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post-operative cognitive dysfunction

Troubles cognitifs post-opératoires

1. Systematic Reviews and Meta-Analysis

1.1. Generic Acupuncture

1.1.1. Zhang 2023

Zhang J, Cairen Z, Shi L, Zhang M, Yang M, Wang Y, Lu Z. Acupuncture-related techniques for postoperative cognitive complications: a systemic review and meta-analysis. Perioper Med (Lond). 2023 May 3;12(1):14. https://doi.org/10.1186/s13741-023-00303-5

Background	Postoperative cognitive complications are major challenges for postoperative recovery. Acupuncture-related techniques have been used for treating neurocognitive dysfunctions. However, whether they help to prevent postoperative cognitive complicationss remains unclear. We intend to evaluate the effect of acupuncture-related techniques on the incidence of postoperative cognitive complications (PCC) in patients undergoing surgery under general anesthesia.
Methods	Based on PRISMA guidelines, a search of PubMed, EMBASE, Web of Science, and the Cochrane Central Register of Controlled Trials and ClinicalTrials.gov was performed to identify eligible trials published from inception to June 6, 2021. The search was performed in June 2021. The inclusion criteria were prospective, randomized, controlled clinical trials that compared acupuncture-related techniques with other techniques or non-acupuncture treatment in patients undergoing surgery under general anesthesia. Pooled odds ratios (ORs), 95% CIs, and P values were estimated for end points using fixed and random effects statistical models.
Results	The analysis included **12 studies with 1058 patients**. Compared with patients not receiving acupuncture, patients treated with acupuncture-related techniques had a lower incidence of PCCs (OR, 0.44; 95% CI, 0.33 to 0.59; P < 0.001; n = 968) and lower levels of biomarkers, including IL-6, TNF-α, and S100β. Acupuncture with needles and without needles showed similar effects on the prevention of PCCs. The effects of acupuncture-related techniques on PCCs were observed in both English and non-English articles. Subgroup analyses showed that both agitation and/or delirium (OR, 0.51; 95% CI, 0.34 to 0.76; P < 0.001; n = 490) and delayed cognitive recovery (OR, 0.33; 95% CI, 0.21 to 0.51; P < 0.001; n = 478) were reduced after treatment with acupuncture-related techniques. In adult studies evaluating MMSE scores, the scores were not different between groups (SMD, - 0.71; 95% CI, - 1.72 to 0.3; P = 0.17; n = 441).
Conclusions	Acupuncture-related techniques, including needle techniques and electrical techniques, are associated with fewer postoperative cognitive complications, suggesting that acupuncture could be considered a potential option in the perioperative setting. Additional research is needed to develop higher-quality evidence and optimal regimens.

1.1.2. Tang 2021

Tang Y, Wang T, Yang L, Zou X, Zhou J, Wu J, Yang J. Acupuncture for post-operative cognitive dysfunction: a systematic review and meta-analysis of randomized controlled trials. Acupunct Med. 2021 Oct;39(5):423-431. https://doi.org/10.1177/0964528420961393

Objective	Post-operative cognitive dysfunction (POCD) is a common post-surgical complication, which is associated with increased costs and extended hospital stays. Recently, interest in acupuncture as a potential therapy for POCD has grown. The objective of this meta-analysis was to assess the effectiveness of acupuncture for POCD.
Methods	PubMed, Embase, CENTRAL, Medline, Web of Science, CNKI, Wanfang, and VIP databases were searched through March 2018. Randomized controlled trials (RCTs) in which patients with POCD treated with acupuncture (acupuncture group) were compared with those receiving a no treatment control were included. Meta-analyses were conducted using Review Manager 5.3.
Results	Sixteen studies containing 1241 participants were included. POCD incidence in the acupuncture group was significantly lower than that in the control groups on the first (odds ratio (OR) = 0.32, 95% confidence interval (CI) = 0.23–0.45) and third (OR = 0.41, 95% CI = 0.30–0.56) post-operative days, with no statistically significant difference on the seventh day (OR = 0.58, 95% CI = 0.32–1.04). Acupuncture therapy also improved mini–mental state examination (MMSE) scores on the first (mean difference (MD) = 3.28, 95% CI = 2.79–3.77) and third (MD = 2.52, 95% CI = 2.18–2.87) post-operative days, with no effect on the seventh (MD = 0.14, 95% CI = –0.24 to 0.51). Visual analogue scale (VAS) scores on the first post-operative day were not impacted by acupuncture but were likely associated with post-operative nausea and vomiting on the seventh post-operative day. With respect to methodological quality, most RCTs were found to have an unclear risk of bias.

