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Research Article

COMPARISON OF BILATERAL USG-GUIDED ERECTOR SPINAE BLOCK VERSUS CONTROL GROUP FOR INTRAOPERATIVE HEMODYNAMIC STABILITY AND POST-OPERATIVE ANALGESIA IN SPINE SURGERIES UNDER GENERAL ANESTHESIA

MANISH KUMAR SAINI[1], RAVINDRA SISODIA[2], GUPTA RC[1], DURGA JETHAVA[1]*

[1]Department of Anaesthesiology, Critical Care and Pain Management, Jaipur, Rajasthan, India. [2]Department of Neuro Anaesthesia and Critical Care, Mahatma Gandhi Medical College and Hospital, Jaipur, Rajasthan, India.
*Corresponding author: Dr. Durga Jethava; Email: djethava@gmail.com

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ABSTRACT

Objectives: The aim of the study was to compare the intraoperative hemodynamics and post-operative analgesia after using bilateral erector spinae block (ESB) and conventional techniques during spinal surgeries. The study also aims at comparison of analgesics consumption in patients during post-operative period.

Methods: One hundred adults aged 18–80 years with American Society of Anaesthesiology physical status I/II scheduled for elective lumbar spine surgeries (two levels) under general anesthesia (GA) were divided into two groups. Group A received erector spinae plane block (ESPB) along with GA and Group B received GA only. Injection Paracetamol 1 g intravenously was given as rescue analgesia. Intraoperative hemodynamics, visual analog score at rest and at movement in 24 h postoperatively, first rescue analgesia, total dose of analgesics in first 24 h postoperatively, and intraoperative opioid dose requirement were compared in both the groups for 7 days.

Results: Intraoperative hemodynamics in ESPB group were found to be more stable than the control group. There was a significant low VAS score in Group A compare to Group B at rest and on movement ($p<0.001$). The time for first rescue analgesia was prolonged in group ESPB as compared to control group ($p<0.05$). The total dose of analgesia required in first 24 h was significantly lower in patients of ESP group 25±41.96 mg 82.5 than patients in control group ±22.73 mg.

Conclusion: Ultrasound-guided bilateral ESB provides profound intraoperative hemodynamic stability with perioperative analgesia in comparison to conventional GA technique. The present study concluded that ESP block decreased the opioid requirement in both intraoperative and post-operative period.

Keywords: Erector spinae, Rescue analgesia, Regional anesthesia, Hemodynamics, Post-operative analgesia.

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INTRODUCTION

Laminectomies, discectomies, spine fusions, instrumentations, scoliosis corrections, and the removal of spinal tumors are among the frequently carried out spinal procedures [1]. Regularly performed conventional spinal procedures (non-minimally invasive) frequently entail substantial dissection of subcutaneous tissues, bones, and ligaments, and as a result cause agonizing agony during the healing process [2]. Opioids are frequently employed as painkillers. Anesthetists are trying to find a technique to utilize less opioids due to the ongoing opioid crisis and its side effects, which include drowsiness, nausea, vomiting, headaches, delirium, cloudy vision, postural hypotension, dry mouth, and delayed patient mobilization [3].

A multimodal approach should be used to deliver painkillers from all three tiers of the analgesic ladder simultaneously (including non-steroidal anti-inflammatory drugs, typically COX-2 inhibitors, narcotics, and opioids), in conjunction with specialized peripheral nerve block techniques and either continuous epidural analgesia [4]. The overuse of opioids and their negative side effects, which have contributed to the present opioid pandemic issue, has sped up the development of non-opioid analgesic approaches to treat post-operative pain [5]. Regional anesthesia has been a widely utilized and successful non-opioid analgesic method. Due to the recent emphasis on lowering the necessity for inpatient surgery, inpatient length of stay, and the frequency of persistent post-surgical pain, RA methods have become more popular for spine procedures in this dynamically developing and quick-paced environment [6].

Analgesia is administered using the erector spinae plane (ESP) block, a more recent approach [7]. After lumbar spine surgeries, a unique para-spinal RA approach of ESP block (ESPB) promises to deliver efficient somatic analgesia. This recently disclosed ultrasound-guided (USG) block is straightforward technically [8]. According to studies, the ESP block dramatically reduces VAS scores at 1, 3, and 6 h after surgery, which results in pain relief [9]. It results in less opioid and other analgesic drug intake during and after surgery. There was a decrease in opioid-related side effects and patient satisfaction with pain management was also noted [10].

