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NEUROLYTIC SPLANCHNIC NERVE BLOCK WITH ALCOHOL FOR UPPER ABDOMINAL CANCER PATIENTS: A SYSTEMATIC REVIEW

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ABSTRAK

Nyeri merupakan gejala yang paling sering dialami oleh sekitar 66% pasien yang menderita kanker stadium lanjut, metastasis, atau terminal. Blok saraf splanchnic dengan neurolitik dapat membantu mengurangi nyeri dan diindikasikan untuk mengobati nyeri yang disebabkan oleh tumor ganas di retroperitoneum dan abdomen atas. Tinjauan sistematis ini menggunakan data dari basis data elektronik (PubMed, Science Direct, Pro Quest, dan EPMC) untuk studi yang diterbitkan dalam bahasa Inggris antara 2015 – 2025 dan didapatkan lima studi untuk ditinjau. Neurolitik dengan konsentrasi alkohol antara 50% hingga 99,7% dan volume injeksi dari 5 mL hingga >20 mL secara konsisten memberikan pengurangan nyeri yang signifikan pada pasien dengan nyeri intra-abdominal akibat kanker dalam tiga bulan pertama. Potensi pengurangan penggunaan opioid dan berbagai teknik menjadikan neurolitik saraf splanchnic salah satu pilihan terapi dalam manajemen nyeri paliatif.

ABSTRACT

Neurolytic Splanchnic Nerve Block with Alcohol for Upper Abdominal Cancer Patients: A Systematic Review. Pain is the most common symptom experienced by approximately 66% of patients with advanced, metastatic, or terminal cancer. Splanchnic nerve block with neurolytics can help reduce pain and is indicated for treating pain caused by malignant tumors in the retroperitoneum and upper abdomen. This systematic review used data from electronic databases (PubMed, ScienceDirect, ProQuest, and EPMC) to identify studies published in English between 2015 and 2025; five studies were included for review. Neurolytics with alcohol concentrations between 50% and 99.7% and injection volumes from 5 mL to >20 mL consistently provided significant pain reduction in patients with intra-abdominal pain due to cancer in the first three months. The potential for reducing opioid use and various techniques make splanchnic nerve neurolytics one of the therapeutic options in palliative pain management.

INTRODUCTION

Cancer is a disease that can occur in any organ or tissue of the body when abnormal cells grow uncontrollably, exceeding normal limits and attacking or spreading to other parts of the body. In 2020, there were 19.3 million new cases of cancer and 10 million deaths from cancer worldwide.[1–

[3] Pain is experienced by 55% of patients undergoing anti-cancer treatment and around 66% of patients suffering from advanced, metastatic, or terminal cancer. The mechanisms of pain in cancer patients can be triggered by inflammation, neuropathic pain, and cancer-specific factors. Conventional cancer pain management still relies on opioids and first and second-line analgesics, which are typically indicated for neuropathic pain conditions. Alternative pain management for cancer patients can be achieved through neurolysis. [1,4]

Splanchnic nerve block with neurolytics can help reduce pain and is indicated to treat pain secondary to malignancies of the retroperitoneum and upper abdomen. The splanchnic nerves originate from the seven lower thoracic sympathetic ganglia and are paired autonomic nerves containing visceral motor fibers and sensory afferent fibers. The splanchnic nerves have sympathetic activity except for the pelvic splanchnic nerves, which carry parasympathetic fibers. [5–7]

The splanchnic nerve neurolysis method can be performed using alcohol selected as a neurolytic agent due to its ability to produce effective nerve destruction and a relatively longer duration of analgesia. Alcohol with a concentration of 35% to 60% acts as a nonselective chemo-neurolytic agent and will spread rapidly from the injection site. Alcohol injection for cancer pain is used to prolong the duration of pain relief. Alcohol damages nerves by nonselectively degrading proteins, extracting cholesterol, phospholipids, and cerebrosides from nerve membranes, and precipitating mucoproteins and lipoproteins, thereby causing retrograde Wallerian degeneration of nerve fibers.[5,8]

Chronic pain is not immediately life-threatening, but pain is associated with poorer quality of life due to psychological disorders such as anxiety, fatigue, or depression, and a decline in daily functioning, so it is important to manage pain so that patients can have a good quality of life. The purpose of this study was to conduct a systematic review to identify the effectiveness of splanchnic nerve neurolysis with alcohol in cancer patients.

