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Comparison of Ultrasound Guided Erector Spinae Plane Block Versus Quadratus lumborum Block in hip and Proximal Femur Surgery

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ORIGINAL ARTICLE

Comparison of Ultrasound Guided Erector Spinae Plane Block Versus Quadratus lumborum Block in hip and Proximal Femur Surgery

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Abstract

Background: ***The global hip surgery patient group exhibits significant diversity, ranging from physically active young adults who undergo hip arthroscopy to elderly individuals had frailty and various comorbidities.***

Aim and objectives: ***To compare between Erector Spinae Plane Block (ESPB) quadratus lumborum block following hip proximal femur surgery under spinal anaesthesia regarding the relief of after-surgery pain.***

Patients and methods: ***prospective, randomized double-blinded clinical research performed on sixty individuals in Al-Azhar University Hospitals, in Cairo, after approval by the departmental ethical Committee. patients divided into two groups.***

Results: ***There was no statistically significant variance among both groups regarding postoperative VAS following surgery at rest through movement p above 0.05. no statistically significant variance among the two groups regarding pain assessment in terms of morphine consumption, time of analgesia, and patient satisfaction p>0.05.***

Conclusion: ***Ultrasound erector spinae block is superior to Ultrasound-guided quadratus lumborum in pain scores, length of analgesia, and total analgesic consumption, but without a statistically significant difference.***

Keywords: Ultrasound Guided Erector Spinae Plane Block; Quadratus lumborum Block; proximal femur surgery

1. Introduction

The global hip surgery patient group exhibits significant diversity, ranging from physically active young adults who undergo hip arthroscopy to elderly individuals had frailty and various comorbidities. This procedure is a significant surgical intervention that leads to intense discomfort after surgery. While pain is often significantly decreased during rest, it is crucial to engage in movement to prevent thromboembolic consequences.[1]

Pain following surgery significantly hinders early postoperative postoperative ambulation. It elevates the likelihood of venous thromboembolism and pulmonary problems and extends the duration of hospitalization. Insufficiently managed pain following surgery can result in the development of chronic pain. Opioids are often employed as analgesics during the postoperative phase, offering pain relief but also carrying inherent adverse effects.

Hence, the implementation of a multimodal analgesic approach is highly crucial. Regional anesthesia analgesia has demonstrated exceptional pain relief and offers advantages.[2,3]

ESPB is a type of interfacial plane block that was initially identified as a highly successful method of treatment for thoracic neuropathic pain.[4,5]

This research aimed to estimate the Efficiency of ESPB and QLP in relieving pain after hip and proximal femur surgery under spinal anesthesia.

2. Patients and methods

This was prospective, randomized double, blinded clinical research performed on sixty cases in Al-Azhar University Hospitals in Cairo after approval from the departmental ethical Committee. Cases were separated into two groups: Group A:(Erector spinae plane block group (ESPB): (30) cases underwent ESPB after completing the surgery and Group B: (Quadratus lamborum block group (QLP)): (30) cases underwent quadratus lamborum block after completing of surgery.

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Inclusion criteria: Age: 21-60 years, BMI < 30 kg/m2, ASA physical status, I, II, Patients underwent hip and proximal femur surgery and maximum operation time 120 minutes.

Exclusion criteria: case refusal, Patient with coagulation disorders, Infection at the injection site, Patients sensitivity to used drugs and Patients with a history of analgesic dependence.

Methods

Anesthetic techniques

All the study participants received intrathecal anaesthesia 17.5 mg of 0.5 per cent hyperbaric bupivacaine in L3, 4 in a sitting position. The case was positioned in a supine position with a 15° head elevation, and after 10 minutes, the patient was repositioned to the best optimal surgical position. Once the anaesthetic level was confirmed to be adequate, surgeries were conducted on the hip and proximal femur. Continuous blood pressure and heart rate monitoring were carried out throughout the procedures to track the patient's hemodynamic status. When the systolic blood pressure dropped by twenty per cent from the initial level or fell below 90 mmHg, a 6 mg dose of ephedrine was administered I/V. In addition, when the heart rate decreased to 60 beats per minute or below, a dose of 0.6 mg of atropine was administered intravenously.