1.2. Special Clinical Forms

1.2.1. Wu 2026 (elderly patients)

Wu C, Wei X, Luo F, Li J, Kwan YYJ, Wang K, Zhou J. Electroacupuncture for the prevention of perioperative neurocognitive disorder in elderly patients undergoing general anesthesia: a systematic review and meta-analysis. Front Med (Lausanne). 2026;13:1729153. https://doi.org/10.3389/fmed.2026.1729153

Background	Perioperative neurocognitive disorder is a common complication after major surgery under general anesthesia, particularly in elderly patients, with negative effects on postoperative recovery and quality of life. Electroacupuncture has been proposed as a preventive intervention, but evidence remains inconclusive. This systematic review and meta-analysis evaluated the effectiveness and safety of perioperative electroacupuncture for preventing perioperative neurocognitive disorder in elderly patients.

Methods	Eight electronic databases and three clinical trial registries were searched from inception to March 16, 2025. Eligible studies were randomized controlled trials including patients aged 60 years or older undergoing general anesthesia, comparing perioperative electroacupuncture with sham electroacupuncture, standard care, or no intervention. The primary outcome was perioperative neurocognitive disorder incidence. Secondary outcomes included MMSE and MoCA scores, inflammatory biomarkers (IL-1β, IL-6, TNF-α), neurological injury markers (NSE, S100β), and adverse events. Risk of bias was assessed using the Cochrane RoB 2 tool, and certainty of evidence was evaluated with GRADE.
Results	**Twenty-six randomized controlled trials involving 2,309 participants** were included. Compared with controls, perioperative electroacupuncture significantly reduced perioperative neurocognitive disorder incidence (RR = 0.47, 95% CI 0.42 to 0.54; I^2 = 0%; moderate to low certainty), improved MMSE scores (MD = 1.92, 95% CI 1.59 to 2.26; I^2 = 96%; low to very low certainty), and decreased inflammatory markers including IL-6, IL-1β, and TNF-α, as well as S100β levels. Adverse events were significantly reduced (RR = 0.52, 95% CI 0.37 to 0.72; I^2 = 0%; moderate certainty). MoCA scores and serum NSE could not be pooled due to insufficient data.
Conclusion	Perioperative electroacupuncture appears to reduce the incidence of perioperative neurocognitive disorder in elderly patients undergoing general anesthesia, with associated improvements in cognitive scores, attenuation of neuroinflammation, reduced neurological injury markers, and a favorable safety profile. Nevertheless, methodological limitations in the included studies warrant cautious interpretation, and further rigorously designed multicenter randomized controlled trials with standardized protocols and long-term follow-up are required.

1.2.2. Chen 2026 (cancer patients)

Chen Z, Ma R, Wan H, Zhang B, Wang H, Wang F, et al. Comparative efficacy and safety of multiple acupoint electrical stimulation therapies for postoperative cognitive dysfunction in cancer patients: a network meta-analysis. Syst Rev. 2026 Jun 4. https://doi.org/10.1186/s13643-026-03217-7

