

Regional block anesthesia for adult patients with inguinal hernia repair

A systematic review

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Abstract

Background: Inguinal hernia repair (IHR) is a common surgical technique performed under regional block anesthesia (RBA). Although previous clinical trials have explored the effectiveness and safety of RBA for IHR, no systematic review has investigated its effectiveness and safety in adult patients with IHR.

Methods: This systematic review searched electronic databases (PubMed, Embase, Cochrane Library, CNKI, Wangfang, and VIP) from their inception to July 1, 2022. We included all potential randomized controlled trials that focused on the effects and safety of RBA in adult patients with IHR. Outcomes included operative time, total rescue analgesics, numerical rating scale at 24 hours, occurrence rate of nausea and vomiting, and occurrence rate of urinary retention (ORUCR).

Results: Five randomized controlled trials, involving 347 patients with IHR, were included in this study. Meta-analysis results showed that no significant differences were identified on operative time (MD = -0.20; fixed 95% confidence interval [CI], -3.87, 3.47; $P = .92$; $I^2 = 0\%$), total rescue analgesics (MD = -8.90; fixed 95% CI, -20.36, 2.56; $P = .13$; $I^2 = 28\%$), and occurrence rate of nausea and vomiting (MD = 0.39; fixed 95% CI, 0.13, 1.16; $P = .09$; $I^2 = 0\%$) between 2 types of anesthetics. However, significant differences were detected in the numerical rating scale at 24 hours (MD = -1.53; random 95% CI, -2.35, -0.71; $P < .001$; $I^2 = 75\%$) and ORUCR (MD = 0.20; fixed 95% CI, 0.05, 0.80; $P = .02$; $I^2 = 0\%$) between the 2 management groups.

Conclusion: The results of this study demonstrated that IHR patients with RBA benefit more from post-surgery pain relief at 24h and a decrease in the ORUCR than those with CSA.

Abbreviations: CI = confidence interval, IH = inguinal hernia, IHR = inguinal hernia repair, MD = mean difference, NRS at 24 hours = numerical rating scale at 24 hours, NV = occurrence rate of nausea and vomiting, ORUCR = occurrence rate of urinary retention, OT = operative time, RBA = regional block anesthesia, RCTs = randomized controlled trials, SA = spinal anesthesia, TRA = total rescue analgesics.

Keywords: inguinal hernia repair, meta-analysis, regional block anesthesia, systematic review

1. Introduction

Inguinal hernia (IH) is a leading type of hernia that presents as a bulge in the groin.^[1-4] It is also a common condition in general surgical operations worldwide, with a lifetime risk of about 27% in males and 3% in females.^[5] Studies have reported an annual incidence ranging from 13 to 34/10,000 people annually.^[6-8] The only definitive modality for such conditions is surgical repair, also known as inguinal hernia repair (IHR).^[9-13]

IHR is often performed under general, regional, or local anesthesia.^[14-16] Spinal anesthesia (SA) is commonly used to manage IHR. However, patients with SA often experience undesirable hemodynamic responses, unfavorable complications, and delayed discharge.^[17,18] Regional block anesthesia (RBA) is also

a popular technique for IHR, which involves the administration of anesthetic drugs to the local dominating nerve roots to avoid complications of SA.^[19,20] Previous studies have investigated the effectiveness of RBA in patients with IHR.^[20-24] However, no systematic review has yet explored this topic. Therefore, this systematic review comprehensively assessed the effectiveness and safety of RBA for the management of adult patients with IHR.

2. Methods

2.1. Ethical notice

This study did not require ethical approval because no individual data were collected in this systematic review.

The authors have no conflicts of interest to disclose.

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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2.2. Literature search

This systematic review searched electronic databases for randomized controlled trials (RCTs) that compared the effects and safety of RBA in adult patients with IHR. PubMed, Embase, Cochrane Library, CNKI, Wangfang, and VIP databases were searched. Searches were performed to identify RCTs published from their inception to July 1, 2022. The keywords used in this study comprised of “hernia,” “inguinal hernia,” “groin,” “abdominal wall,” “herniorrhaphy,” “hernia repair,” “surgery,” “operation,” “laparoscopy,” “celioscopy,” “peritoneoscopy,” “open,” “conventional,” “traditional,” “randomized controlled trial,” “clinical trial,” and “controlled study.” The search strategy for PubMed is shown in Table 1. Additionally, we identified other literature sources, such as the reference lists of relevant studies.

