



# Comparison Between Uniport and Multiport Wire-reinforced Catheters for Labor Analgesia During Programmed Intermittent Epidural Boluses: A Randomized Controlled Clinical Trial

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## Background

- High-rate bolus delivery increased the delivery pressure at the catheter orifice and may improve drug distribution in the epidural space.
- To achieve a high flow rate with programmed intermittent epidural bolus (PIEB), special high-flow epidural catheters may be needed.
- There are theoretical reasons to believe that multiport catheters may have a more favorable clinical profile than uniport catheters.
- This study was based on the results of our in vitro study<sup>1</sup> (**Fig 1**) which demonstrated that closed-ended multiport catheters had no advantages over open-ended uniport catheters in terms of diffusion distance or area during programmed high-rate epidural injection (>360 mL/h).
- We hypothesized that uniport catheters would provide more preferable analgesic outcomes over multiport catheters at 480 mL/h delivery rate with PIEB.

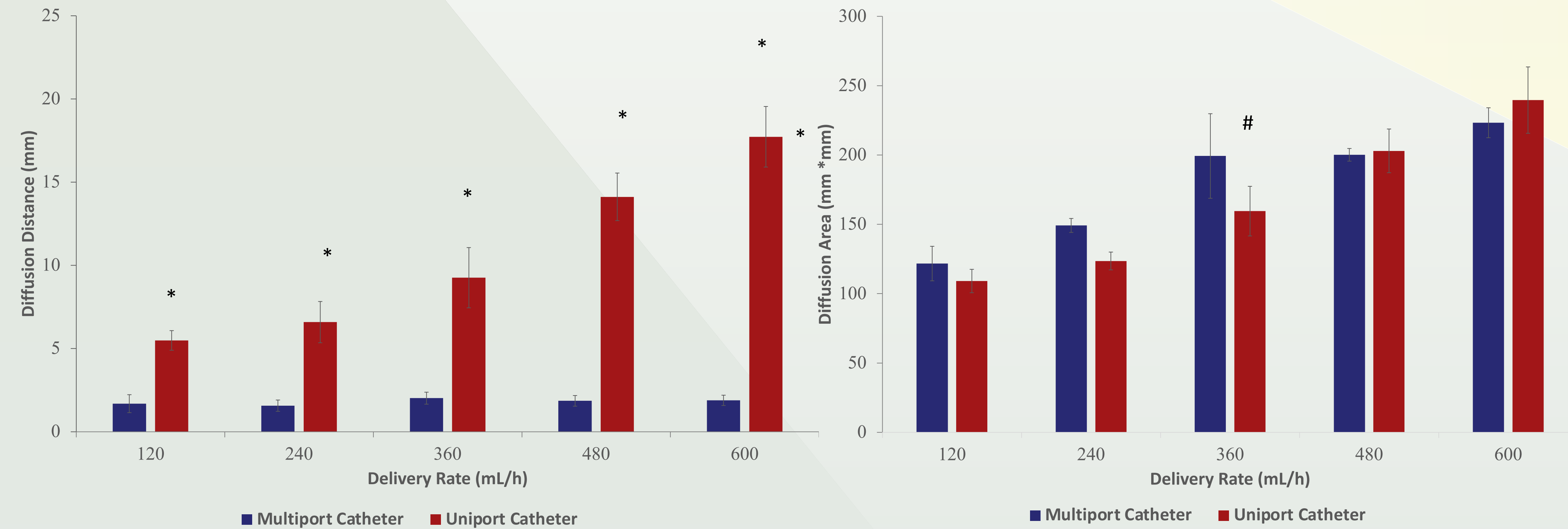


**Fig 1:** The diffusion distance (left) and area (right) at five delivery rates ( 120, 240, 360, 480 and 600 mL/h ) combined with the uniport catheter or the multiport catheter. \* $P < 0.025$ . We used an ambulatory infusion pump (Apon Medical Tech. Co., Ltd, Jiangsu, China) and set the delivery rate at 120, 240, 360, 480, and 600 mL/h, based on the gradient approach. Each combination were measured three times. The diffusion distance in the multiport catheters was shorter than that in the uniport catheters at all delivery rates [ \* $P < 0.001$  for all]. Differences in the diffusion area between the uniport and multiport catheters were noted at delivery rates of 360mL/h, # $P < 0.05$ ].

## Methods

- This was a prospective, randomized, parallel-group study (No: ChiCTR2100049872) .
- Nulliparous and healthy women with singleton pregnancy, 2–5 cm cervical dilation, and requesting neuraxial analgesia were eligible.
- Epidural analgesia was initiated and maintained with 0.1% ropivacaine and 0.3 µg/mL of sufentanil.
- The PIEB volume was 10 mL administered every 45 min at 480 mL/h after the test dose.
- Primary outcome was the percentage of participants with a numerical rating scale (NRS) score  $\leq 3$  during two consecutive uterine contractions 20 min after the initial bolus.
- The secondary outcomes were sacral blockade 20 min after the initial epidural bolus, numbers of PCEA boluses, time to adequate analgesia, and ropivacaine consumption per hour.