Analgesic Techniques of ESP block

Patients in the ESP group underwent a unilateral ESP block after surgery. A linear US probe was placed to visualize the lumbar erector spinal muscle. A 22-G needle was inserted into the cranial-caudal direction, confirmed with saline injection and linear fluid visualization. Twenty mL of 0.25 per cent bupivacaine was injected.

Analgesic Techniques of QL Block:

Transmuscular quadratus lumborum (TQL) was performed after surgery using ultrasonographic guidance. The probe was moved to the lateral side until transverse processes vanished while the individual was in the lateral decubitus posture. The anterior layer of the thoracolumbar fascia (ATLF) was observed, dividing the QL and PM muscles, and the QL muscle was discovered. In addition to injecting 20 ml of 0.25% bupivacaine, LA was injected in front of the QL muscle. Patients were advised to notify any indications of local anaesthetic systemic toxicity.

Assessment of Pain

The assessment of pain following surgery was conducted by visual analogue scale (VAS) pain score (range, 0–10; 0, no pain; 10, worst pain) at rest and after movement at 0,30,60,90, min, 2,4,8, 12,16,24 hours. Rescue analgesia: Patients with VAS of more than 3 received ketorolac 30 mg intravenous and reassessed after 30 min; patients with VAS of more than four received morphine 0.1 mg/kg intravenous and reassessed after 30 min. Several patients who received morphine and ketorolac and total consumption of morphine and ketorolac were recorded. Opioids may cause addiction, but they can also cause physiological effects like sleep issues, exhaustion, anxiety, tachycardia, raised oxygen demand, immunosuppression, and catabolism.[6] Pain scales are utilized to assess the intensity of pain that a patient is currently undergoing. The numeric rating scale (NRS), VAS, and the FACES scale are three commonly utilized scales. NRS is a commonly utilized method for quantifying pain intensity in clinical settings. It ranges from 0 to 10, with 0 representing no pain and 10 representing the worst pain. NRS can be used by clinicians or patients as part of a pain diary, providing detailed information about persistent pain experiences. 7 The VAS is a validated method for measuring pain intensity, consisting of a 10-cm line labelled "no pain" or "worst pain imaginable." It allows for a more detailed rating of pain than the NRS, allowing for more accurate pain assessment.[7]

Patient Satisfaction

The satisfaction of cases was assessed using a four-point scale, with ratings ranging from 1 (excellent) to 4 (poor). All negative impacts or problems were documented.

Sample size

The necessary sample size was determined utilizing G power software 3.1.9.4. Previous research comparing the effects of ESP block and QLP block has determined that a minimum sample size of twenty-seven individuals in every group is required to achieve a power level of 0.80, an alpha level of 0.05 (two-tailed), and an effect size of 0.78 for the length. The mean ± SD duration in the QL block group is 8 ± 4, while in the ESP group, it is 12 ± 6. The determined sample size was augmented by ten per cent to achieve thirty individuals in every group, accounting for any dropouts.[8]

Statistical analysis

The recorded data was analyzed utilizing the statistical software package for social sciences, version 22.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data is the mean value plus or minus the standard deviation (SD). Qualitative data is typically represented using median, frequency, and percentage measures. The independent-sample t-test was employed to compare the significance between the two means. The Mann-Whitney U test compares two groups when the data is non-parametric. The chi-square (x2) test of significance was employed to compare proportions among two qualitative parameters. The confidence interval is 95%, with a tolerated margin of error of 5%. P values below 0.05 are deemed significant, and P values below 0.001 are regarded as extremely significant.

Outcomes

The current research was done on sixty individuals scheduled to undergo hip and proximal femur surgery regarding postoperative analgesia as the primary outcome by evaluating analgesic consumption over twenty-four hours and the secondary outcome by evaluating VAS and time of the first analgesic request

