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RESEARCH ARTICLE
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EFFICACY OF SACRAL ERECTOR SPINAE PLANE BLOCK FOR POSTOPERATIVE ANALGESIA IN LUMBAR SPINE SURGERY – AN OBSERVATIONAL STUDY

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Abstract

Background: Postoperative pain following lumbar spine surgery is often moderate to severe and can delay early mobilization, rehabilitation, and recovery. Although various interfascial plane blocks have been investigated, evidence regarding the use of sacral erector spinae plane block (SESPB) in lumbar spine surgery remains limited.

Objective: To evaluate the efficacy of ultrasound-guided sacral erector spinae plane block in providing postoperative analgesia following lumbar spine surgery.

Key Words: Sacral erector spinae plane block, Lumbar spine surgery, Postoperative analgesia, Regional anesthesia, Ultrasound-guided block, Multimodal analgesia, Opioid-sparing analgesia, Numerical rating scale, Enhanced recovery after surgery

Introduction

Pain after lumbar spine surgery is a significant problem leading to delay in early mobilization , rehabilitation and chronic pain. The intensity of postoperative pain which can be moderate to severe depends on the preoperative pathology inflammation of surrounding structures after the surgery. (1) If acute postoperative pain is not effectively treated it may to lead to delay in discharge, prolonged morbidity and financial burden on patients. Adequate Pain management after spine surgery is a rewarding but challenging task.2

Prospect guidelines have been published in 2021 for lumbar spine surgery and they recommended only intravenous analgesics and ketamine infusion in the intraoperative period3and no regional blocks were suggested. But over the years many authors have studied the effects of wound infiltration4, lumbar erector spinae block(ESP) 5,6 and thoracolumbar interfacial plane block(TLIP)7 for lumbar spine surgeries has been widely described in literature as part of multimodal analgesia for spine surgeries. Interfascial plane blocks offer intraoperative hemodynamic stability, decreases opioid requirements in the perioperative period facilitating early recovery. Out of these ESP has gained wide popularity as it can be performed at various vertebral levels like cervical, thoracic and lumbar regions depending on the surgical procedure and provides analgesia by blocking the dorsal and ventral rami of the spinal nerves.8

Tulgar et al 9 documented a new variant of ESP block in the Sacral region which involves injecting the drug between intermediate crest of sacrum and Multifidus muscle.
Sacral ESPB was used for haemorrhoids,(10) gender reassignment surgeries (11) and pilonidus surgeries (9)effectively and proved to be effective analgesic option for postoperative analgesia. There are no studies demonstrating the efficacy of Sacral ESPB for lumbar spine surgeries till date. So We hypothesized that Sacral ESPB would alleviate postoperative pain after lumbar spine surgery effectively improving the functional outcomes for patients and conducted this observational trial to evaluate the analgesic effects of sacral ESPB after lumbar spine surgeries.

Materials And Methods

This observational study was conducted at Narayana medical college, Nellore between April 2024 to October 2024 after IEC approval.
100patients were enrolled for the study after obtaining written informed consent. Patients of both sex aged 25-60 yrs. American Society of Anesthesiologists (ASA) physical state classes I–II, scheduled for lumbar spine surgery fixation under GA, were included in the study. The exclusion criteria were patients' refusal, pre-existing neurological or psychiatric illnesses, mental retardation, body mass index (BMI)>35 kg/m2, allergy to LA, and infection at the injection site, contraindication to regional block.
Sample size was calculated from the pilot study we conducted on 10 patients.5 patients received GA with sacral ESPB and 5 received GA alone. The use of ESPB combined with GA significantly decreased the visual analogue scale (VAS) score from 3.8 ± 1.09 to 3 ± 0.71 at 12 hours post-operative, so at least 29 patients were needed to find a difference in each group in the mean of VAS 0.8 at an alpha value of 0.05 and 80% power of the study. 50 patients were included in each group for the assumption of dropout.
Using a computer-number generator technique and opaque sealed envelopes, patients were randomly assigned to two groups (50 patients in each group at 1:1 allocation ratio), Group C (control group) received GA only, and in group S (SESPB group), sacral ESPB was performed after induction of GA.
After thorough preoperative assessment, on the day of surgery all the patients were administered GA with Inj.Midazolam 0.05mg/kg,Inj.fentanyl 2mics/kg,Inj.propofol 2mg/kg,Inj.cisatracurium 0.2mg/kg. After intubation in prone position under aseptic precautions patients in group S received Sacral ESPB under ultrsound guidance.
Technique : Ultrasound guided Sacral ESPB was given with linear ultrasound probe (6-13HZ,Sonosite). Scanning started over L5 spinous process in the midline and the probe moved caudally in the midline. Once S1 median crest was identified the probe was moved laterally to identify intermediate crest with Multifidus and erector spinae muscles over it.Needle was introduced in in-plane caudo-cranial direction and 20ml of 0.375% ropivacaine 4mg dexamethasone+20mics Dexmedetomidine was injected. Spread of the drug in the plane was observed. Same procedure was followed on the opposite side.At the end of the surgery muscle relaxation was reversed using Inj,glycopyrrolate and neostigmine was given and patients were extubated. All patients were shifted to PACU and monitored as per institutional guidelines. Inj.Paracetmol 1g was given 8th hourly as part of multimodal analgesia. When VAS >3 Inj.ketorolac 0.5mg/kg was given as rescue analgesia.
Outcomes : Intraoperative fentanyl consumption based on heart rate>20% of baseline or MAP >20% above baseline , NRS at 0,4,8,12,24hrs after surgery, time for 1st rescue analgesic and patient satisfaction scores were recorded.