Background	Postoperative cognitive dysfunction (POCD) is a frequent complication after cancer surgery and may impair recovery and quality of life. Several non-pharmacological interventions based on **electrical stimulation of acupuncture points**, including electroacupuncture (EA), transcutaneous electrical acupoint stimulation (TEAS), and transcutaneous auricular vagus nerve stimulation (taVNS), are used to reduce POCD, but their relative efficacy remains unclear.
Objective	To compare the efficacy of EA, TEAS, and taVNS for the prevention and treatment of POCD in patients undergoing cancer surgery using a network meta-analysis.
Methods	A systematic review and network meta-analysis were conducted according to Cochrane guidelines. Randomized controlled trials evaluating acupoint electrical stimulation therapies for POCD in cancer patients were identified from CNKI, Wanfang, VIP, CBM, PubMed, Embase, Web of Science, and Cochrane Library from inception to November 1, 2024. Risk of bias was assessed using the Cochrane tool. Network meta-analysis was performed using the BUGSnet package in R 4.3.2. Outcomes included Mini-Mental State Examination (MMSE) scores and POCD incidence on postoperative days 1, 3, and 7. Twenty-three RCTs involving 2,055 patients and six interventions (EA, TEAS, taVNS, sham EA, sham TEAS, and blank control) were included.

Results	For MMSE scores on postoperative days 1 and 3, EA and TEAS were significantly superior to blank controls, whereas taVNS showed no significant benefit. At postoperative day 7, no significant differences in MMSE scores were observed among EA, TEAS, taVNS, and blank controls. For POCD incidence on postoperative days 1 and 3, EA and TEAS were significantly superior to sham EA, sham TEAS, and blank controls. At postoperative day 7, EA and TEAS remained significantly more effective than sham TEAS and blank controls in reducing POCD incidence. Probability ranking analyses indicated that TEAS had the highest likelihood of being the most effective intervention for improving MMSE scores on days 1 and 3, whereas EA ranked highest for MMSE at day 7 and for reducing POCD incidence at all evaluated time points.
Conclusion	TEAS appears to provide the greatest improvement in early postoperative cognitive performance as measured by MMSE, whereas EA appears most effective for reducing the incidence of POCD. However, the differences between interventions were modest and methodological limitations prevent definitive conclusions regarding superiority. The findings should therefore be interpreted as indicative of trends rather than conclusive evidence.

1.3. Special Acupuncture Techniques

1.3.1. Comparison of Acupuncture techniques

1.3.1.1. Chen 2026

Chen Z, Ma R, Wan H, Zhang B, Wang H, Wang F, Wang X, Zheng Y. Comparative efficacy and safety of multiple acupoint electrical stimulation therapies for postoperative cognitive dysfunction in cancer patients: a network meta-analysis. Syst Rev. 2026;15(1):213. https://doi.org/10.1186/s13643-026-03217-7

Background	Surgery is a primary treatment modality for cancer, yet it is associated with postoperative complications, including postoperative cognitive dysfunction (POCD), which can adversely affect recovery and quality of life. Multiple non-pharmacological approaches, including electroacupuncture (EA), transcutaneous electrical acupoint stimulation (TEAS), and transcutaneous auricular vagus nerve stimulation (taVNS), are employed to mitigate POCD. However, direct comparisons of their relative efficacy are lacking.
Objective	This network meta-analysis aimed to comparatively assess the efficacy of distinct acupoint electrical stimulation modalities-EA, TEAS, and taVNS-in alleviating POCD among surgical oncology patients.
Methods	In accordance with Cochrane guidelines, a systematic review coupled with network meta-analysis was undertaken. Randomized controlled trials (RCTs) investigating acupoint electrical stimulation therapies for POCD in cancer patients were searched in databases including CNKI, Wanfang, VIP, CBM, PubMed, Embase, Web of Science, and Cochrane Library from inception to November 1, 2024. Study quality was assessed using the Cochrane Risk of Bias tool. Network meta-analysis was performed using the BUGSnet package in R 4.3.2. Outcome measures included Mini-Mental State Examination (MMSE) scores and the incidence of POCD on postoperative 1-day, 3-day, and 7-day.