3. Results

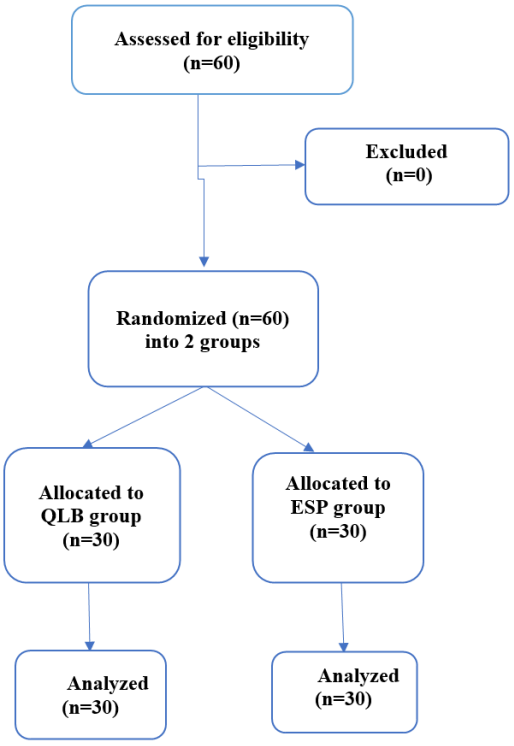

Figure 1. Consort flow chart

No statistically significant variance (P-value above 0.05) amongst 2 groups concerning demographic data. (Table 1)

Table 1. Comparison among groups concerning patient data & Surgical duration.

		QLB group	ESB group	Test value	P-value
		No. = 30	No. = 30		
Age (years)	Mean ± SD	28.72 ± 3.84	28.48 ± 3.99	-0.217•	0.829
	Range	22 – 35	24 – 35		
Weight (kg)	Mean ± SD	72.20 ± 4.29	75.84 ± 9.16	1.799•	0.078
	Range	65 – 80	60 – 90		
Height (cm)	Mean ± SD	169.84 ± 4.83	169.80 ± 10.51	-0.017•	0.986
	Range	160 – 178	150 – 180		
Body Mass Index (BMI) (kg/m^2)	Mean ± SD	25.06 ± 1.59	24.87 ± 2.03	-0.380•	0.706
	Range	22.9 – 28.3	22 – 28.7		
ASA	I	19 (64.0%)	16 (52.0%)	0.739*	0.390
	II	11 (36.0%)	14 (48.0%)		
Duration of surgery (min.)	Mean ± SD	53.20 ± 13.90	51.20 ± 13.97	-0.507•	0.614
	Range	32 – 77	30 – 74		

P-value > 0.05: Non-significant; P-value < 0.05: Significant; P-value < 0.01: Highly significant

*: Chi-square test; •: Independent t-test, SD: standard deviation, ASA: American Society of Anesthesiologists

No statistically significant variance among two groups Concerning Postoperative MABP at one hour, two hour, four hour, eight hour, twelve hour and twenty four hour p above 0.05 was determined. (Table 2)

Table 2. Comparison between groups concerning post-operative MABP (mmHg)

Postoperative MABP		QLB group	ESB group	Test value	P-value
		No. = 30	No. = 30		
PACU	Mean ± SD	80.52 ± 9.50	76.24 ± 8.97	1.638•	0.108
	Range	65 – 95	60 – 90		
1 hr	Mean ± SD	81.80 ± 4.05	80.40 ± 5.39	-1.039	0.304
	Range	70 – 85	70 – 85		
2 hrs	Mean ± SD	84.60 ± 5.39	83.20 ± 7.62	-0.750	0.457
	Range	70 – 90	70 – 90		
4 hrs	Mean ± SD	85.00 ± 5.77	83.40 ± 7.18	-0.869	0.389
	Range	70 – 90	70 – 90		
8 hrs	Mean ± SD	82.80 ± 6.78	81.20 ± 6.00	-0.883	0.381
	Range	70 – 90	70 – 90		
12 hrs	Mean ± SD	81.96 ± 5.98	80.40 ± 7.21	-0.810	0.422
	Range	70 – 90	70 – 90		
24 hrs	Mean ± SD	79.40 ± 4.86	78.80 ± 5.26	-0.419	0.677
	Range	70 – 85	70 – 85		

PACU: POST-ANESTHESIA CARE UNIT

No statistically significant variance amongst both groups concerning post-operative heart rate at one hour, two hour, four hour, eight hour, twelve hour & twenty four hour was noted. (Table 3)

Table 3. Comparison among groups concerning post-operative heart rate (beat/ min.)

