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Comparison of different trans-gastric stents for drainage of peripancreatic fluid collections: A systematic review and network meta-analysis of randomized control trials

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Abstract

Acute pancreatitis exhibits varying degrees of severity and may lead to complications such as peripancreatic fluid collections, which can develop into pseudocysts or walled-off necrosis. Interventions are necessary in cases of organ failure, bleeding, or infection. For endoscopic drainage, biomedical researchers have optimized stents such as double pigtail plastic stents (DPSs), modified fully covered self-expanding stents (mFCSEMSs), or lumen-apposing metallic stents (LAMSs). However, the most suitable type of stent for this purpose remains to be determined. Thus, we conducted the present systematic review and network meta-analysis of randomized controlled trials (RCTs) to compare efficacy and safety among various stents for the drainage of necrotic collection from necrotizing pancreatitis. PubMed, Embase, and Cochrane Library were comprehensively searched for RCTs (published before January 7, 2024) comparing various stents used for draining acute pancreatitis-associated peripancreatic fluid collections. In addition, we manually searched the reference lists of the included RCTs as well as relevant review articles and clinical guidelines. The primary study outcome was clinical success, and the secondary outcomes were technical success and adverse events. This study included four RCTs (a total of 200 patients). A direct meta-analysis indicated no significant difference in the rate of clinical success between LAMSs and DPSs (risk ratio [RR]: 1.02; 95% confidence interval [CI]: 0.89–1.16) or between DPSs and mFCSEMSs

(RR: 1.05; 95% CI: 0.85–1.28). Moreover, an indirect comparison between LAMSs and mFCSEMSs revealed nonsignificant between-stent difference in the rate of clinical success (mFCSEMS vs. LAMS, odds ratio: 1.41; 95% CI: 0.13–15.06). A network meta-analysis identified DPSs to be the best device for the drainage of necrotic collection from necrotizing pancreatitis (*P*-score: 0.24, 0.53, and 0.73 for DPSs, mFCSEMSs, and LAMSs, respectively). Furthermore, the network meta-analysis revealed that the rate of adverse events was the lowest for mFCSEMSs. The direct meta-analysis indicated no significant difference in the rate of adverse events between LAMSs and DPSs (RR: 0.50; 95% CI: 0.06–4.10) or between mFCSEMSs and DPSs (RR: 0.19; 95% CI: 0.01–3.78). Among the three types of stents examined in the present study, the rate of clinical success was the highest for DPSs and that of adverse events was the lowest for mFCSEMSs. Systematic reviews should be conducted frequently to update the literature with findings from new RCTs on this crucial topic.

KEYWORDS

acute pancreatitis, double pigtail plastic stent, lumen-apposing metallic stent, peripancreatic fluid collection, pseudocyst, walled-off necrosis

1 | INTRODUCTION

Acute pancreatitis (AP) is characterized by a broad spectrum of clinical courses.[1–3] Most cases of AP are usually self-limiting and can be treated conservatively; however, some patients may develop shock followed by multiorgan failure and thus death.[2] Inflammation in AP can result in peripancreatic fluid collections (PFCs).[4–6] According to the 2012 Revised Atlanta Classification guidelines, PFCs may develop into pseudocysts or walled-off necroses (WONs) 4 weeks after the onset of pancreatitis.[1] Among patients with AP, the rates of pseudocyst and WON incidence are approximately 5%–16% and 20%, respectively.[7] PFCs may lead to severe complications.[8] Indications for interventions in patients with pseudocysts or WONs include organ failure, abdominal compartment syndrome, bleeding, bowel ischemia, obstruction due to the mass effect of the necrosis, or infection of the necrosis, which is associated with a mortality rate of up to 30%.[9,10]

Interventions are selected on the basis of the condition of the patient, location of the necrosis, and capacity of the hospital. Initially, percutaneous drainage and open surgery were the only options for patients with necrotizing pancreatitis. However, with advances in endoscopy and laparoscopy, interventions for necrotizing pancreatitis have markedly evolved over the last two decades, transitioning to a step-up approach and from open surgery to minimally invasive surgery. These advancements have improved patients' quality of life and reduced the risk of adverse events, such as pancreaticocutaneous fistula.[11]