## Results

- Between August and November 2021, 182 parturients were randomized to receive either uniport or multiport catheters.
- Percentage of parturients with adequate analgesia 20 mins after the initial bolus was higher with uniport catheters than multiport catheters (71.8% vs. 56.0%, respectively; difference of -0.182 [95% confidence interval (CI), -0.322 to -0.034];  $P = .0032$ ).
- Median time (interquartile range) to adequate analgesia was 12 (8–30) mins and 20 (10–46.8) mins with uniport and multiport catheters, respectively (hazard ratio:1.724, 95% CI, 1.177 to 2.525;  $P = 0.003$ , **Fig 2**).
- $S_2$  sensory blockade levels were more frequently observed in the uniport catheter group at 20 mins ( $P < 0.05$ ).
- Parturients with multiport catheters reported a significantly higher NRS at 10-cm cervical dilation ( $P = 0.000$ ).
- The percentage of parturients requiring patient-controlled epidural analgesia, number of patient-controlled epidural analgesia boluses, and hourly consumption of ropivacaine were lower with uniport catheters (all  $P < 0.05$ , **Fig 3**).

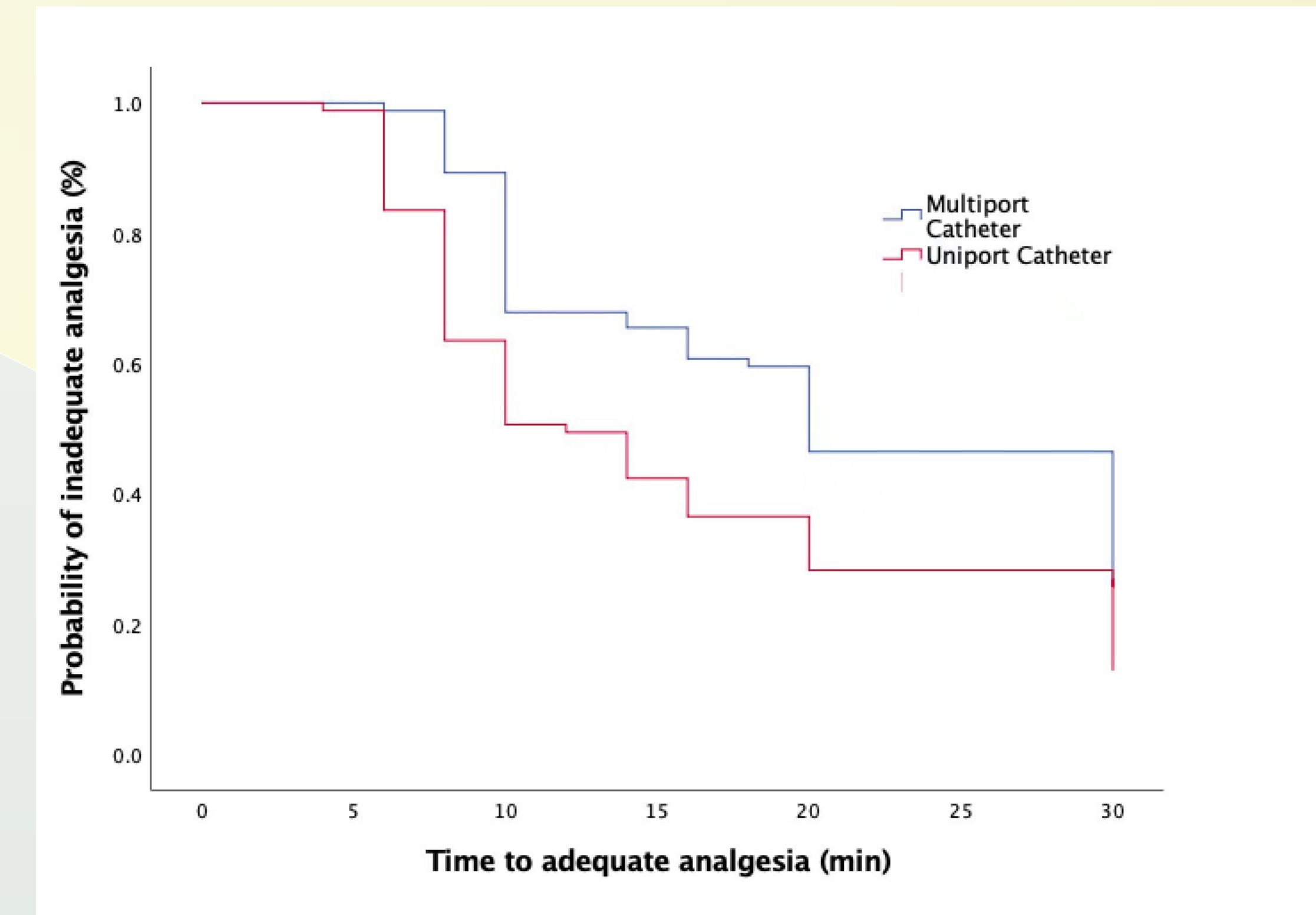


**Fig 2.** Kaplan-Meier curves for the time to achieve adequate analgesia between two groups.  $P = 0.001$ .

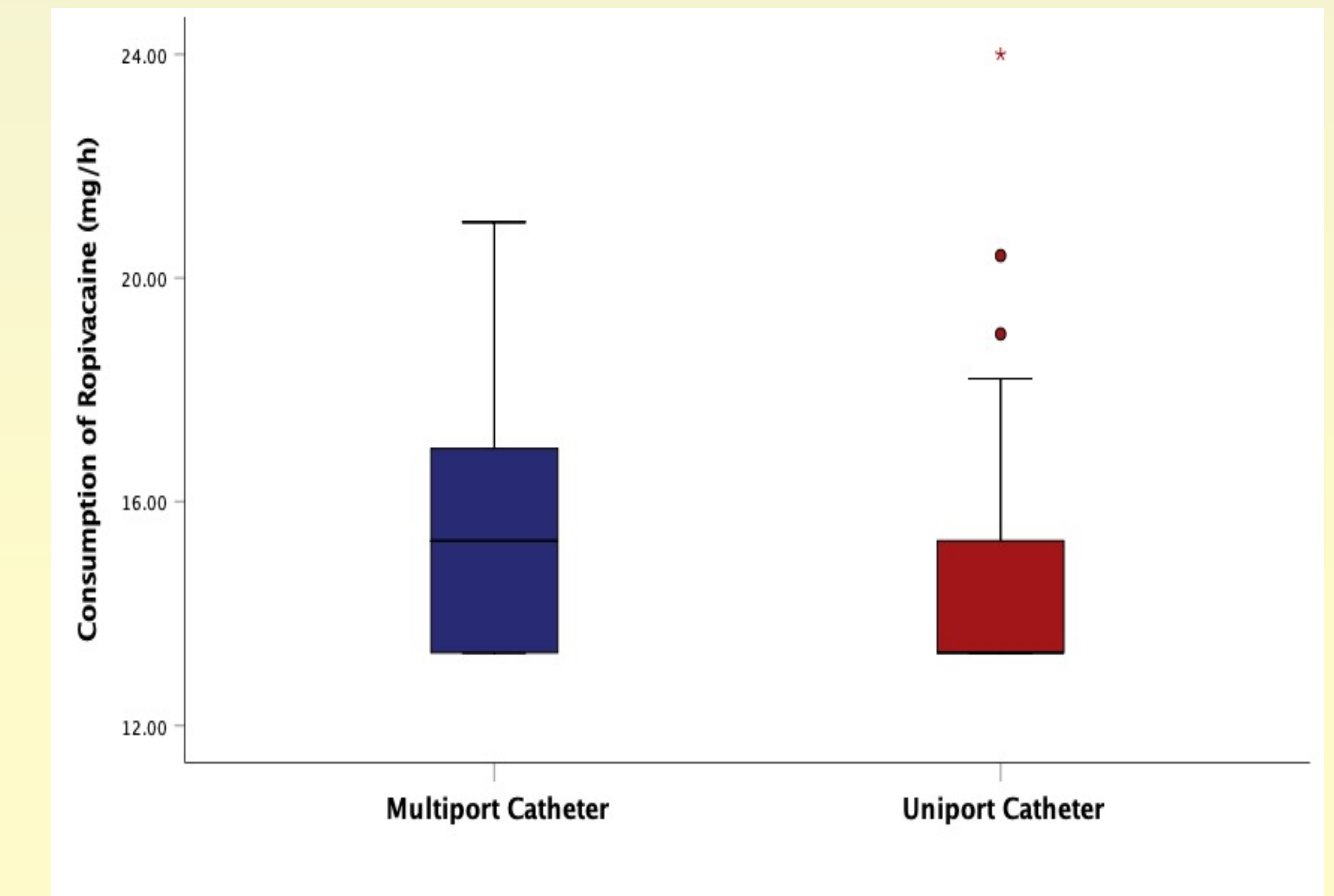


**Fig 3.** Consumption of ropivacaine between the 2 groups. A comparison of hourly consumption of ropivacaine between the 2 groups analyzed by using with Kruskal-Willis test. The length of the box represents the interquartile range, with the top and bottom at the 25th and 75th percentiles, respectively. The horizontal line represents the median.

## Conclusion

- Uniport catheters were associated with earlier onset, less ropivacaine consumption, more frequent sacral coverage at 20 min, and fewer PCEA boluses compared to multiport catheters with a 480 mL/h delivery rate for epidural labor analgesia .

## Reference

- [1] Du W, Song Y, Zhao Q, et al. The effect of open-end versus closed-end epidural catheter design on injection pressure and dye diffusion under various programmed intermittent epidural delivery rates: an in vitro study[J]. International Journal of Obstetric Anesthesia, 2022:103252.