Postoperative pulse		QLB group	ESB group	Test value	P-value
		No. = 30	No. = 30		
PACU	Mean ± SD	85.64 ± 6.10	84.68 ± 5.92	-0.565•	0.575
	Range	70 – 98	70 – 98		
1 hr	Mean ± SD	84.12 ± 5.26	83.00 ± 5.95	-0.705•	0.484
	Range	70 – 90	70 – 90		
2 hrs	Mean ± SD	86.00 ± 4.33	84.20 ± 4.72	-1.406•	0.166
	Range	80 – 90	75 – 90		
4 hrs	Mean ± SD	82.60 ± 3.77	81.08 ± 4.28	-1.332•	0.189
	Range	75 – 88	75 – 88		
8 hrs	Mean ± SD	82.60 ± 3.77	81.08 ± 4.28	-1.332•	0.189
	Range	75 – 88	75 – 88		
12 hrs	Mean ± SD	79.76 ± 4.57	78.28 ± 4.50	-1.154•	0.254
	Range	70 – 88	70 – 85		
24 hrs	Mean ± SD	78.28 ± 5.92	76.52 ± 4.68	-1.166•	0.249
	Range	70 – 90	70 – 85		

No statistically significant variance among both groups concerning post-operative SpO2 % at 1 hour, 2 hours, 4 hours, 8 hours, 12 hours & 24 hours p above 0.05. (Table 4)

Table 4. Comparison among groups concerning post-operative SpO2 %

Postoperative Spo2		QLB group	ESB group	Test value	P-value
		No. = 30	No. = 30		
1 hr	Mean ± SD	97.76 ± 0.88	97.68 ± 0.95	-0.310•	0.758
	Range	96 – 99	96 – 99		
2 hrs	Mean ± SD	97.76 ± 0.88	97.68 ± 0.95	-0.310•	0.758
	Range	96 – 99	96 – 99		
4 hrs	Mean ± SD	97.76 ± 0.88	97.52 ± 1.19	0.869•	0.389
	Range	96 – 99	95 – 99		
8 hrs	Mean ± SD	97.76 ± 0.88	97.68 ± 0.95	-0.310•	0.758
	Range	96 – 99	96 – 99		
12 hrs	Mean ± SD	97.44 ± 1.08	97.52 ± 1.19	0.810•	0.422
	Range	95 – 99	95 – 99		
24 hrs	Mean ± SD	97.52 ± 1.29	97.68 ± 0.95	0.419•	0.677
	Range	95 – 99	96 – 99		

There wasn't any statistically significant variance among both groups concerning postoperative VAS after surgery at rest & through movement p above 0.05. (Table 5)

Table 5. Comparison among groups concerning

post-operative VAS (from 0 to 10)

VAS SCORE		QLB GROUP No. = 30	ESB GROUP No. = 30	TEST VALUE	P-VALUE
PACU	Median (IQR)	1 (1 – 1)	1 (1 – 1)	0.000≠	1.000
	Mean ± SD	1.00 ± 0.00	1.00 ± 0.00		
	Range	1 – 1	1 – 1		
1 HR	Median (IQR)	1 (1 – 1)	1 (1 – 1)	0.000≠	1.000
	Mean ± SD	1.00 ± 0.00	1.00 ± 0.00		
	Range	1 – 1	1 – 1		
2 HRS	Median (IQR)	1 (1 – 1)	1 (1 – 1)	0.000≠	1.000
	Mean ± SD	1.00 ± 0.00	1.00 ± 0.00		
	Range	1 – 1	1 – 1		
4 HRS	Median (IQR)	1 (1 – 2)	1 (1 – 1)	-0.319≠	0.750
	Mean ± SD	1.28 ± 0.46	1.24 ± 0.44		
	Range	1 – 2	1 – 2		
8 HRS	Median (IQR)	1 (1 – 3)	1 (1 – 3)	-0.181≠	0.856
	Mean ± SD	1.92 ± 1.22	1.96 ± 1.17		
	Range	1 – 4	1 – 4		
12 HRS	Median (IQR)	4 (1 – 4)	2 (1 – 4)	-1.064≠	0.287
	Mean ± SD	3.24 ± 1.74	2.68 ± 1.68		
	Range	1 – 6	1 – 6		
24 HRS	Median (IQR)	4 (4 – 5)	4 (2 – 4)	-1.416≠	0.157
	Mean ± SD	3.84 ± 1.46	3.24 ± 1.56		
	Range	1 – 6	1 – 6		