Endoscopic drainage of PFCs, first reported in the late 1980s, is a clinically effective and safe technique.[12] The evolution of endoscopic ultrasound devices and techniques has expanded the drainage indications for PFCs to include pancreatic abscesses and organized liquefied necroses.[12] Endoscopists typically adopt an endoscopic ultrasound-assisted transmural approach to drain the necrosis, using different types of stents to facilitate drainage. The three major types of stents used for this purpose are double pigtail plastic stents (DPSs), fully covered self-expanding stents (mFCSEMSs), and lumen-apposing metallic stents (LAMSs). However, the most suitable type of stent for the drainage of necrotic collection from necrotizing pancreatitis remains to be determined.[13] Several randomized controlled trials (RCTs) have compared various stents in terms of their safety and efficacy.[14,15] However, few RCTs have focused on a head-to-head comparison of mFCSEMSs and LAMSs. Only one network meta-analysis has compared the aforementioned three types of stents, but it had a heterogeneity bias arising from the inclusion of not only RCTs but also retrospective studies.[16] Including studies lacking randomization may introduce a confounding bias, affecting the associations between potential prognostic factors and study outcomes and thus compromising the validity of the results.[17,18]

To the best of our knowledge, current guidelines do not provide a definitive recommendation regarding the optimal timing of procedures using DPSs, mFCSEMSs, or LAMSs.[19,20] Although systematic reviews and meta-

analyses have compared the three stents, as mentioned, such studies have included both RCTs and retrospective studies, which likely compromised the conclusions. Recently, multiple RCTs have been conducted to compare various stents, necessitating a comprehensive analysis of only RCTs to update the literature with the most current and accurate information. Therefore, the present systematic review and network meta-analysis of RCTs was conducted to compare DPSs, mFCSEMSs, and LAMSs in terms of the rates of clinical success (efficacy) and adverse events (safety).

2 | METHODS

2.1 | Guidelines and ethics

This systematic review and network meta-analysis was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (Table S1).[21] The study protocol has been registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (registration number: INPLASY2023120086). The institutional review board of our hospital waived the requirements for ethical approval and informed consent because this study included no human participants or individual-level data.

2.2 | Search strategy

PubMed, Embase, and Cochrane Library were systematically searched for pertinent RCTs published from database inception to January 7, 2024. No language restriction was imposed. Key terms, including Medical Subject Headings terms such as "necrotizing pancreatitis," "peripancreatic fluid collections," and "stent" (Table S2), were used for literature search. We further scrutinized the reference lists of the included RCTs as well as relevant meta-analyses and guidelines.

2.3 | Inclusion criteria

Two reviewers (XWL and CS) independently selected relevant articles on the basis of the patient/population, intervention, comparison, and outcome (PICO) framework. In the context of the present study, the PICO components were as follows. "P" for participants: Adults with necrotizing pancreatitis complicated by PFCs; "I" for interventions: drainage using endoscopic transgastric stents; "C" for comparisons: DPSs versus mFCSEMSs versus LAMSs; and "O" for outcomes: clinical success (primary outcome)—defined as the improvement of organ function, resolution of systemic inflammatory response syndrome, or detection of PFC resolution through imaging—and adverse events (secondary outcome). Any between-reviewer disagreement in study selection was resolved through discussions with a senior reviewer (LCL).

2.4 | Data extraction

Three reviewers (XWL, LYL, and CS) independently extracted relevant data from the included studies by using a predesigned form. Information on the following was collected: study details (first author's name, publication year, and study period), participant demographics (mean age), PFC characteristics, and group-specific details (DPSs, mFCSEMSs, and LAMSs). In addition, the following outcome data were collected: rate of clinical success, rate of technical success, rate of adverse events, rate of recurrence, duration of the procedure, and length of hospital stay.