Results	**Twenty-three RCTs involving 2055 patients** and 6 interventions were included, namely EA, TEAS, taVNS, sham EA, sham TEAS, and blank control. Network meta-analysis revealed that for MMSE scores on postoperative 1-day and 3-day, EA and TEAS showed statistically significant differences compared to blank controls, whereas taVNS did not. By postoperative 7-day, no significant differences were observed among EA, TEAS, taVNS, and blank controls in MMSE scores. For POCD incidence on 1-day and 3-day, EA and TEAS demonstrated significant differences compared to sham EA, sham TEAS, and blank controls. By postoperative 7-day, EA and TEAS remained significantly superior to sham TEAS and blank controls in reducing POCD incidence. Cumulative probability ranking indicated that TEAS had the highest probability of being the best for MMSE scores on 1-day and 3-day, while EA ranked highest for MMSE at 7 days, and for reducing POCD incidence at all time points.
Conclusion	Based on probability rankings, TEAS may be more effective in improving postoperative MMSE scores, whereas EA appears superior in reducing POCD incidence. However, due to modest differences in ranking values and methodological limitations, these findings indicate trends rather than establishing definitive superiority.

1.3.1.2. Liang 2025

Liang W, Li M, Zhang J, Liang W. The effects of different acupuncture modalities on postoperative cognitive function in elderly Chinese patients undergoing general anesthesia: a network meta-analysis. Front Neurol. 2025 Sep 19;16:1637566. https://doi.org/10.3389/fneur.2025.1637566

Background	Postoperative cognitive dysfunction (POCD) is a syndrome characterized by long-term cognitive impairment following anesthesia and surgery. Acupuncture has demonstrated potential therapeutic benefits in managing POCD. However, comparative efficacy among different acupuncture modalities remains unexplored. This study aims to systematically compare the effects of various acupuncture interventions on postoperative cognitive function in elderly patients undergoing general anesthesia.
Methods	A comprehensive literature search was conducted across eight databases-CNKI, Wanfang, VIP, SinoMed, PubMed, Embase, Cochrane Library, and Web of Science-up to January 2025. Randomized controlled trials (RCTs) assessing acupuncture interventions for POCD in elderly patients receiving general anesthesia were included, provided cognitive outcomes were measured by the Mini-Mental State Examination (MMSE) or reported POCD incidence. Study quality was appraised using the Cochrane Risk of Bias Tool 2.0. A Bayesian network meta-analysis (NMA) was performed with the GEMTC package in R software, incorporating both direct and indirect comparisons. Intervention rankings were evaluated using the Surface Under the Cumulative Ranking Curve (SUCRA). Statistical significance was set at $p < 0.05$. Publication bias was assessed by funnel plots generated in Stata 18.0.
Results	**Thirty-two studies involving 2,644 patients** were included. The SUCRA rankings for efficacy in improving postoperative cognitive function were: Electroacupuncture (77.93%) > Thumbtack Needle (73.89%) > Scalp Acupuncture (68.58%). Subgroup analysis by intervention timing revealed: preoperative phase-electroacupuncture was significantly superior to conventional anesthesia and thumbtack needle; intraoperative phase-electroacupuncture outperformed scalp acupuncture and placebo; postoperative phase-electroacupuncture showed the best efficacy, surpassing conventional anesthesia and Xingnao Kaiqiao acupuncture; perioperative phase-auricular acupuncture exhibited notable advantages over electroacupuncture and standard of care. Regarding POCD incidence, 23 studies with 1,886 patients demonstrated SUCRA rankings as: Xingnao Kaiqiao acupuncture (86.56%) > Thumbtack Needle (80.16%) > Electroacupuncture (58.78%).

Conclusion	Electroacupuncture exerted the most substantial effect in mitigating postoperative declines in Mini-Mental State Examination (MMSE) scores among elderly Chinese patients receiving general anesthesia. Thumbtack needle acupuncture and scalp acupuncture also showed relatively favorable benefits. Electroacupuncture consistently achieved superior outcomes across preoperative, intraoperative, and postoperative interventions.