Most of the studies included were retrospective, without randomisation, thus potentially introducing selection bias and limiting the strength of the conclusions. Sample sizes were relatively small, procedures and alcohol concentrations varied, and follow-up was generally short, making it difficult to assess long-term effectiveness. Reporting on quality of life and side effects was inconsistent. Overall, there are methodological limitations and heterogeneity between studies, necessitating larger, standardised prospective research.

METHODS

The journals used in the systematic review were collected from literature searches in the electronic data-based publication centres PubMed, Science Direct, ProQuest, and Europe PMC. The studies reviewed were those related to splanchnic nerve block or neurolysis using alcohol in cancer patients between November 2015 and November 2025. The keywords used in the database search were ('splanchnic nerve' OR 'splanchnic nerves') AND ('neurolysis' OR 'neurolytic' OR 'nerve block' OR 'block') AND ('alcohol' OR 'ethanol') AND ('cancer' OR "neoplasm" OR 'malignant'). The titles and abstracts of each study were analysed, and selected studies were reviewed in full to check their relevance.

This systematic review includes studies investigating the effects of neurolytic splanchnic nerve block using alcohol/ethanol on visceral pain in cancer patients who are unresponsive to conservative treatment. This journal uses a structured PICOST design to select relevant studies. This review includes RCT studies and retrospective or prospective studies conducted between 2015 and

2025. Studies were excluded if they were not available in English, were animal studies, had full texts that were not available, were systematic/literature/scoping reviews, or were case reports/serial reports that lacked contralateral controls and were at high risk of bias. All studies that met the keywords were imported into Rayyan for duplicate removal and screening. Full-text studies that did not meet the inclusion criteria were excluded. The search results were reported and presented in a PRISMA flow diagram. Two researchers (NAP, DF) independently screened and assessed each study to reduce errors in data extraction, and any disagreements were resolved by consensus with a third author (AF). This ranking did not influence decisions concerning the exclusion of studies or the analytic approach. The final inclusion-exclusion decision was made after the articles were reviewed in full.

This systematic review focuses on adult patients with visceral pain due to upper intra-abdominal cancer that is unresponsive to analgesics (P). The intervention (I) consists of a neurolytic splanchnic nerve block using 50–100% alcohol/ethanol, CT/fluoro-guided, generally bilateral. The comparator (C) is a neurolytic splanchnic nerve block using saline/placebo, standard therapy, phenol, or no comparator. The outcomes (O) assessed include changes in pain intensity, opioid consumption, quality of life, side effects, and survival. The study design (S) used is a randomized controlled trial (RCT) and prospective/retrospective cohort study, and the study was published between (T) 2015 and 2025. Risk of bias assessment using the Newcastle-Ottawa Scale (NOS) for observational studies (cohort and case-control) and RoB 2 for RCT studies.

RESULTS

A total of 237 articles were identified through database searching using combinations of relevant keywords from PubMed, ScienceDirect, ProQuest, and Europe PMC. After the removal of 16 duplicate records, 221 articles were screened for title and abstract coherence with the aim of the present review. Following this screening process, 200 articles were excluded due to irrelevancy to the review objectives. A total of 21 full-text articles were then assessed for eligibility. All full texts were successfully retrieved and reviewed in detail, and after applying the predetermined inclusion and exclusion criteria, 5 studies were finally included in the present systematic review. The complete selection process is presented in Figure 1, in accordance with the PRISMA 2020 guidelines.

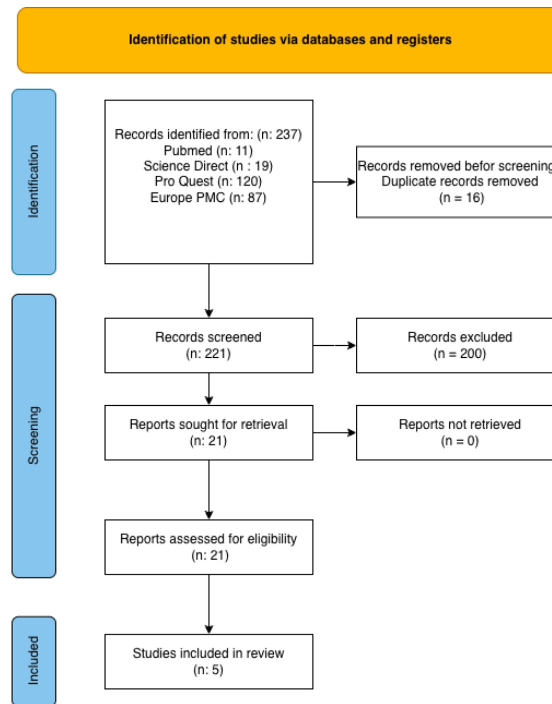

Figure 1. PRISMA Diagram

Risk of bias assessment in each article included in this review was conducted independently using the Newcastle Ottawa Scale (NOS) for observational study (Table 1) and Cochrane Risk of Bias 2 for randomized clinical trials (Figure 2).