Statistical analysis

Statistical analyses were performed using the SPSS 21.0 pro- gram (IBM Inc., Chicago, IL). Descriptive statistics of the numerical and categorical data obtained in the study were analyzed. Numerical parameters were expressed as mean ± SD or median (min–max) (interquartile range [IQR]), whereas categorical variables were expressed as frequency and percentage. The conformance of numerical variables to the normal distribution was assessed using the Kolmogorov–Smirnov test, histogram graphs, and Q–Q plot graphs. Levene's test was performed to analyze the homogeneity properties of numerical parameters. Correlation relationships between numerical data were exam- ined using 2-way Pearson's or Spearman's correlation analyses. The Wilcoxon test was employed to compare the values of the 2 dependent groups. An independent t test or Mann–Whitney U test was used for pairwise comparisons of independent groups.

Relationships between categorical variables were examined using Pearson's chi-square analysis. The relationships between categorical groups and numerical parameters were summarized using boxplot graphics. In this study, the type-I error rate was set at 5%, and a P value of <.05 was considered significant.

Results

A total of 100 patients were enrolled into study initially.6 patients were excluded from the study due to change of surgical procedures and difficulty in procedure.

Demographic profile like age,gender,BMI,ASA physical status were comparable in both the groups.

Results

Baseline Characterstics

Table.1 Comparison of baseline characteristics among two groups

Variable	ESP group	Control group	p-value
Age (Years)	41.80 ± 14.04	45.68 ± 15.30	0.190
Males (%)	29 (58%)	22 (44%)	0.161
BMI	25.06 ± 2.87	24.78 ± 2.85	0.628
ASA grade II (%)	27 (54%)	25 (50%)	0.689
Duration of surgery (min)	164.62 ± 46.45	175.72 ± 39.66	0.202

The baseline demographic and clinical characteristics were comparable between the ESP group and the control group. The mean age of patients in the ESP group was 41.80 ± 14.04 years, while in the control group it was 45.68 ± 15.30 years, with no statistically significant difference between the groups (p = 0.190).

Male participants constituted 58% of the ESP group and 44% of the control group; however, this difference was not statistically significant (p = 0.161). The mean BMI was also comparable between the groups (25.06 ± 2.87 kg/m² in the ESP group vs. 24.78 ± 2.85 kg/m² in the control group; p = 0.628).

With regard to ASA physical status, 54% of patients in the ESP group and 50% in the control group belonged to ASA grade II, showing no significant difference (p = 0.689). Similarly, the duration of surgery was comparable between the two groups, with a mean duration of 164.62 ± 46.45 minutes in the ESP group and 175.72 ± 39.66 minutes in the control group (p = 0.202).