2.3. Eligibility criteria

2.3.1. Inclusion criteria. The following inclusion criteria were applied: RCTs of RBA for patients with IHR; all patients aged between 18 and 80 years; study subjects were diagnosed with IH and underwent IHR; patients in the treatment group received RBA, whereas those in the control group underwent conventional spinal anesthesia (CSA); and full text was available.

Studies fulfilling any of the following criteria were excluded: studies on other health issues; studies that received treatments other than IHR and RBA in the treatment group; duplicates, irrelevant studies, animal studies, experimental studies, nonclinical trials, and uncontrolled trials; and studies involving inappropriate comparisons and insufficient information.

2.4. Outcome measurements

Outcomes included operative time (OT), total rescue analgesics (TRA), numerical rating scale (NRS) at 24 hours, occurrence rate of nausea and vomiting (NV), and occurrence rate of urinary retention (ORUCR). The NRS ranges from 0 (no pain) to 10 (worst pain), with a higher score indicating a worse pain intensity.^[25,26]

Table 1
Search strategy of PubMed.

Number	Search terms
1	Hernia
2	Inguinal hernia
3	Groin
4	Abdominal wall
5	Herniorrhaphys
6	Or 1-5
7	Hernia repair
8	Surgery
9	Operation
10	Laparoscopy
11	Celioscopy
12	Peritoneoscopy
13	Open
14	Conventional
15	Traditional
16	Or 7-15
17	Randomized controlled trial
18	Clinical trial
19	Controlled study
20	Or 17-19
21	6 AND 16 AND 20

2.5. Record selection

Two authors independently performed record selection according to the eligibility criteria. First, duplicate records were removed. Second, the titles and abstracts were scanned to eliminate irrelevant records. Third, the full texts of the remaining articles were read cautiously, and the final records were entered into the analysis. Any disagreement was resolved by a third author through a discussion.

2.6. Data collection

Two authors independently collected the data using a previously defined data extraction form. We collected the following data: title, first author, year of publication, age, sex, sample size, methodological details, details of the intervention and control, and outcomes. Any divergence was resolved by a third author through a discussion.

