

PRESENTATION: ORAL PRESENTATION (FAST PRESENTATION)

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886 – Sentinel and axillary lymph node marking with charcoal suspension in breast cancer after neoadjuvant chemotherapy: a systematic review with meta-analysis

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Introduction: Accurate axillary staging following neoadjuvant chemotherapy in breast cancer requires reliable techniques for identifying sentinel lymph nodes (SLNs). Activated charcoal tattooing has emerged as a viable marking agent, particularly in resource-constrained settings.

Methods: A PRISMA-compliant systematic review and single-arm meta-analysis was conducted. The databases PubMed, Embase, Cochrane CENTRAL, Scopus, and Web of Science were searched through January 2026 for observational studies evaluating breast cancer patients (cT1–T4, cN1–N2) who underwent carbon tattooing of suspicious or metastatic lymph nodes prior to neoadjuvant chemotherapy. Pooled proportions were estimated using random-effects meta-analysis. Proportions were logit-transformed to stabilize variances and pooled using the inverse variance method with restricted maximum likelihood estimation. Between-study heterogeneity was assessed using Cochran's Q and I^2 statistics. The primary endpoints were the intraoperative identification rate (IDR) of tattooed nodes and the false-negative rate (FNR). Secondary outcomes included local events. All analyses were performed using R (v.4.5.1).

Results: A total of 1,182 articles were retrieved, and 16 studies were included in the meta-analysis of primary outcomes. The combined IDR of carbon-labeled lymph nodes was 92% (n=1,221; 95% confidence interval [CI] 88–95%) with moderate heterogeneity ($I^2=65.5\%$), and the FNR was 12% (n=374; 95%CI 8–18%), with moderate heterogeneity ($I^2=41.3\%$). The concordance between SLN and carbon-marked nodes was 76% (n=1,035; 95%CI 63–86%) with high heterogeneity ($I^2=85.9\%$). Local events occurred at a combined rate of 7% (n=726; 95%CI 2–22%), with high heterogeneity ($I^2=91.9\%$); unintentional skin tattooing and diffuse carbon staining were the most common events.

Conclusion: Carbon tattooing has a high IDR for tattooed lymph nodes, suggesting that it is a viable strategy for intraoperative localization and a more cost-effective option in centers with limited resources. However, the moderate agreement with the SLN and the FNR >10% limit definitive conclusions, justifying the need for more high-quality studies to establish its clinical accuracy and the learning curve.

Ethics: Public data – Literature Review.

Registry: International Prospective Register of Systematic Reviews (PROSPERO) CRD42023464355.

Keywords: breast neoplasms; carbon; sentinel lymph node.