Table 1. Newcastle Ottawa Scale

Study	Selection (Maximum 4)	Comparability (Maximum 2)	Exposure (Maximum 3)	Total (Maximum 9)	Quality
Koyyalagunta D et al., (2016)	4	1	2	7	Good
Koyyalagunta D et al., (2025)	4	0	3	7	Good
Ahmed A et al. (2017)	3	0	3	6	Moderate
Cai Z et al. (2022)	3	0	3	6	Moderate

Unique ID	D1	D2	D3	D4	D5	Overall
Dong, et al (2021)	+	+	+	+	!	!

+ Low risk
! Some concerns
- High risk

D1 Randomisation process
D2 Deviations from the intended interventions
D3 Missing outcome data
D4 Measurement of the outcome
D5 Selection of the reported result

Figure 2. Cochrane risk of bias 2 (RoB2) tools

The literature search was conducted through four databases and 5 articles were selected for use in the systematic review. Of the five studies, one study were randomized clinical trials (Dong D et al), and four studies were a retrospective cohort study (Koyyalagunta D et al., Ahmed A et al., Cai Z et al.). The extracted

data included the title of the study, author's name, location of the study, study design, population, year of publication, and the main results or findings of each study as shown on (Table 2).

Table 2. Summary of Results and Article Characteristics

Title (author, year)	Study design and sample (n)	Cancer type	Technique/ guide	Alcohol concentration and volume	Comparator	Outcome	Side effects/ complication
Dong D et al., (2021)[9]	Prospective double-blind RCT; n=96 (alcohol 48 vs saline 48)	Unresectable stage III–IV pancreatic cancer	CT-guided bilateral transdiscal T12–L1 SNN	Absolute alcohol 12–18 mL total	Saline	• Pain ↓ significantly up to 3 months • opioid ↓ up to 5 months • small QoL improvement month 1 • shorter median survival in alcohol group	Mostly mild–moderate: orthostatic hypotension, lethargy/fatigue, diarrhea, anterior-thigh numbness; no major complications
Koyyalagunta D et al., (2016)[10]	Retrospective chart review; n=93 (alcohol 27 vs phenol 67)	54% pancreatic; others upper abdominal cancers/metastases	Fluoroscopy-guided bilateral retrocrural SNN, mostly T12	98% alcohol 24.73±8.89 mL	10% phenol	• Mean pain ↓ −1.17; ≥30% responders 44%; • Alcohol = phenol at 1 month • Opioid ↓ not significant	Symptomatic hypotension (2), leg weakness (1), dyspnea without pneumothorax (1); no other serious events
Koyyalagunta et al., (2025)[11]	Retrospective cohort; n=254	55% pancreatic; GI 17%; hepatobiliary 10%; others; 72% metastatic	Fluoroscopy posterior SNN at T11/T12/ L1; 96% bilateral; diagnostic block used	Absolute alcohol 98% 6–10 mL/side	None (phenol used in 2%)	• Pain ↓ significant at 1 & 6 months • Opioid ↓ at 1 month • No outcome difference by level; • Some ESAS domains improved	Complications 4%, mild: hypotension, loose stool, nausea/vomiting, fever, worsening dyspnea, falls

Ahmed A, Arora D, (2017)[12]	Retrospective; n=21	Pancreas (9), gastric (7), gallbladder (5); distorted celiac anatomy	Fluoroscopy-guided bilateral SNN at T12 after positive diagnostic block	50% alcohol + bupivacaine; 6 mL/side	None	• NRS 8.67 → 3.52 (2 wks) → 2.57 (3 mo) • Opioid 200 → 70 mg (3 mo) • Karnofsky & SF-36 physical ↑	Mild: transient hypotension (19%), diarrhea (14%), neuritis (1); no serious complications
Cai Z et al., (2022)[13]	Retrospective; n=34 (31 neurolysis), 65 procedures	Pancreatic 18, GI 6, hepatobiliary 10	Fluoroscopy-guided transdiscal T11–T12 SNN, single curved needle; diagnostic block day before	99.7% alcohol 5 mL/procedure (+0.5 mL saline flush)	None	• NRS 7.6 → 3.7 (1 day) → ~2.6–2.9 (1 wk–2 mo) • morphine/day 182 → ~52–60 mg • QoL & satisfaction ↑	No major events; mild: backache 16%, diarrhea 13%, postural hypotension 10%, transient burning pain 10%