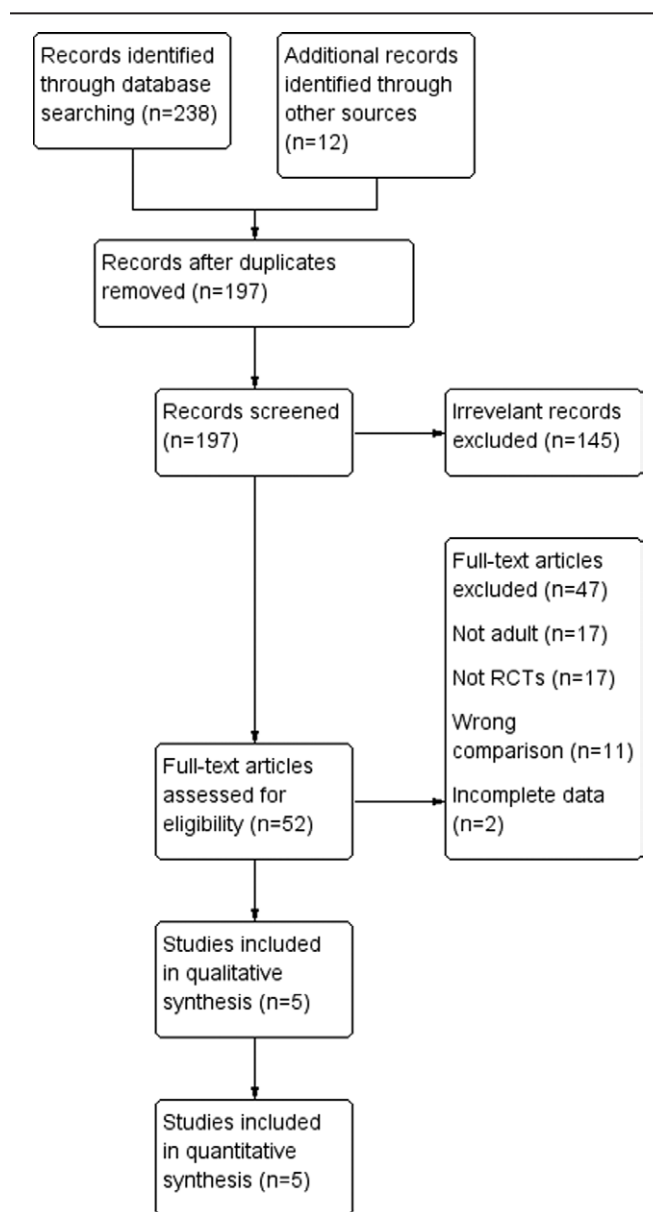


Figure 1. Flow diagram of study selection.

2.7. Risk of bias assessment

Two authors independently conducted a risk-of-bias assessment using the Cochrane risk-of-bias tool in 7 domains. Each field was further divided into high, unclear, and low risk of bias. If there was a conflict between the 2 authors, a third author was invited to resolve it through a discussion.

2.8. Statistical analysis

RevMan 5.4 (Cochrane Collaboration, London, UK) was used to conduct statistical analysis. Continuous data were presented as mean difference (MD) and 95% confidence interval (CI). Dichotomous data were calculated as odds ratios and 95% CI. Statistical heterogeneity across the included trials was identified using the I^2 test. A value of $I^2 < 50\%$ indicated reasonable heterogeneity and a fixed-effects model was used to pool the data. In contrast, a value of $I^2 \geq 50\%$ suggested significant heterogeneity, and a random-effects model was used to synthesize the data. Meta-analysis was performed if insufficient data were collected from the included RCTs.

3. Results

3.1. Search results

After a comprehensive search, 250 records were identified with our search strategy (Fig. 1). Of these, 53 duplicate records were excluded. The remaining 197 records were scanned using the titles and abstracts. Of these, 145 irrelevant records were excluded, and 52 articles were considered for the full-text review. Forty-seven records were further removed because they were not adults (n = 17), not RCTs (n = 17), wrong comparisons (n = 11), and incomplete data (n = 2). Therefore, 5 RCTs were included in the analysis.^[20-24]

3.2. Study characteristics

The general characteristics of the included studies and the eligible patients are summarized in Table 2. This study included 5 RCTs involving 347 adults who underwent IHR. All the included trials investigated the comparative outcomes of RBA and CSA.

Table 2
General characteristics of included studies.

Study	No. of patients (T/C)	Age (yr, T/C)	Treatment	Control	Outcomes
Bhattacharya et al ^[20]	28/30	T: 53.0 ± 6.3; C: 51.4 ± 9.7	RBA	CSA	OT, TRA, ORUCR, NV
Flaherty et al ^[21]	45/45	T: 62.4 ± 13.2; C: 57.7 ± 14.3	RBA	CSA	OT, TRA, NRS at 24 hr
Kartalov et al ^[22]	30/30	T: 51.3 ± 15.8; C: 52.4 ± 14.7	RBA	CSA	OT
Theodoraki et al ^[23]	29/28	T: 61.9 ± 14.6; C: 59.6 ± 14.4	RBA	CSA	OT
Zhou et al ^[24]	41/41	48.5 ± 15.3	RBA	CSA	NRS at 24 hr, ORUCR, NV

C = control group, CSA = conventional spinal anesthesia, NRS at 24 hr = numerical rating scale at 24 hr, NV = occurrence rate of nausea and vomiting, ORUCR = occurrence rate of urinary retention, OT = operative time, RBA = regional block anesthesia, T = treatment group, TRA = total rescue analgesics.

3.3. Study quality evaluation

The Cochrane risk-of-bias tool was used to evaluate the risk of bias in the included RCTs^[20-24] (Fig. 2). All 5 trials showed a low risk for random sequence generation, incomplete outcome data, selective reporting, and other bias.^[20-24] One study did not report allocation concealment.^[24] Two studies failed to mention blinding of participants and investigators^[20,24] or blinding of the outcome assessment.^[22,24]

3.4. Pooled analysis of the operative time (min)

Four studies involving 265 patients investigated the effects of RBA versus CSA on IHR using OT.^[20-23] The meta-analysis results showed no statistically significant difference in the OT between the 2 groups (MD = -0.20; fixed 95% CI, -3.87, 3.47; $P = .92$; $I^2 = 0\%$; Table 3, Fig. 3).