Intraoperative Parameters

Table.2 Comparison of Intraoperative Parameters among two groups

Variable	ESP group	Control group	p-value

Hypotension (%)	8 (16%)	19 (38%)	0.013*
Bradycardia (%)	7 (14%)	18 (36%)	0.011*
Intra OP opioid (mg)	74.33 ± 20.89	108.93 ± 23.39	0.0001*

The incidence of intraoperative hypotension was significantly lower in the ESP group compared to the control group, occurring in 8 patients (16%) in the ESP group and 19 patients (38%) in the control group ($p = 0.013$). Similarly, intraoperative bradycardia was observed less frequently in the ESP group, with 7 patients (14%) affected compared to 18 patients (36%) in the control group, and this difference was statistically significant ($p = 0.011$). The mean intraoperative opioid requirement was also significantly lower in the ESP group (74.33 ± 20.89 mg) compared to the control group (108.93 ± 23.39 mg), with a highly statistically significant difference ($p = 0.0001$).

Post-Operative Pain Scores (Nrs)

Table.3 Comparison of post-operative pain scores (NRS) at rest and movement among two group.

Time point	NRS at rest (ESP)	NRS at rest (Control)	p value	NRS on movement (ESP)	NRS on movement (Control)	p value
1 hour	2.798 ± 0.887	4.440 ± 1.402	0.000*	3.116 ± 1.254	6.034 ± 1.685	0.000*
4 hours	2.982 ± 0.934	4.894 ± 1.446	0.000*	3.588 ± 0.993	5.938 ± 1.515	0.000*
8 hours	3.328 ± 1.324	4.972 ± 1.535	0.000*	3.988 ± 1.277	5.940 ± 1.448	0.000*
12 hours	3.296 ± 1.189	5.042 ± 1.581	0.000*	3.992 ± 1.301	6.114 ± 1.492	0.000*
24 hours	2.404 ± 0.899	3.944 ± 0.995	0.000*	3.044 ± 1.073	5.442 ± 1.413	0.000*

Postoperative pain scores at both rest and movement were significantly lower in the ESP group compared to the control group at all measured time intervals.

At 1 hour postoperatively, the mean NRS score at rest was 2.798 ± 0.887 in the ESP group compared to 4.440 ± 1.402 in the control group ($p < 0.001$). Similarly, the mean NRS score on movement was significantly lower in the ESP group (3.116 ± 1.254) than in the control group (6.034 ± 1.685) ($p < 0.001$).

At 4 hours, pain scores at rest and movement remained significantly lower in the ESP group (2.982 ± 0.934 and 3.588 ± 0.993, respectively) compared to the control group (4.894 ± 1.446 and 5.938 ± 1.515, respectively), with p-values <0.001.

A similar trend was observed at 8 hours and 12 hours postoperatively, where both resting and movement-related pain scores were consistently lower in the ESP group, demonstrating superior analgesic efficacy of the sacral ESP block.

At 24 hours, the ESP group continued to show significantly reduced pain scores at rest (2.404 ± 0.899 vs. 3.944 ± 0.995) and during movement (3.044 ± 1.073 vs. 5.442 ± 1.413) compared to the control group, with all differences remaining highly statistically significant ($p < 0.001$).

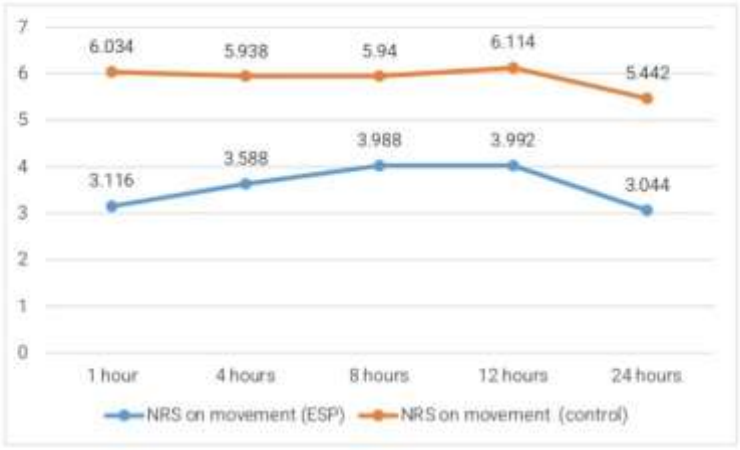

Figure.2 Comparison of post-operative pain scores (NRS) at movement among two groups