1.3.2. Electroacupuncture

1.3.2.1. Gan 2025

Gan L, Qian K, Yang J, Cai Q, Ye Q, Dai M, Jia Z, Jiang T, Ma C, Lin X. Intraoperative transcutaneous electrical acupoint stimulation combined with anesthesia to prevent postoperative cognitive dysfunction: A systematic review and meta-analysis. PLoS One. 2025 Jan 9;20(1):e0313622. https://doi.org/10.1371/journal.pone.0313622

Background	Postoperative cognitive dysfunction (POCD) is associated with an increased risk of dementia and may lead to chronic neurodegeneration. The utilization of intraoperative Transcutaneous Electrical Acupoint Stimulation (TEAS) in conjunction with anesthesia is expected to become an effective preventive measure for POCD in clinical practice.
Methods	We conducted a comprehensive literature review focusing on the use of TEAS in the prevention of POCD during surgical anesthesia. We searched various databases for relevant literature, including PubMed, Embase, Cochrane Library, Web of Science, China National Knowledge Infrastructure (CNKI), and Wanfang Data. The synthesis of data was performed using RevMan version 5.4.
Results	Our meta-analysis incorporated data from **20 Randomized Controlled Trials (RCTs) involving 1549 patients**. The findings revealed that intraoperative TEAS significantly reduced the incidence of POCD when compared to the control group [Odds Ratio (OR) 0.29, 95% Confidence Interval (CI) 0.22–0.39, $p < 0.00001$]. Moreover, patients receiving intraoperative TEAS exhibited a significant increase in MMSE scores (MD 1.21, 95% CI 0.53–1.89, $p = 0.0005$). Additionally, intraoperative TEAS demonstrated efficacy in reducing the contents of perioperative serum S100β protein (S100β), neuron-specific enolase (NSE), interleukin-6 (IL-6), and tumor necrosis factor-α (TNF-α) in patients, and the improvement of these indexes may be the potential mechanism of TEAS in preventing POCD.
Conclusion	Our results suggest that intraoperative TEAS combined with anesthesia prevents cognitive dysfunction in the immediate postoperative period, however we need additional evidence of its utility in preventing long-term cognitive dysfunction. We advocate for the broader promotion and application of this approach in clinical surgical settings.

1.3.2.2. Chen 2022

Chen X, Kong D, Du J, Ban Y, Xu H. Transcutaneous electrical acupoint stimulation affects older adults' cognition after general anesthesia: A meta-analysis. Geriatr Nurs. 2022 Jul-Aug;46:144-156. https://doi.org/10.1016/j.gerinurse.2022.05.010. Epub 2022 Jun 11.

Objective	Perioperative neurocognitive dysfunction comprises pre-existing neurocognitive dysfunction, postoperative delirium (POD), and postoperative cognitive dysfunction (POCD). This meta-analysis aims to study the effects of transcutaneous electrical acupoint stimulation (TEAS) on postoperative cognitive function after general anesthesia in older adults.
Methods	Eight databases were searched, from the establishment of the databases to January 2022.
Results	**Eighteen randomized controlled trials** were included. TEAS reduced POCD incidence on the 1st and 3rd but not on the 5th and 7th postoperative days ($p<0.00001$; $p<0.00001$; $p = 0.20$; $p = 0.30$). Owing to the limited number of original studies, POD incidence could not be analyzed. TEAS improved the MMSE scores on the 1st and 3rd but not on the 5th and 7th postoperative days. TEAS reduced the values of S100β at the end of the surgery and 1 day after surgery and IL-6 on the 1st postoperative day.
Conclusion	TEAS can prevent early postoperative cognitive decline after general anesthesia in older adults.

1.3.2.3. Li 2022

Li S, Jiang H, Liu W, Yin Y, Yin C, Chen H, Du Y, Zhao Q, Zhang Y, Li C. Transcutaneous electrical acupoint stimulation for the prevention of perioperative neurocognitive disorders in geriatric patients: A systematic review and meta-analysis of randomized controlled trials. Medicine (Baltimore). 2022 Dec 16;101(50):e32329. https://doi.org/10.1097/MD.0000000000032329.