3.5. Pooled analysis of the total rescue analgesics

Two trials with 148 participants assessed the total number of rescue analgesics that were administered. No statistically significant difference in TRA was detected between the 2 management groups (MD = -8.90; fixed 95% CI, -20.36, 2.56; $P = .13$; $I^2 = 28\%$; Table 3, Fig. 4).

3.6. Pooled analysis of numerical rating scale at 24 hours

Two eligible trials with 172 subjects evaluated the NRS at 24 hours. The meta-analysis results showed a significant difference in the numerical rating scale at 24 hours (MD = -1.53; Random 95% CI, -2.35, -0.71; $P < .001$; $I^2 = 75\%$; Table 3, Fig. 5).

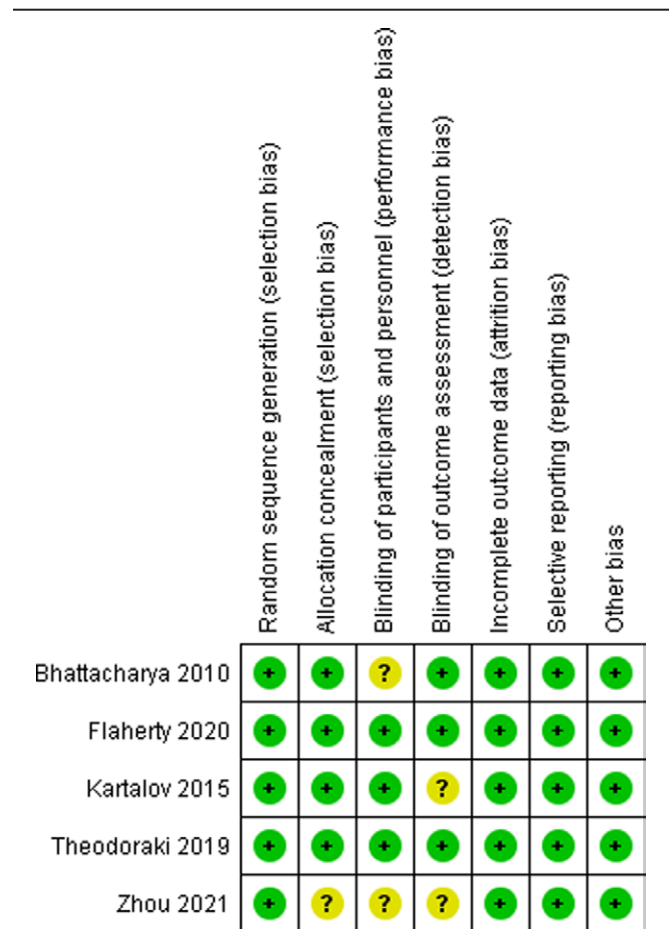


Figure 2. Risk of bias summary.

3.7. Pooled analysis of the occurrence rate of nausea and vomiting

Two studies, involving 140 patients, investigated the occurrence rates of nausea and vomiting. No significant differences were detected between the 2 modalities (MD = 0.39; fixed 95% CI, 0.13, 1.16; $P = .09$; $I^2 = 0\%$; Table 3, Fig. 6).

3.8. Pooled analysis of urinary retention rate

Two RCTs involving 140 patients explored the ORUCR. The meta-analysis results showed significant differences in the ORUCR (MD = 0.20; fixed 95% CI, 0.05, 0.80; $P = .02$; $I^2 = 0\%$; Table 3, Fig. 7).

4. Discussion

IH is a common disorder in general surgery, and occurs more frequently in men than in women. It often manifests as groin

pain, mass, or even complicated cases and greatly affects the quality of life in patients with such conditions, or even their morbidity and mortality. IHR is one of the most common modalities for IH, with approximately 20 million IHR performed annually worldwide. Throughout the process of IHR, the choice of anesthesia is very important for post-surgery recovery. Currently, RBA is a popular technique for IHR. Although a variety of studies have investigated the effects and safety of IHR, there is little evidence to support this issue. This systematic review explored the effects and safety of RBA in adult patients with IHR.