The purpose of this study is to compare the intraoperative hemodynamics and post-operative analgesia after using bilateral erector spinae block (ESB) and conventional techniques during spinal surgeries. The study also aims at comparison of analgesics consumption in patients during post-operative period.

METHODS

After approval from the institutional research and ethical committee, this prospective, single-blinded, randomized, and controlled trial was conducted from February 2021 to June 2022 at a tertiary care hospital. After taking written informed consent, 100 patients aged between 18 and 80 years belonging to American Society of Anaesthesiologists (ASA) physical status I and II undergoing lumbar spine surgery under general anesthesia (GA) were enrolled in the study and randomized into two groups of 50 in each group with the help of chit in the box.

Patients in group ESPB, after induction were put in prone position and a guided ESP block was performed where 20 mL of 0.25% of bupivacaine was injected on each side at desired surgical level. In control group, patients were induced with conventional GA method and surgeries performed in prone position similar to ESP group.

The parameters studied were intraoperative hemodynamics, visual analog score at rest and at movement in 24 h postoperatively, first rescue analgesia, total dose of analgesics in first 24 h postoperatively, and intraoperative opioid dose requirement. Both the study groups were comparable with respect to distribution of age, sex, body mass index, and ASA grade. There were no significant differences between these 2 groups according to these parameters.

The patients were pre-oxygenated and pre-medicated with intravenous fentanyl 2 μg/kg and, induced by administering injection propofol 2–3 mg/kg (till loss of verbal command) and injection vecuronium 0.1 mg/kg. The patient was intubated and maintenance of anesthesia was done with isoflurane and nitrous oxide in both groups.

After induction of anesthesia, patients were turned to prone and ESP block as applied for applying block, the transducer probe was shifted from the midline, 3 cm laterally to visualize the lumbar transverse process, and erector spinae muscle. A 21gauge needle was inserted in the plane cranial to caudal till the tip of the needle reached into the fascial plane between erector spinae muscle and lumber transverse process. The position of the needle tip was checked by hydrodissection with 2 mL normal saline; thereafter, a total of 0.25% bupivacaine 20 mL each side was injected. The spread of injectate was observed ultrasonographically. Likewise, the same block procedure was performed on the other side.

The patient was extubated once appropriate extubation criteria were met.

Patients were observed for 24 h after surgery in the post-anesthesia care unit by an anesthesiologist who will not be aware of the patient's group assignment. The pain score was evaluated using an 11-point Numerical Rating Scale (0=pain and 10=worst pain imaginable) on arrival in the post-anesthesia care unit and then at 1, 3, 6, 12, 18, and 24 h postoperatively. Rescue analgesia is provided with intravenous paracetamol 15 mg per kg and if pain is not relieved with this then intravenous tramadol 2 mg per kg on demand or whenever the visual analog score (VAS) is ≥3. The number of patients requiring rescue analgesia and total paracetamol/tramadol consumption during the first 24 h after surgery was recorded. Any adverse events including hypotension, bradycardia, dry mouth, dizziness, diplopia, and nausea and vomiting were noted.

A proper approach to acute post-operative pain management must include an appropriate assessment tool. A 10-point pain assessment scale-visual analogue scale (VAS), where 1 is no pain and 10 is the worst possible pain imaginable, has been nationally accepted. The goal of pain management must be determined with each patient. The goal may not be a score of 1; the patient may be satisfied and functional with a score of 3, preferring to manage some pain and thereby avoid unpleasant side effects of therapy, such as sedation, nausea, or pruritus. The key is to reassess the patient and determine if he or she is satisfied with the outcome. A satisfaction score should be obtained together with a pain score. This combination will help ensure that unrelieved, unwanted pain does not go unnoticed. Responsive analgesia management with good patient communication is the key to a successful program.