Background	To evaluate whether transcutaneous electrical acupoint stimulation (TEAS) decreases rates of perioperative neurocognitive disorders (PND) when used as an adjuvant method during perioperative period in geriatric patients since the new definition was released in 2018.
Methods	Six databases [Chinese National Knowledge Infrastructure, VIP Database for Chinese Technical Periodicals, WanFang Database, PubMed, EMBASE, and Cochrane Library] were systematically searched. Data analysis was performed using RevMan 5.4.1 software (Copenhagen: The Nordic Cochrane Centre, the Cochrane Collaboration, 2020). Risk ratios (RR) with 95% confidence interval were calculated using a random effects model. Quality of evidence was assessed using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach.
Results	**13 randomized clinical trials (999 patients)** in total were included. TEAS had positive effects on preventing the incidence of PND (RR: 0.43; 0.31, 0.61; P < .001; low certainty) [postoperative delirium within 7 days (RR: 0.39; 0.26, 0.59; P < .001), delayed neurocognitive recovery within 3 months (RR: 0.51; 0.33, 0.78; P = .002)]. TEAS could also improve the scores of the confusion assessment method (CAM) (Mean difference: -1.30; -2.14, -0.46; P = .003; low certainty). Limited evidence suggested that TEAS could reduce the serum levels of biochemical indicator (S100β) (SMD = -1.08, -1.67, -0.49, P < .001; I2 = 83%; very low certainty) as well as anesthetic requirements (remifentanil) (SMD: -1.58; -2.54, -0.63; P = .001; I2 = 87%; very low certainty). Subgroup analysis indicated that different protocols of TEAS had significant pooled benefits (TEAS used only in surgery and in combination with postoperative intervention) (RR: 0.45; 0.31, 0.63; P < .001). Acupoint combination (LI4 and PC6) in the TEAS group had more significantly advantages (RR: 0.34; 0.17, 0.67; P = .002). TEAS group had a lower incidence of PND in different surgery type (orthopedic surgery and abdominal surgery) (RR: 0.43; 0.30, 0.60; P < .001), as well as with different anesthetic modality (intravenous anesthesia and intravenous and inhalational combined anesthesia) (RR: 0.38; 0.23, 0.61; P < .001).
Conclusion	In terms of clinical effectiveness, TEAS appeared to be beneficial for prophylaxis of PND during a relatively recent period, noting the limitations of the current evidence.

2. Overviews of systematic reviews

2.1. D'Amico 2026

D'Amico F, Turi S, Manazza M, Lo Bianco G, Monti G, Zangrillo A, Landoni G, Beretta L. Interventions to prevent postoperative neurocognitive complications: an umbrella review of meta-analyses of randomised controlled trials. Anaesthesia. 2026;81(4):532-540. https://doi.org/10.1111/anae.70061

Introduction	The certainty of the effectiveness of interventions to manage postoperative neurocognitive complications remains unclear. The objective of this umbrella review was to synthesise and evaluate the evidence for interventions aimed at reducing the incidence of peri-operative neurocognitive complications.
Methods	We searched relevant databases from inception to 23 August 2025. We included systematic reviews and meta-analyses of randomised trials evaluating pharmacological and non-pharmacological interventions for the prevention of postoperative neurocognitive complications in adult surgical populations. Certainty of evidence for each intervention was assessed using the GRADE framework. Methodological quality was appraised using AMSTAR and the Ioannidis classification.
Results	A total of 114 systematic reviews and meta-analyses, with data from 250,777 patients, were included. Dexmedetomidine, cerebral monitoring, **acupuncture**, sleep interventions, steroids, antipsychotics, peripheral nerve blocks, esketamine and remimazolam were associated with reductions in postoperative neurocognitive complications. Subgroup analyses indicated that these interventions also showed potential benefits across non-cardiac, orthopaedic and cardiac surgery. However, the overall certainty of evidence for all these interventions was predominantly very low.
Discussion	A number of peri-operative interventions are associated with a reduction in postoperative neurocognitive complications but the certainty of evidence supporting these interventions to prevent is very low. High-quality research is needed to advance the evidence base and inform future clinical practice.

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