Analgesic Outcomes

Table.4 Comparison of analgesic outcomes among two groups

Variable	ESP group	Control group	p-value
Time to first rescue	8.232 ± 1.903	3.144 ± 1.384	0.000*
Opioids consumption (0–24 hrs.)	56.766 ± 19.15	107.77 ± 24.17	0.000*
Opioids consumption (24–48 hrs.)	33.34 ± 10.69	72.52 ± 23.07	0.000*
Severe pain (%)	9 (18%)	20 (40%)	0.015*

The mean time to first rescue analgesia was significantly prolonged in the ESP group (8.232 ± 1.903 hours) compared to the control group (3.144 ± 1.384 hours), indicating longer duration of effective postoperative analgesia in patients receiving the sacral ESP block ($p < 0.001$).

Postoperative opioid consumption during the first 24 hours was significantly lower in the ESP group (56.766 ± 19.15 mg) compared to the control group (107.77 ± 24.17 mg) ($p < 0.001$). Similarly, opioid consumption during the 24–48 hour period was also markedly reduced in the ESP group (33.34 ± 10.69 mg) when compared to the control group (72.52 ± 23.07 mg), with a highly statistically significant difference ($p < 0.001$).
The incidence of severe postoperative pain was significantly lower in the ESP group, observed in 9 patients (18%) compared to 20 patients (40%) in the control group ($p = 0.015$).

Adverse Effects

Table.5 Comparison of adverse effects among two groups

Variable	ESP group	Control group	p-value
Nausea/vomiting	9 (18%)	23 (46%)	0.003*
Sedation	4 (8%)	16 (32%)	0.003*
Pruritus	1 (2%)	2 (4%)	0.558
Respiratory depression	1 (2%)	3 (6%)	0.307

Postoperative nausea and vomiting were observed in 9 patients (18%) in the ESP group and 23 patients (46%) in the control group, with the difference being statistically significant ($p = 0.003$). Similarly, sedation was significantly less common in the ESP group, occurring in 4 patients (8%) compared to 16 patients (32%) in the control group ($p = 0.003$).
Pruritus was noted in 1 patient (2%) in the ESP group and 2 patients (4%) in the control group; however, this difference was not statistically significant ($p = 0.558$). Respiratory depression occurred in 1 patient (2%) in the ESP group and 3 patients (6%) in the control group, with no statistically significant difference between the groups ($p = 0.307$).

Recovery & Satisfaction

Table.6 Comparison of recovery & satisfaction among two groups

Variable	ESP group	Control group	P-Value
PACU stay (hours)	3.696 ± 0.803	5.498±1.84	0.000*
Patient satisfaction	4.482 ±0.502	3.410±0.830	0.000*

The mean duration of stay in the post-anesthesia care unit (PACU) was significantly shorter in the ESP group (3.696 ± 0.803 hours) compared to the control group (5.498 ± 1.84 hours), with a highly statistically significant difference ($p < 0.001$). This indicates faster postoperative recovery among patients who received the sacral erector spinae plane block.
Patient satisfaction scores were also significantly higher in the ESP group (4.482 ± 0.502) compared to the control group (3.410 ± 0.830) ($p < 0.001$), reflecting improved overall comfort and analgesic effectiveness in the ESP group.

Discussion

Pain after lumbar spine surgery in the early postoperative period is often very distressing for the patients limiting their mobility and delaying the recovery. Opioids and NSAIDS are frequently used despite their side effect.With the incorporation of interfascial plane blocks in the multimodal analgesia postoperative pain management has witnessed a significant improvement in functional outcomes of patients after surgery.Lumbar ESPB and TLIP blocks were used for analgesia after lumbar spine surgeries with success. In our study we evaluated the efficacy of a new variant of ESPB called as Sacral ESPB which involves depositing the drug in the interfascial plane between intermediate sacral crest and erector spinae muscles.Till date this approach has been used for haemorrhoids,pilonidal sinus surgeries ,gender reassignment surgeries and in paediatrics for hypospadias surgeries. There are no studies on sacral ESPB for lumbar spine surgeries .

Keles BO et al has conducted a cadaveric and radiologic study comparing median and intermediate approaches to ultrasound guided SESPB and revealed the presence of dye in superficial and erector spinae compartments in both the approaches.Anterior spread to epidural space was seen with median approach but intermediate approach demonstrated cranio caudal muscular spread.

