Single-shot sacral erector spinae block: a cadaveric study of dye spreading

Article *in* Minerva Anestesiologica · November 2024

DOI: 10.23736/S0375-9393.24.18383-6

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Minerva Anestesiologica 2024 December;90(4):1163-4
DOI: 10.23736/S0375-9393.24.18383-6

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An ultrasound-guided sacral erector spinae block (S-ESPB), also known as sacral multifidus block, provides analgesia for the posterior branches of the sacral nerves, effectively treating radicular pain at L5-SI. In recent literature, S-ESPB has been shown to be effective for treating posterior perianal pain and hip fracture surgery, however its mechanism is still unclear.[1-3] Through a cadaveric study, only one study has attempted to understand the mechanism of continuous sacral erector spinae block (S-ESPB).[4] It is the purpose of this cadaveric study to investigate how a single-shot local anesthetic spreads during S-ESPB. A high-frequency linear US probe (11-12 MHz; Vivid Q, Probo Medical, Tampa, FL, USA) and an 80 mm block needle (Braun 360°; Frankfurt am Main, Germany) were used to perform S-ESPB. Using the US probe, the cadaver was placed in the prone position in the sagittal plane to determine the beginning of the sacrum. The probe was then moved caudally to visualize the sacral medial crest. After moving the probe laterally and obtaining an optimal image with US at the S2 level, the block needle was moved in the cranio-caudal direction and 5 mL of saline were injected between the multifidus muscle and the medial sacral crest, followed by 20 mL of methylene blue dye (MBD) once the block site was confirmed. After advancing the probe further caudally, the needle was redirected, and 10 mL MBD was injected at the S4 level after confirming the area with 5 mL saline. A dissection was conducted 20 minutes after the injection to assess spread. Dissection of the sacrum revealed staining of the posterior sacral foramina from which the sacral plexus arises, especially between S2-S3 and S3-S4. At the lumbar level, the anterior and posterior surface of the erector spinae muscle as well as the multifudius muscle were stained with MBD. Additionally, the posterior roots of the spinal nerves at the last lumbar level were stained (Figure 1). Using cadaveric models, both our study and that by Diwan *et al*. provide valuable insights into local anesthetic distribution in the sacral region.[4] There are, however, some distinctions worth noting. Our study focused on a single-dose injection of MBD at specific levels, whereas Divan *et al*. used continuous infusion of saline and MBD. As reported by Diwan *et al*., MBD percolated through muscle and ligaments over the dorsal sacral foramina, possibly due to volume-related pressure.[4] However, our single-dose study revealed localized staining in the posterior sacral foramina. Divan *et al*. conducted their study on three cadavers, which introduces potential specimen variations.[4] Our study used a single cadaver, limiting generalizability. The previous study performed dissection one hour after injection, while our study assessed the spread 20 minutes later. The timing difference may affect dye diffusion. Both of these studies contribute insights into distinct aspects of sacral erector spinae block. Compared to Diwan *et al*.'s continuous study, our single-dose study explores localized distribution patterns. These contributions add to our understanding of S-ESPB's potential clinical applications.

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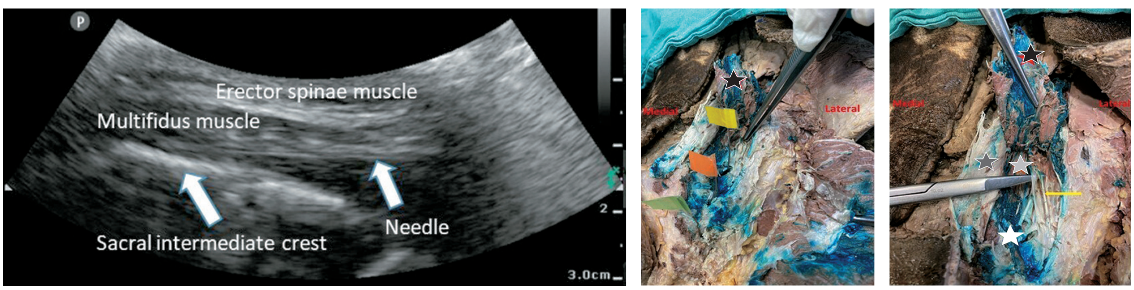

Figure 1.—The spread of dye after sacral erector spinae block.
Black star (red star in the online version): erector spinae muscle; light gray sticker (green sticker in the online version): second posterior sacral foramen; dark gray sticker (orange sticker in the online version): third posterior sacral foramen; white sticker (yellow sticker in the online version): fourth posterior sacral foramen; dark gray star (purple star in the online version): thoracolumbal fascia; light gray star (brown star in the online version): multifidus muscle; white star (green star in the online version): posterior sacro-iliac ligaments; light gray arrow (yellow arrow in the online version): spinal nerves.