Data were entered in Microsoft excel 2019 and statistical analysis was performed using Statistical Package for the Social Science Chicago, IL, USA version 21 for windows. The categorical data were presented as numbers and percentage and were compared using Chi-square test. The quantitative data were presented as mean and standard deviation or median and interquartile range and were compared using t-test or Mann–Whitney U-test. Probability was considered significant if $p<0.05$.

RESULTS

Both groups had comparable demographic and baseline clinical profiles (Table 1 and Fig. 1).

Difference in mean pulse rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure (MAP) between cases of both study groups was statistically insignificant ($p>0.05$) and mean respiratory rate was significantly higher in Group B cases than Group A cases ($p<0.05$).

Mean pulse rate in Group A was lower than cases of Group B and this difference is found to be statistically significant at 10 min, 30 min, 60 min, and 90 min after induction ($p<0.05$) (Table 2 and Fig. 2).

Mean MAP in Group A was lower than cases of Group B and this difference is found to be statistically significant at 10 min, 30 min, 60 min, and 90 min after induction ($p<0.05$) (Table 3 and Fig. 3).

Median VAS score at rest in Group B cases was significantly higher than Group A cases at post-extubation, 1st h, 3rd h, 6th h, 12th h, 18th h, and 24th h ($p<0.05$) (Table 4 and Fig. 4).

VAS score on movement in Group B cases was significantly higher than Group A cases at post-extubation, 1st h, 3rd h, 6th h, 12th h, 18th h, and 24th h ($p<0.05$ (Table 5 and Figs. 5 and 6).

Table 1: Mean baseline variables in cases of both study groups

Baseline parameters	ESB	MMA	Test of significance
Pulse	85.70±10.57	84.14±10.72	t=0.733, Df=98, *P*=0.465
Systolic blood pressure	136.96±14.61	133.9±11.95	t=1.146, Df=98, *P*=0.254
Diastolic blood pressure	84.98±10.31	85.74±7.23	t=0.427, Df=98, *P*=0.671
Mean arterial pressure	102.54±10.4	102.06±7.79	t=0.261, Df=98, *P*=0.794
Respiratory rate	16.52±1.13	17.14±1.26	t=2.589, Df=98, *P*=0.011
SpO_2	99.42±0.76	99.36±0.78	t=0.391, Df=98, *P*=0.697

ESB: Erector spinae block, MMA: Multimodal analgesia

Table 2: Mean intraoperative pulse rate in cases of both study groups

Intraoperative pulse rate	Group A	Group B	Test of significance
Just after induction	82±8.96	82.06±10.84	t=0.030, Df=98, *P*=0.976
10 min after induction	80.54±8.73	85.86±11.75	t=2.570, Df=98, *P*=0.012
30 min after induction	78.32±6.5	83.36±11.48	t=2.702, Df=98, *P*=0.008
60 min after induction	77.88±6.35	82.48±11.37	t=2.498, Df=98, *P*=0.014
90 min after induction	76.98±5.85	80.76±10.99	t=2.146, Df=98, *P*=0.034
120 min after induction	79.4±8.17	82.94±11.47	t=1.778, Df=98, *P*=0.079
150 min after induction	79.7±7.8	83.44±13.2	t=1.725, Df=98, *P*=0.088
180 min after induction	79.14±6.76	81.94±11.17	t=1.516, Df=98, *P*=0.133

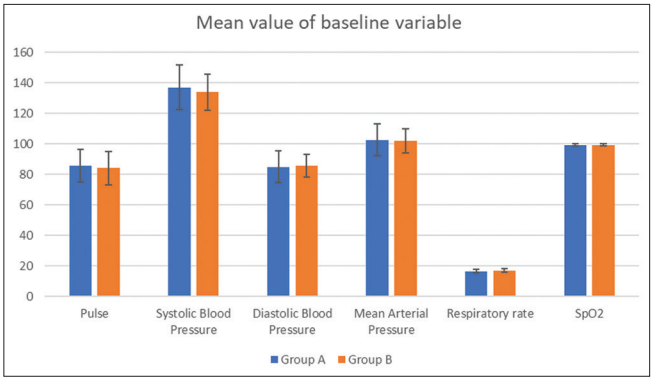

Fig. 1: Bar diagram showing mean baseline variables in cases of both study groups

