impact recurrence or mortality in patients after rectal cancer resection. Sci Rep. 2021 Dec 1;11(1).

59. Shin S, Kim HI, Kim NY, Lee KY, Kim DW, Yoo YC. Effect of postoperative analgesia technique on the prognosis of gastric cancer: a retrospective analysis [Internet]. Vol. 8, Oncotarget. 2017. Available from: www.impactjournals.com/oncotarget/

60. Hiller JG, Hacking MB, Link EK, Wessels KL, Riedel BJ. Perioperative epidural analgesia reduces cancer recurrence after gastro-oesophageal surgery. Acta Anaesthesiol Scand. 2014 Mar;58(3):281–90.

61. Heinrich S, Janitz K, Merkel S, Klein P, Schmidt J. Short- and long term effects of epidural analgesia on morbidity and mortality of esophageal cancer surgery. Langenbecks Arch Surg. 2015 Jan 1;400(1):19–26.

62. Pérez-González O, Cuéllar-Guzmán LF, Navarrete-Pacheco M, Ortiz-Martínez JJ, Williams WH, Cata JP. Impact of regional anesthesia on gastroesophageal cancer surgery outcomes: A systematic review of the literature. Vol. 127, Anesthesia and Analgesia. Lippincott Williams and Wilkins; 2018. p. 753–8.

63. Biki B, Mascha E, Moriarty DC, Fitzpatrick JM, Sessler DI, Buggy DJ. Anesthetic Technique for Radical Prostatectomy Surgery Affects Cancer Recurrence A Retrospective Analysis [Internet]. Vol. 109, Anesthesiology. 2008. Available from: www.cancer.org/downloads/STT/CAFF2007PWSecured.pdf.

64. Tsui BCH, Rashiq S, Schopflocher D, Murtha A, Broemling S, Pillay J, et al. Epidural anesthesia and cancer recurrence rates after radical prostatectomy. Canadian Journal of Anesthesia. 2010 Feb;57(2):107–12.

65. Ehdaie B, Sjoberg DD, Dalecki PH, Scardino PT, Eastham JA, Amar D. Association entre techniques anesthésiques pour la prostatectomie radicale et récidive biochimique: une étude rétrospective de cohorte. Canadian Journal of Anesthesia. 2014 Nov 22;61(12):1068–74.

66. Wuethrich PY, Schmitz SFH, Kessler TM, Thalmann GN, Studer UE, Burkhard FC. PERIOPERATIVE MEDICINE Potential Influence of the Anesthetic Technique Used during Open Radical Prostatectomy on Prostate Cancer-related Outcome A Retrospective Study [Internet]. Vol. 113, Anesthesiology. 2010. Available from: www.anesthesiology.org

67. Forget P, Tombal B, Scholtès JL, Nzimbala J, Meulders C, Legrand C, et al. Do intraoperative analgesics influence oncological outcomes after radical prostatectomy for prostate cancer? Eur J Anaesthesiol. 2011 Dec;28(12):830–5.

68. Lee BM, Singh Ghotra V, Karam JA, Hernandez M, Pratt G, Cata JP. Regional anesthesia/analgesia and the risk of cancer recurrence and mortality after prostatectomy: a meta-analysis. Pain Manag. 2015 Sep 1;5(5):387–95.

69. Xu ZZ, Li HJ, Li MH, Huang SM, Li X, Liu QH, et al. Epidural Anesthesia-Analgesia and Recurrence-free Survival after Lung Cancer Surgery: A Randomized Trial. Anesthesiology. 2021 Sep 1;135(3):419–32.

70. Du YT, Li YW, Zhao BJ, Guo XY, Feng Y, Zuo MZ, et al. Long-term Survival after Combined Epidural-General Anesthesia or General Anesthesia Alone: Follow-up of a Randomized Trial. Anesthesiology. 2021 Aug 1;135(2):233–45.

71. Lai R, Peng Z, Chen D, Wang X, Xing W, Zeng W, et al. The effects of anesthetic technique on cancer recurrence in percutaneous radiofrequency ablation of small hepatocellular carcinoma. Anesth Analg. 2012 Feb;114(2):290–6.

72. Cao L, Chang Y, Lin W, Zhou J, Tan H, Yuan Y, et al. Long-term survival after resection of hepatocelluar carcinoma: A potential risk associated with the choice of postoperative analgesia. Anesth Analg. 2014;118(6):1309–16.

73. Sun HZ, Song YL, Wang XY. Effects of Different Anesthetic Methods on Cellular Immune and Neuroendocrine Functions in Patients With Hepatocellular Carcinoma Before and After Surgery. J Clin Lab Anal. 2016 Nov 1;30(6):1175–82.

74. Lin KJ, Hsu FK, Shyr YM, Ni YW, Tsou MY, Chang KY. Effect of epidural analgesia on long-term outcomes after curative

surgery for pancreatic cancer: A single-center cohort study in Taiwan. Journal of the Chinese Medical Association. 2022 Jan 1;85(1):124–8.

75. Alexander A, Lehwald-Tywuschik N, Rehders A, Rabenalt S, Verde PE, Eisenberger CF, et al. Peridural anesthesia and cancer-related survival after surgery for pancreatic cancer—a retrospective cohort study. Clin Pract. 2021 Sep 1;11(3):532–42.

76. Zhu J, Zhang XR, Yang H. Effects of combined epidural and general anesthesia on intraoperative hemodynamic responses, postoperative cellular immunity, and prognosis in patients with gallbladder cancer. Medicine (United States). 2017 Mar 1;96(10).

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his/her consent for his/her images and other clinical information to be reported in the Journal. The patient understands that his/her name and initials will not be published, and due efforts will be made to conceal his/her identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

How to cite this article: Grewal A, Challa RB, Sharma J. Regional Anaesthesia for Cancer Surgery and Its Impact on Recurrence and Metastasis: What Is the Evidence? International Journal of Regional Anaesthesia. January-June 2025; 6(1): 20-27. DOI: https://doi.org/10.13107/ijra.2025.v06.i01.118