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Conflicts of interest
The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

Authors' contributions
All authors read and approved the final version of the manuscript.

History
Article first published online: November 20, 2024. - Manuscript accepted: October 4, 2024. - Manuscript revised: September 12, 2024. - Manuscript received: June 25, 2024.

(*Cite this article as*: Atalay YO, Tekin B, Ansen G, Uzunoglu E, Koc EK, Sakul BU, *et al*. Single-shot sacral erector spinae block: a cadaveric study of dye spreading. Minerva Anestesiol 2024;90:1163-4. DOI: 10.23736/S0375-9393.24.18383-6)

Online version at https://www.minervamedica.it
Minerva Anestesiologica 2024 December;90(4):1164-5
DOI: 10.23736/S0375-9393.24.18384-8

Impact of stellate ganglion block on postoperative gastrointestinal function

Delayed recovery of gastrointestinal function is common after surgery under general anesthesia and can lead to prolonged hospital stay and increased costs. Stellate ganglion block (SGB) has been explored as a potential method to promote postoperative recovery of gastrointestinal function in a previous meta-analysis.[1] Owing to the limited number of studies included in the previous meta-analysis (five articles with data on 274 patients),[1] we conducted an updated meta-analysis to comprehensively summarize the effects of SGB on the recovery of gastrointestinal function following surgery.

We searched PubMed, Cochrane Library, Embase, and Google Scholar for randomized controlled trials comparing SGB to control (sham block or no treatment) in adult patients undergoing surgery with general anesthesia. The primary outcome was the time to first postoperative flatus. The Cochrane risk-of-bias tool was utilized to assess the potential for bias, and the I^2 statistic was employed to measure heterogeneity among the studies, with values exceeding 75% suggesting substantial heterogeneity. The meta-analysis was conducted using a random-effects model and performed with Review Manager 5.3 software. Nine studies involving 504 patients conducted between 2013 and 2024 were included. Four studies published after 2020 were identified from major databases,[2-5] and five studies[6-10] were sourced from a previous meta-analysis.[1] All studies were conducted in China. As shown in Figure 1A, SGB significantly reduced the time to first flatus compared to the control, with a mean difference of -11.85 hours (95% CI: -19.27 to -4.43, P=0.002, I^2=97%). Excluding one study at a time in the sensitivity analysis did not alter the results. Figure 1B illustrates that the majority of studies exhibited a low to unclear risk of bias. However, asymmetry in the funnel plot (Figure 1C) indicated a possible presence of publication bias. The certainty of evidence was rated as low due to potential publication bias and significant heterogeneity. Our meta-analysis suggested that SGB may promote postoperative recovery of gastrointestinal function in patients undergoing various surgeries. These findings suggest that SGB could be a valuable addition to Enhanced Recovery After Surgery (ERAS) protocols, which are designed to reduce postoperative complications and accelerate patient recovery. By facilitating earlier return of gastrointestinal function, SGB may contribute to shorter hospital stays, reduced healthcare costs, and decreased patient discomfort associated with postoperative ileus. This meta-analysis had several limitations. First, all studies were conducted in a single country, which reduces the generalizability of the finding to other countries. Second, there was considerable heterogeneity among the studies regarding the primary outcome, possibly due to variations in patient populations, surgical procedures, and SGB techniques. Third, the certainty of the evidence was rated low, which could have affected the reliability of the results. In conclusion, this meta-analysis provides evidence that SGB may promote postoperative recovery of gastrointestinal function in patients undergoing surgery. However, given the limitations of this meta-analysis, further high-quality, Large-scale randomized controlled trials are necessary to validate these findings and to establish the optimal timing, technique, and patient selection for perioperative setting.

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