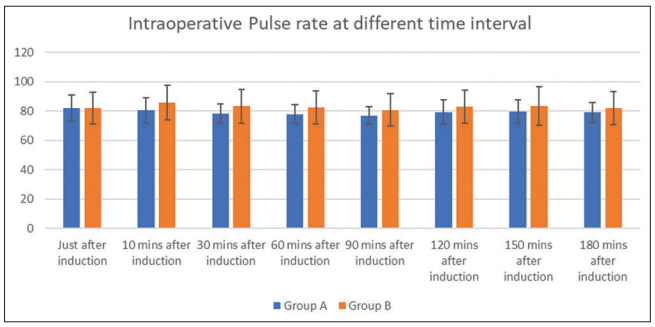

Fig. 2: Bar diagram showing mean intraoperative pulse rate in cases of both study groups

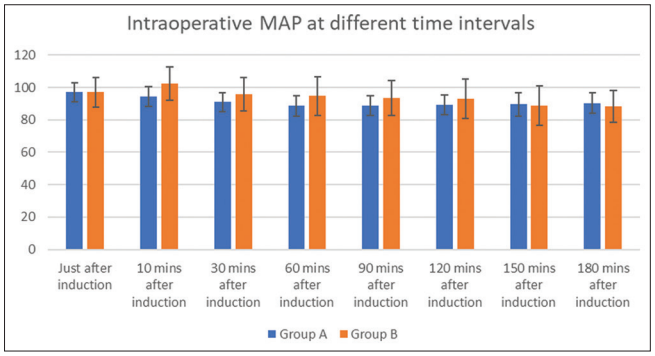

Fig. 3: Bar diagram showing mean intraoperative mean arterial pressure in cases of both study groups

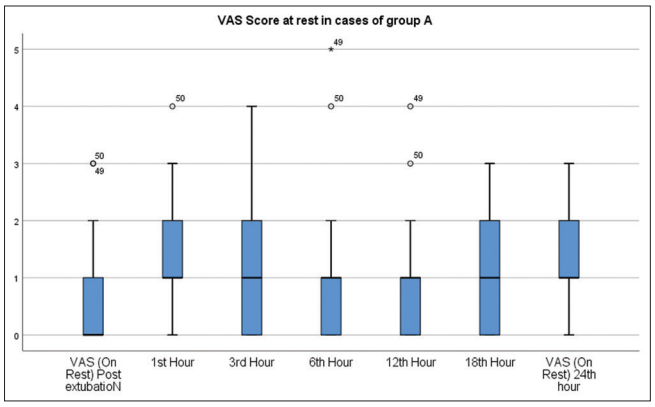

Fig. 4: Diagram showing comparison of median VAS score at rest using Mann–Whitney test

Table 3: Mean intraoperative MAP in cases of both study groups

Intraoperative MAP	Group A	Group B	Test of significance
Just after induction	96.98±5.73	97.04±9.09	t=0.039, Df=98, *P*=0.969
10 min after induction	94.5±6.12	102.42±10.29	t=4.680, Df=98, *P*<0.001
30 min after induction	90.96±5.97	95.78±10.08	t=2.909, Df=98, *P*=0.004
60 min after induction	88.7±6.3	94.64±11.88	t=3.123, Df=98, *P*=0.002
90 min after induction	88.86±5.97	93.42±10.96	t=2.584, Df=98, *P*=0.011
120 min after induction	89.06±6.12	92.78±12.16	t=1.932, Df=98, *P*=0.056
150 min after induction	89.58±7.21	88.98±12.16	t=0.300, Df=98, *P*=0.765
180 min after induction	90.2±6.32	88.12±9.78	t=1.263, Df=98, *P*=0.210

MAP: Mean arterial pressure

Table 4: Comparison of median VAS score at rest using Mann–Whitney test

VAS score on rest	Group A		Group B		p-value
	Median	IQR	Median	IQR	
Post-extubation	0	(1–0)	3	(3–1.75)	<0.001
1st h	1	(2–1)	3	(4–3)	<0.001
3rd h	1	(2–0)	5	(5–4)	<0.001
6th h	1	(1–0)	4	(4–3.75)	<0.001
12th h	1	(1–0)	3	(4–3)	<0.001
18th h	1	(2–0)	2	(3–2)	<0.001
24th h	1.5	(2–1)	2	(2–2)	<0.001