DISCUSSION

Pain is one of the symptoms cancer patients experience most often, affecting nearly 90% of them and remains poorly controlled in 40% of patients with cancer. It can significantly diminish their quality of life, contributing to problems like anxiety, fatigue, depression, and difficulty carrying out day-to-day activities. The goal of pain management is to bring the pain down to a level that enables patients to maintain an acceptable quality of life. Conventional cancer pain management still relies on opioids and first and second line analgesics. Interventional pain managements in cancer patients can be considered when there's persistent pain that remains uncontrolled despite standard medical treatment, including substantial increases in medication doses, or pain accompanied by opioid-related adverse effects such as sedation, severe gastrointestinal intolerance, or refractory constipation that limit the use of opioids or prevent further dose escalation.[1,14,15]

Splanchnic nerve block (SNB) is an important interventional technique for managing visceral pain in patients with upper abdominal malignancies. Physiologically, the splanchnic nerves constitute the primary conduit for visceral nociceptive signals originating from retroperitoneal and upper abdominal organs; thus, blockade at this level can provide substantial analgesia.[16,17] Diagnostic SNB with local anaesthetic is frequently performed to confirm sympathetic involvement in pain transmission and to predict the success of subsequent neurolytic procedures. It is also used therapeutically in acute visceral pain syndromes such as acute pancreatitis or post-embolisation pain following hepatic artery embolisation.[18]

SNB can be performed using two main approaches: the paravertebral and the transdiscal routes. The paravertebral technique positions the needle at the anterior third of the vertebral body on lateral fluoroscopic view but carries limitations, including inadvertent spread toward the intervertebral foramen, with associated risks of paraesthesia, neurological deficits, paraplegia, or

pleural or vascular puncture. [13,17,19] In contrast, the transdiscal approach first demonstrated by Plancarte and colleagues allows bilateral block through a single unilateral puncture and provides a more anatomically targeted spread.[20,21] Although traditionally performed under CT guidance, concerns regarding radiation exposure and limited CT availability have led to the use of a fluoroscopy-guided T11–T12 transdiscal approach as a practical alternative. The use of a curved needle further facilitates directional adjustments to optimize drug distribution; with increased operator experience, the entire procedure can often be completed with a single needle.[22]

Splanchnic nerve neurolysis with alcohol provides significant pain relief in patients with upper gastrointestinal cancer who cannot undergo celiac plexus neurolysis due to anatomical distortion. This finding can be explained through the anatomy and physiology of visceral pain: pain afferent fibers from organs such as the pancreas, stomach, and gallbladder travel through the splanchnic nerves before reaching the celiac plexus. Due to their retrocrural position and higher location than the celiac plexus, the splanchnic nerves are less likely to be displaced even in the presence of tumor masses or enlarged lymph nodes.

This systematic review demonstrates that neurolytic splanchnic nerve block (SNN) using alcohol consistently provides significant pain relief in patients with intra-abdominal cancer pain. The randomised controlled trial by Dong et al. [9] showed superior and sustained pain reduction compared with saline for up to three months, while retrospective studies by Koyyalagunta et al., Ahmed & Arora[12], and Cai et al.[13] reported meaningful improvements within the first week, with analgesic efficacy lasting two to six months. Across studies, reductions in pain scores typically ranged from 3 to 5 points on the NRS, with 40–80% of patients achieving at least a 30% decrease in pain. Variability in analgesic response likely reflects differences in tumour infiltration, alcohol spread, concentration and volume of alcohol injected, and the spinal level selected for the procedure.