Based on this observation we have used intermediate approach in our study.

Tulgar et al (9) was the first to describe a case report on SESPB for post-operative pain management in pilonidal sinus surgery. The block was done post-operatively after surgery. Though there was delayed onset of analgesia (40 minutes), there was no additional analgesic requirement within 13 hours after the block. In a case report by Kukreja et al (11) who performed the sacral ESPB for a case of 39 years old trans-woman undergoing gender reassignment operation, they observed that patient had moderate pain ratings and got limited intra-operative and early post-operative opioids. Authors concluded that sacral ESPB is a superficial block which provides haemodynamic stability without significant motor weakness compared with neuraxial blocks, so it can be used safely in patients who cannot tolerate changes in haemodynamics.

Öksüz et al (12) performed sacral ESPB after induction of GA in a 7-month-old boy presented for anoplasty. In the first 30 minutes in the PACU, the patient had a FLACC score of 1, and in the subsequent 24 hours on the ward, despite not receiving any analgesics, the score dropped to 0. There was no evidence of lower limb muscular weakness and no urine retention, and no other complications were recorded.

Kilicaslan A et al (13)

When sacral ESPB was applied after induction of GA, the finding of Aksu C and Gürkan[5] supported that sacral ESPB provided intra- and post-operative pain control for paediatric hypospadias repair.

Moreover, Piraccini E et al.[15] suggested that sacral ESPB could be useful for lower extremity radicular pain treatment.

F Marrone et al in their case report has used SESPB in a frail woman for intramedullary nailing of femur successfully. The author observed that an unilateral injection at intermediate s2 sacral crest resulted in sensory block from T12 to S2 dermatomes which was in line with our study where analgesia was observed for incisions over the lumbar region.

Conclusion

Ultrasound-guided sacral erector spinae plane block (ESPB) proved to be an effective adjunct for perioperative analgesia in patients undergoing lumbar spine surgery. Patients receiving sacral ESPB demonstrated significantly lower intraoperative opioid requirements, prolonged duration of postoperative analgesia, and reduced opioid consumption during the first 48 hours after surgery compared with the control group. In addition, the incidence of opioid-related adverse effects and intraoperative hemodynamic disturbances was lower in the ESPB group. These findings suggest that sacral ESPB is a safe, feasible, and valuable component of multimodal analgesia, providing enhanced postoperative pain control and improved recovery following lumbar spine surgery. Further randomized controlled trials with larger sample sizes are warranted to validate these findings and establish standardized protocols for its clinical use.