IQR: Interquartile range

Table 5: Comparison of median VAS score at movement using Mann–Whitney test

VAS score on movement	Group A		Group B		p-value
	Median	IQR	Median	IQR	
Post-extubation	0.00	(1–0)	4.00	(5–3)	<0.001
1st h	3.00	(4–2)	4.00	(5–3)	<0.001
3rd h	2.00	(3–2)	6.00	(6–4)	<0.001
6th h	2.00	(3–1)	5.00	(6–4.75)	<0.001
12th h	2.00	(2–1)	4.00	(5–3)	<0.001

IQR: Interquartile range

In our study, opioid was required in around one-third (28%, 14/50) and all cases of Group B required opioid. This difference in the proportion of requirement of rescue analgesia in cases of both study groups was found to be statistically significant (p<0.05) (Table 6 and Fig. 7).

Chi-square=53.168 with 1° of freedom; p<0.001.

In Group A, mean dose of opioid required in 24 h was 25±41.96 and in Group B cases was 82.5±22.73. Required mean dose of opioid was significantly higher in Group B cases than Group A cases (p<0.05) (Tables 7, 8 and Fig. 8).

DISCUSSION

In our study, we evaluated the intraoperative hemodynamics and post-operative analgesia after using bilateral ESB and conventional techniques during spinal surgeries. The study also evaluated the consumption of analgesics in patients during post-operative period.