PACU	Median (IQR)	1(1-1)	1(1-1)	0.000≠	1.000
	Mean ± SD	1.00 ± 0.00	1.00 ± 0.00		
	Range	1 – 1	1 – 1		
1 hr	Median (IQR)	1(1-1)	1(1-1)	0.000≠	1.000
	Mean ± SD	1.00 ± 0.00	1.00 ± 0.00		
	Range	1 – 1	1 – 1		
2 hrs	Median (IQR)	1(1-1)	1(1-1)	0.000≠	1.000
	Mean ± SD	1.00 ± 0.00	1.00 ± 0.00		
	Range	1 – 1	1 – 1		
4 hrs	Median (IQR)	2(2-3)	1(1-2)	-0.425≠	0.760
	Mean ± SD	1.30 ± 0.48	1.26±.47		
	Range	1 - 3	1 - 3		
8 hrs	Median (IQR)	3(3- 4)	2 (2- 2)	-0.185≠	0.860
	Mean ± SD	1.38 ± 1.96	1.20 ± 1.98		
	Range	2- 4	3 - 4		
12 hrs	Median (IQR)	5(2-4)	3(3–4)	-1.066≠	0.290
	Mean ± SD	1.87 ± 3.28	1.70 ± 2.69		
	Range	6 3 -	6 – 2		
24 hrs	Median (IQR)	6(6 – 5)	5 (3- 4)	-1.420≠	0.160
	Mean ± SD	1.58 ± 3.86	1.68 ± 3.25		
	Range	6 – 3	6 – 1		

No statistically significant variance seen among 2 groups concerning pain evaluation, morphine intake, period of analgesia, & case satisfaction (p above 0.05) WAS observed (Table 6)

Table 6. Comparison among groups concerning pain assessment.

		QLB group No. = 30	ESB group No. = 30	Test value	P-value
Morphine consumption	No	11 (24.0%)	14 (40.0%)	1.471*	0.225
	Yes	19 (76.0%)	16 (60.0%)		
Morphine consumption	Median (IQR)	6 (3 – 7)	3 (3 – 7)	-1.343≠	0.179
	Range	3 – 9	3 – 7		
Time of analgesia	Median (IQR)	12 (12-12)	12 (12-24)	-1.414≠	0.158
	Range	8 – 24	8 – 24		
	2	0 (0%)	7 (23.3%)	2.547*	0.280
	4	1 (3.3 %)	14 (46.6%)		
	8	4 (21%)	2 (13.3%)		
	12	12(63.3%)	7 (46.7%)		
	16	8(32.7%)	5(17%)		
	24	3 (15.8%)	6 (40.0%)		
Patient satisfaction	Poor	0 (0.0%)	0 (0.0%)	3.359*	0.186
	Fair	6 (24.0%)	2 (8.0%)		
	Good	12 (48.0%)	11 (44.0%)		
	Excellent	7 (28.0%)	12 (48.0%)		

None of patients developed any complication as local anesthesia toxicity, hematoma, nausea & vomiting p above 0.05. (Table 7)

Table 7. Postoperative complications % among examined groups.

Complications	QLB	ESP	Test value	P-value
Local anesthesia	0 (0.0%)	0 (0.0%)	–	–
Hematoma	0 (0.0%)	0 (0.0%)	–	–
Postoperative Nausea + vomiting	0 (0.0%)	0 (0.0%)	–	–

4. Discussion

No significant variance among the two groups was noted in demographic data, which included age, weight, height, BMI, and length of surgery. Similarly, no significant variance was noted among the intraoperative vital signs, which include heart rate, MABP, and spo2.

After-surgery vital signs (heart rate and MABP), the measurements were less in the ESB group than in the QLP group, but without significant variance with a p-value above 0.05; also, the research indicated no significant variance among both groups in postoperative spo2.

The present research also evaluated and compared VAS between two groups, and the outcomes indicated that there was no statistically significant variance among both groups with a p-value above 0.05. Also, the research stated that the duration required to provide the initial dosage of systemic analgesia following the surgery was more significant in the ESB group than in the QLP group. However, no statistically significant variance among both groups was observed, as shown by a p-value higher than 0.05.