Reference

1. Kang S, Brennan TJ. Mechanisms of postoperative pain. Anesth Pain Med 2016;11:236–248.
2. Kurd MF, Kreitz T, Schroeder G, Vaccaro AR. The role of multimodal analgesia in spine surgery. J Am Acad Orthop Surg. 2017;25:260–8. doi: 10.5435/JAAOS-D-16-00049.
3. Waelkens P, Alsabbagh E, Sauter A, et al211 Pain management after complex spine surgery: a systematic review and procedure-specific postoperative pain management (PROSPECT) recommendationsRegional Anesthesia & Pain Medicine 2021;70:A110.
4. Kjaergaard M, Moiniche S, Olsen KS. Wound infiltration with local anesthetics for post-operative pain relief in lumbar spine surgery: a systematic review. Acta Anaesthesiol Scand 2012;56:282–290. [PubMed] [Google Scholar]
5. Brandao J, Graca R, Sa M, et al.. Lumbar erector spinae plane block: successful control of acute pain after lumbar spine surgery – a clinical report. Rev Esp Anestesiol Reanim 2019;66:167–171. [PubMed] [Google Scholar]
6. Melvin JP, Schrot RJ, Chu GM, et al.. Low thoracic erector spinae plane block for perioperative analgesia in lumbosacral spine surgery: a case series. Can J Anaesth 2018;65:1057–1065.
7. Farag E, Seif J. Thoracolumbar interfascial block (TLIP): a new technique of interfascial plane blocks. J Clin Anesth 2020;61:109640.
8. Tulgar S, Ahiskalioglu A, De Cassai A, Gurkan Y. Efficacy of bilateral erector spinae plane block in the management of pain: current insights. J Pain Res. 2019;12:2597–613. doi: 10.2147/JPR.S182128.
9. Tulgar S, Senturk O, Thomas DT, et al. A new technique for sensory blockage of posterior branches of sacral nerves: ultrasound guided sacral erector spinae plane block. J Clin Anesth. 2019;57:129–30.
10. Mermer A, Simsek G, Mermer HA, Tire Y, Kozanhan B. Effect of sacral erector spinae plane block on post-hemorrhoidectomy pain: A randomized controlled trial. Medicine 2023;102:37(e35168).
11. Kukreja P, Deichmann P, Selph JP, et al. Sacral erector spinae plane block for gender reassignment surgery.Cureus. 2020;12:7665.
12. Oksuz G, Arslan M, Bilal B, Gişi G, Yavuz C. Ultrasound guided sacral erector spinae block for postoperative analgesia in pediatric anoplasty surgeries. J Clin Anesth 2020;60:88.
13. Kilicaslan A, Aydin A, Kekec AF, Ahiskalioglu A. Sacral erector spinae plane block provides effective postoperative analgesia for pelvic and sacral fracture surgery. J Clin Anesth. 2020 May;61:109674. doi: 10.1016/j.jclinane.2019.109674. Epub 2019 Dec 4. PMID: 31812367.1.Kang S, Brennan TJ. Mechanisms of postoperative pain. Anesth Pain Med 2016;11:236–248.
14. Kurd MF, Kreitz T, Schroeder G, Vaccaro AR. The role of multimodal analgesia in spine surgery. J Am Acad Orthop Surg. 2017;25:260–8. doi: 10.5435/JAAOS-D-16-00049.
15. Waelkens P, Alsabbagh E, Sauter A, et al211 Pain management after complex spine surgery: a systematic review and procedure-specific postoperative pain management (PROSPECT) recommendationsRegional Anesthesia & Pain Medicine 2021;70:A110.
16. Kjaergaard M, Moiniche S, Olsen KS. Wound infiltration with local anesthetics for post-operative pain relief in lumbar spine surgery: a systematic review. Acta Anaesthesiol Scand 2012;56:282–290. [PubMed] [Google Scholar]
17. Brandao J, Graca R, Sa M, et al.. Lumbar erector spinae plane block: successful control of acute pain after lumbar spine surgery – a clinical report. Rev Esp Anestesiol Reanim 2019;66:167–171. [PubMed] [Google Scholar]
18. Melvin JP, Schrot RJ, Chu GM, et al.. Low thoracic erector spinae plane block for perioperative analgesia in lumbosacral spine surgery: a case series. Can J Anaesth 2018;65:1057–1065.
19. Farag E, Seif J. Thoracolumbar interfascial block (TLIP): a new technique of interfascial plane blocks. J Clin Anesth 2020;61:109640.

20. Tulgar S, Ahiskalioglu A, De Cassai A, Gurkan Y. Efficacy of bilateral erector spinae plane block in the management of pain: current insights. J Pain Res. 2019;12:2597–613. doi: 10.2147/JPR.S182128.
21. Tulgar S, Senturk O, Thomas DT, et al. A new technique for sensory blockage of posterior branches of sacral nerves: ultrasound guided sacral erector spinae plane block. J Clin Anesth. 2019;57:129–30.
22. Mermer A, Simsek G, Mermer HA, Tire Y, Kozanhan B. Effect of sacral erector spinae plane block on post-hemorrhoidectomy pain: A randomized controlled trial. Medicine 2023;102:37(e35168).
23. Kukreja P, Deichmann P, Selph JP, et al. Sacral erector spinae plane block for gender reassignment surgery.Cureus. 2020;12:7665.
24. Oksuz G, Arslan M, Bilal B, Gişi G, Yavuz C. Ultrasound guided sacral erector spinae block for postoperative analgesia in pediatric anoplasty surgeries. J Clin Anesth 2020;60:88.
25. Kilicaslan A, Aydin A, Kekec AF, Ahiskalioglu A. Sacral erector spinae plane block provides effective postoperative analgesia for pelvic and sacral fracture surgery. J Clin Anesth. 2020 May;61:109674. doi: 10.1016/j.jclinane.2019.109674. Epub 2019 Dec 4. PMID: 31812367.