In this systematic review, we included 5 RCTs involving 347 adults who underwent IHR. We pooled the outcome data of OT, TRA, NRS at 24 hours, NV, and ORUCR. The meta-analysis results did not show significant differences in OT (MD = -0.20; 95% CI, -3.87, 3.47; $P = .92$; $I^2 = 0\%$), TRA (MD = -8.90; 95% CI, -20.36, 2.56; $P = .13$; $I^2 = 28\%$), and NV (MD = 0.39; 95% CI, 0.13, 1.16; $P = .09$; $I^2 = 0\%$) between the 2 modalities. However, there were significant

Table 3

Data analysis of included trials.

Outcome or subgroup	Studies	Participants	Statistical method	Effect estimate
1.1 Operative time (min)	4	265	Mean difference (IV, fixed, 95% CI)	-0.20 [-3.87, 3.47]
1.2 Total rescue analgesics	2	148	Mean difference (IV, fixed, 95% CI)	-8.90 [-20.36, 2.56]
1.3 NRS at 24 hr	2	172	Mean difference (IV, random, 95% CI)	-1.53 [-2.35, -0.71]
1.4 Occurrence rate of nausea and vomiting	2	140	Odds ratio (M-H, fixed, 95% CI)	0.39 [0.13, 1.16]
1.5 Occurrence rate of urinary retention	2	140	Odds ratio (M-H, fixed, 95% CI)	0.20 [0.05, 0.80]

CI = confidence interval, IV = inverse variance, M-H = Mantel-Haenszel, NRS = numerical rating scale.

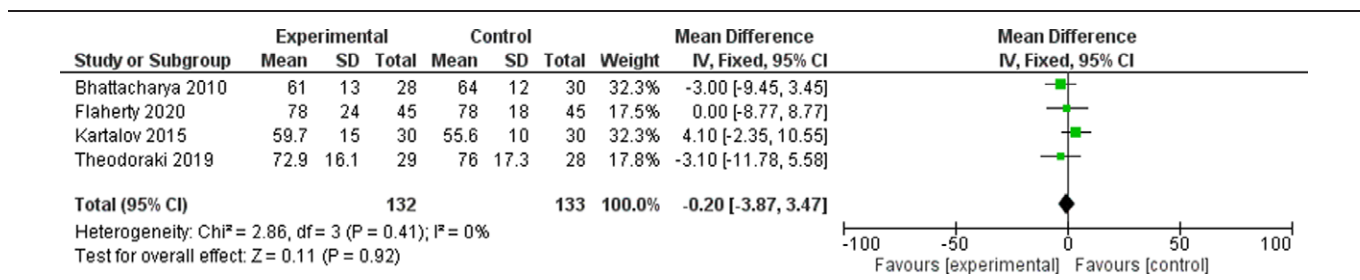


Figure 3. Meta-analysis of operative time.

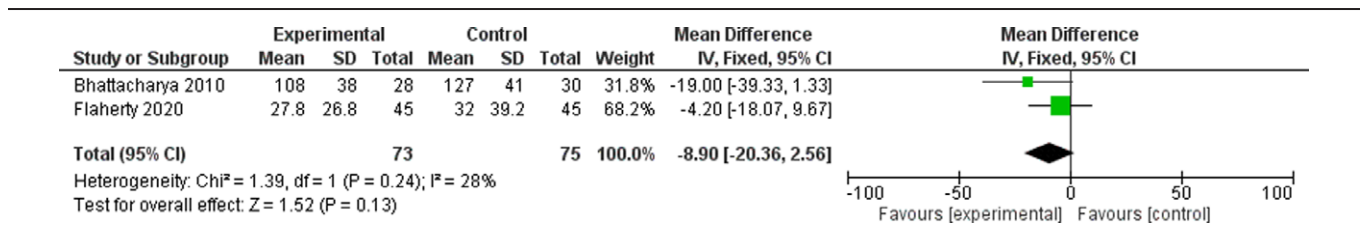


Figure 4. Meta-analysis of total rescue analgesics.