The current research also measured and compared the total amount of morphine consumed on the first day after surgery. The results showed that the amounts of morphine in the ESB group were lower than those in the QLP group but without any statistically significant disparity amongst both groups, with a p-value above 0.05. Also, Patient satisfaction scores showed no significant variance among both groups, with a p-value higher than 0.05.

The current research showed no complications such as local anaesthesia toxicity, hematoma, nausea and vomiting.

In their study to assess the effectiveness of ESB & QLB as pain relief after surgery in female patients scheduled for abdominal hysterectomy, Hamed et al. reported a significant decrease in morphine requirement in the first postoperative 24 hours with >12 hours of analgesia duration in the ESB group with higher VAS in QLB group in the same duration, while VAS score showed insignificant measurements between the two groups at 24 hour.[9]

By the results of this investigation, Raman & Prabha undertook hospital-based, randomized, double-blind, controlled, prospective research to evaluate the effectiveness of posterior QLB for pain relief following surgery in forty cases following percutaneous nephrolithotomy. The researchers discovered that QLB offers high-quality, long-lasting pain relief after surgery, resulting in increased satisfaction and reduced need for pain medication compared to a placebo.[10]

Alshaimaa et al. found that patients who got bilateral ESP blocks after completing abdominal hysterectomy had significantly less pain than those who received Transverse abdominis plane blocks after 30 min, 2,4,8,12, 16, and 24 hours postoperatively.[11]

Dam et al. conducted research at a single medical facility to examine the pain-relieving effectiveness of TQL block in cases after PCNL surgery. The study randomly assigned sixty individuals to get a QL block with either bupivacaine 0.75 percent, 30 ml (intervention group) or saline. Researchers discovered that administering QLB to patients following the PCNL operation resulted in decreased postoperative morphine usage and pain levels, shorter postoperative mobilization time and hospital stay duration.[12]

The outcomes of this investigation were aligned with the investigation performed by Aksu, which examined the comparative analgesic efficacy of ESPB versus QLB for pediatric lower abdominal surgery. Fifty-seven individuals were categorized into two distinct groups, namely the ESP and the QLP groups. Pain assessments using the Face, Legs, Activity, Cry & Consolability (FLACC) scoring system were conducted 0, 1, 3, and 6 hours after the operation. Additionally, the amount of pain relief medication needed and the duration till the first administration of pain relief medication were also documented. The results indicated no statistically significant variance in FLACC ratings among groups at 0, 1, 3, or 6 hours after the surgery (p greater than 0.05). The groups showed no significant variance in the time it took to get the initial analgesic effect (p greater than 0.05).[13]

The outcomes of the present investigation were Aligned with the research performed by Aygun, who investigated the comparison between US-guided ESPB and QLP for pain relief after surgery in cases undergoing laparoscopic cholecystectomy. Eighty individuals were allocated into two distinct groups, namely the ESP group and the QLP group. Opioid use and numeric Rating Scores were assessed within the initial 24 hours following the surgery. The outcomes indicated that no statistically significant disparity was noted in NRS ratings and opioid use at any given hour across the groups.[14]

The findings of our investigation are inconsistent with the research conducted by Khanna et al., which examined the analgesic efficacy of QLP compared to transversus abdominis plane block for post-Caesarean analgesia.[15]

The findings revealed that the QL group required eighteen hours to obtain rescue analgesia, while the TAP group required 12 hours (P below 0.001). The mean rescue analgesia (paracetamol) needed in the QL group was 153.84 mg, whereas in the TAP group, it was 756.09 mg. However, in our research, the QL group only required 12 hours to receive rescue analgesia, which could be attributed to adding 4 mg dexamethasone to the local anaesthetic medications.

Our research findings contradicted those of Malawat et al., who investigated the analgesic properties of the transversus abdominis plane ESPB after cesarean section.[16]

4. Conclusion

The Ultrasound erector spinae block is more effective than the ultrasound-guided quadratus lumborum in terms of pain ratings, length of pain relief, and total analgesic usage, but the difference is not statistically significant. The level of pleasure was high in both groups, but the erector spine plane block group reported even more satisfaction.

Disclosure

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Authorship

All authors have a substantial contribution to the article

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Conflicts of interest

There are no conflicts of interest.

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