Four of the five included studies also demonstrated reductions in opioid requirements following alcohol-based SNN. Opioid analgesics are widely used to manage cancer-related pain. However, their use often leads to opioid-related side effects, ranging from gastrointestinal problems such as nausea, reflux, reduced appetite, abdominal discomfort, bloating, and constipation to central nervous system effects like drowsiness and excessive sedation.[23] Dong et al. [9] reported significant opioid reduction lasting up to five months, whereas Cai et al.[13] and Ahmed & Arora[12] observed substantial decreases from the first day through the second or third month. Only one study Koyyalagunta et al.[10] did not show a statistically significant decrease in opioid consumption, possibly due to heterogeneity in the study population and variability in injection volumes. Overall, the findings support the role of alcohol-based SNN as an effective opioid-sparing strategy in advanced cancer pain management.

The included studies employed various techniques, including CT-guided transdiscal T12–L1 neurolysis, fluoroscopy-guided retrocrural approaches, and single-needle T11–T12 techniques with alcohol concentrations ranging from 50% to 99.7% and injection volumes from 5 mL to >20 mL. Despite significant heterogeneity in technique, equipment, concentration, and operator experience, analgesic efficacy remained consistently favourable. This suggests that the critical determinant of success lies in accurate deposition of the neurolytic agent within the retrocrural space rather than the specific vertebral level or procedural variation. This interpretation is supported by the large study of Koyyalagunta et al.[11], which found no significant differences in pain outcomes, opioid consumption, or complication rates among procedures performed at T11, T12, or L1.

The survival findings reported by Dong et al.[9] suggest a possible association between neurolysis and survival outcomes, but the mechanism remains unclear. The authors suggest that

more effective pain control after neurolysis may influence factors related to survival, including mood changes, functional ability, stress response, reduced opioid requirements, and possible improvement in immune function. However, the available data also show symptoms such as lethargy and fatigue after the procedure, and the relationship between these autonomic changes and mortality has not been clearly explained, including differences in outcomes according to disease stage. Therefore, the available evidence is insufficient to conclude a causal effect on survival, and its interpretation requires caution and confirmation through studies with more controlled designs.[9]

Across studies, SNN demonstrated an acceptable safety profile. Reported adverse effects, including orthostatic hypotension, diarrhea, transient back pain, abdominal burning sensation, and fatigue, were mild to moderate and self-limiting. Blockade of the splanchnic nerve results in increased bowel motility, causing diarrhea in about 50% of patients; in most cases, the diarrhea resolves within 48–72 h. Approximately 20% of patients may develop hypotension lasting up to 48–72 h, probably due to the vasodilation effect following neurolysis of the sympathetic fibers. Importantly, no cases of pneumothorax, retroperitoneal haemorrhage, or permanent neurological injury were reported. Given that these procedures are often performed in patients with late-stage cancer and significant symptom burden, this safety profile is considered clinically acceptable.[7,24,25]

Overall, alcohol-based splanchnic nerve neurolysis demonstrates consistent analgesic benefits and relative safety for visceral pain in upper abdominal cancer, particularly in advanced pancreatic cancer. The consistent analgesic benefits, potential opioid savings, and flexibility across various techniques make SNN a valuable component in palliative pain management. Although there is variation in procedural methods or anatomical approaches, the overall results remain favorable, indicating that SNN can be adapted to clinical conditions, anatomical distortions, and operator expertise.

CONCLUSION

Splanchnic nerve block with alcohol has been proven effective as an analgesic modality for visceral pain caused by cancer, particularly pancreatic cancer and other upper abdominal malignancies. Alcohol at high concentrations (98–100%) consistently produces a significant reduction in pain within the first 1–3 months and, in some studies, provides analgesia lasting up to 6 months. In addition to pain relief, this procedure also contributed to a significant reduction in opioid requirements in most studies, providing additional clinical benefits by reducing the side effects associated with long-term opioid use. Side effects arising from alcohol use, such as orthostatic hypotension, diarrhea, and back discomfort, were generally mild and temporary, and rarely caused serious complications, making its safety profile acceptable in a palliative care context.

However, comparative studies show that alcohol does not have a significant advantage over phenol in reducing pain, so the intervention's effectiveness is determined more by the block technique, imaging guidance, and success in reaching the nerve target than by the type of chemical agent used. Furthermore, one randomised clinical trial in patients with advanced pancreatic cancer reported that although alcohol provided analgesic benefits and reduced opioid consumption, it did not improve quality of life and may even shorten survival, particularly in stage IV patients. This emphasizes the importance of appropriate patient selection and careful clinical consideration before performing neurolysis. Overall, splanchnic nerve block with alcohol is an effective, safe, and

relevant intervention in cancer pain management; however, its use must be tailored to the patient's condition, prognosis, and palliative care goals

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