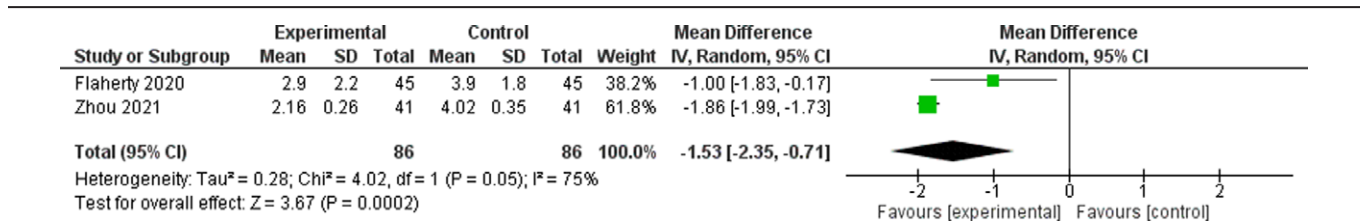


Figure 5. Meta-analysis of numerical rating scale at 24 hours.

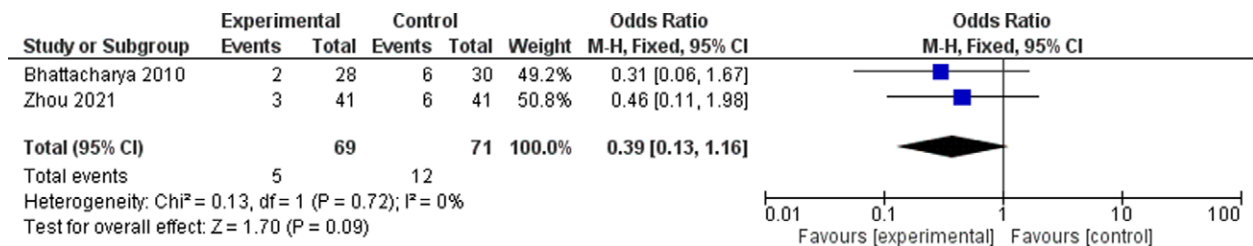


Figure 6. Meta-analysis of occurrence rate of nausea and vomiting.

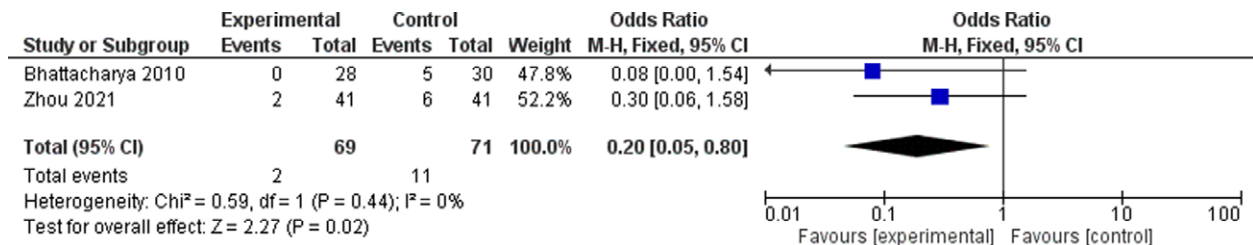


Figure 7. Meta-analysis of occurrence rate of urinary retention.

differences in the NRS at 24 hours (MD = -1.53; random 95% CI, -2.35, -0.71; $P < .001$; $I^2 = 75\%$) and ORUCR (MD = 0.20; fixed 95% CI, 0.05, 0.80; $P = .02$; $I^2 = 0\%$) between the 2 management groups. The results indicate that RBA is more effective in post-surgery pain relief at 24 hours and is safe in reducing the ORUCR.

This study has several limitations. First, there were a few eligible RCTs, which may have affected the findings of this study. Second, the sample sizes of all included trials were small, which may have affected the results of this study. Third, all studies were conducted in China, which may have affected the publication bias. Fourth, a source of heterogeneity may be the different types of IHR and analgesics used in the included RCTs. Finally, there were no long-term data for the outcome measurements. Future studies should address these limitations.

5. Conclusion

This study showed that RBA is superior to CSA for pain relief at 24 hours post-surgery and a reduction in the ORUCR compared to CSA.

Author contributions

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Supervision: Cui Yang.

Validation: Lv Jie, Zhang Qi, Zeng Ting, Li Xue-Feng, Cui Yang.

Visualization: Lv Jie, Zhang Qi, Zeng Ting, Li Xue-Feng, Cui Yang.

Writing – original draft: Lv Jie, Cui Yang.

Writing – review & editing: Lv Jie, Zhang Qi, Li Xue-Feng, Cui Yang.

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