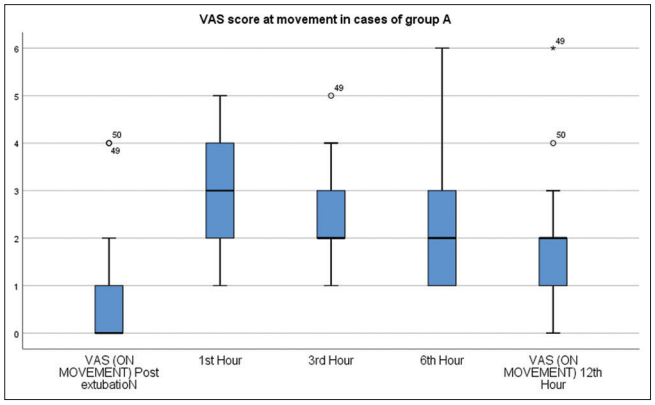

Fig. 5: Diagram showing VAS score at movement in Group A

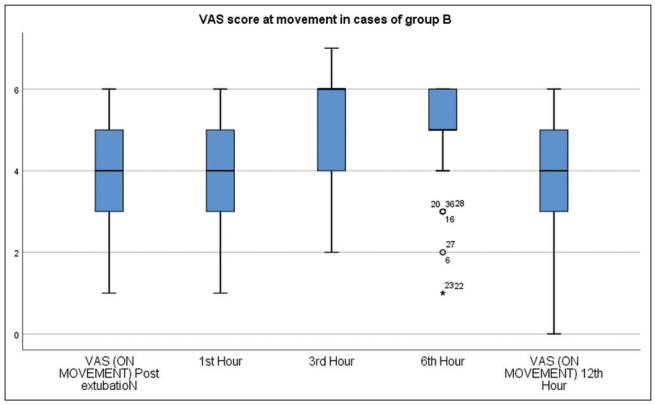

Fig. 6: Diagram showing VAS score at movement in Group B

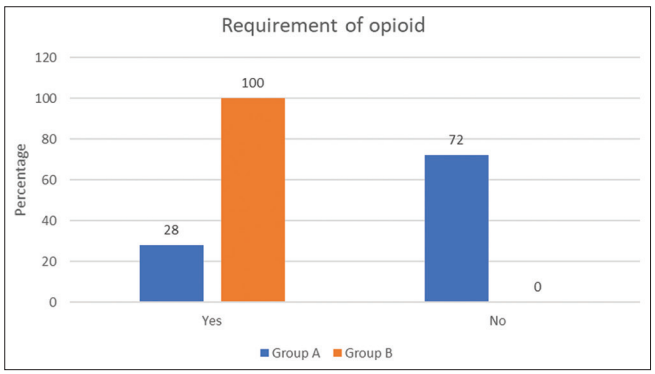

Fig. 7: Bar diagram showing requirement of opioid

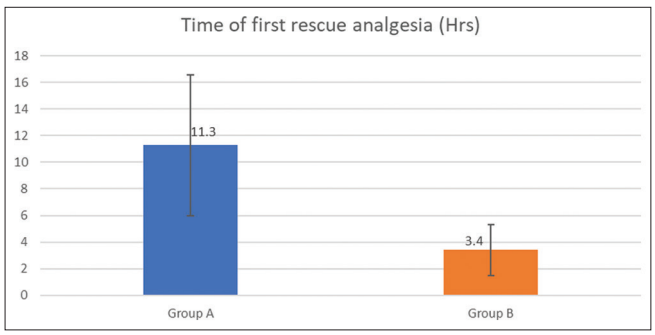

Fig. 8: Bar diagram showing mean time of first rescue analgesia

Table 6: Requirement of opioid in cases of both study groups

Requirement of opioid	Group A	Group B
Yes	14 (28)	50 (100)
No	36 (72)	0
Total	50 (100)	50 (100)

Table 7: Mean dose of opioid required (mg)

Dose of opioid	Mean	SD	Test of significance
Group A	25	41.96	t=8.521, Df=98, *P*<0.001
Group B	82.5	22.73	

SD: Standard deviation

Table 8: Mean time of first rescue analgesia (h)

Time of first rescue analgesia (h)	Mean	SD	Test of significance
Group A	11.3	5.3	t=9.873, Df=98, *P*<0.001
Group B	3.4	1.9	

SD: Standard deviation

To the best of our knowledge, our study is one of the few studies that compared intraoperative hemodynamics of ESP block with GA to conventional GA.

The ESP block is an effective analgesic technique in a variety of clinical scenarios [11]. It can be used successfully in the treatment of acute and chronic pain. It has been shown as an effective analgesic technique in various trials at the cervical, thoracic, and lumbar levels. In addition, it has a low rate of reported complications [12].

Change in MAP from just after induction to 180 min after induction in cases of Group A was lower than cases of Group B. This difference in variation in MAP over the time period between both groups was found to be statistically significant (p<0.05).

Change in pulse rate from just after induction to 180 min after induction in cases of Group A was lower than cases of Group B. This difference in variation in pulse rate over the time period between both groups was found to be statistically significant (p<0.05).

Mean VAS score at rest as well as at movement in Group B cases was significantly higher than Group A cases at post-extubation, 1st h, 3rd h, 6th h, 12th h, 18th h, and 24th h (p<0.05).

In Group A, around two-third (66%, 33/50) cases had 9–24 h of time interval of first rescue analgesia, followed by 14(28%) cases had 5–8 h and three (6%) cases had 0–4 h of time of first rescue analgesia. In Group B, all cases required rescue analgesia within 8 h, almost three-fourth (72%, 36/50) cases required in 0–4 h, and rest 14 (28%) cases required rescue analgesia in 5–8 h of interval.

In our study, required mean dose of opioid in post-operative period was significantly higher in Group B (control group) cases than Group A cases In Group A, mean dose of opioid required in 24 h was 25±41.96 and in Group B cases was 82.5±22.73 (p<0.05). Tramadol and Paracetamol were given as analgesics in the post-operative period. The mean intraoperative opioid dose (µg) required in cases of Group A was significantly lower than cases of Group B. (p<0.05). Fentanyl was used as intraoperative opioid analgesic.

The assessment of pain by the VAS scale has certain limitations: One needs to recognize that the pain the patient reports may not be the pain

he actually feels: Whether or not and at which intensity pain is reported is influenced by many factors, such as a wish to attract the nurse's sympathy and attention or conversely the wish to deny the presence of seriousness.

CONCLUSION

Our study shows that USG-guided bilateral ESB at the desired surgical level in patients undergoing lumbar spine surgeries is a feasible option as it provides profound intraoperative hemodynamic stability with perioperative analgesia in comparison to conventional GA technique. The present study concluded that ESP block decreased the opioid requirement in both intraoperative and post-operative period.

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AUTHORS' CONTRIBUTION

All the authors have contributed equally.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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