2.5 | Risk-of-bias assessment

CHW and CS independently assessed the methodological quality of the included RCTs by using the Cochrane risk-of-bias assessment tool (version 2.0). This tool assesses risks of bias in the following domains: randomization process, deviations from intended interventions, missing outcome data, outcome measurement, result selection, and overall bias.[22] The risk of bias in each domain was graded as "low risk," "some concerns," or "high risk." Any between-reviewer disagreement was resolved through discussions with LCL.

2.6 | Data synthesis and statistical analysis

A random-effects meta-analysis was performed using RevMan software (version 5.3; Copenhagen: Nordic Cochrane Centre, Cochrane Collaboration, 2014), given the potential clinical heterogeneity among the included RCTs. To account for heterogeneity, we separately calculated pooled risk ratios (RRs) and mean differences with 95% confidence intervals (CIs) for categorical and continuous variables, respectively. Heterogeneity was assessed using the I^2 statistic; $p < .05$ indicated significance. Notably, funnel plots were not generated because the meta-analysis included <10 RCTs.

2.7 | Certainty-of-evidence assessment

CHW and CS independently evaluated the certainty of evidence for each study outcome by using the Confidence in Network Meta-Analysis Web application. This framework comprises six domains: intrastudy bias, reporting bias, indirectness, imprecision, heterogeneity, and incoherence.[23,24] Any between-reviewer disagreement was resolved through discussions with LCL (Table S3).

3 | RESULTS

3.1 | Study selection

The PICO framework revealed 158 relevant articles. A total of 29 duplicate articles were removed; additional reasons for exclusion are presented in Table S4. We further performed a manual review of the remaining literature. Finally, four eligible RCTs were included in this study.[12,14,15,25] A flowchart depicting study selection is presented in Figure S1.

3.2 | Summary of network geometry and study characteristics

The four RCTs comprised a total of 200 patients with necrotizing pancreatitis. Three studies specifically compared DPSs with LAMSs,[14,15,25] and one study compared DPSs with mFCSEMSs.[12] However, no study directly compared mFCSEMSs with LAMSs (Figure 1).

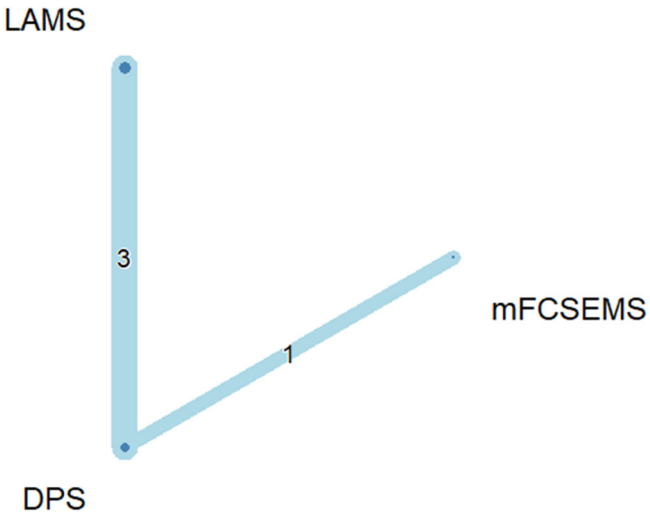

FIGURE 1 Network plot for the included studies. DPS, double pigtail plastic stent; LAMS, lumen-apposing metal stent; mFCSEMS, modified fully covered self-expanding metal stent.

Table 1 presents the basic characteristics of the patients. Their mean age ranged from 35 to 61 years, and the proportion of men ranged from 55% to 88%. The most common causes of necrotizing pancreatitis were gallstones, followed by alcohol consumption. The outcomes of the included studies are summarized in Table 2 and Table S5. Notably, the three RCTs comparing LAMSs with DPSs reported a high rate of clinical success (>93%); recurrence was noted in only two patients receiving an LAMS. Furthermore, the included RCTs reported a high rate of technical success for all stents.

3.3 | Results of risk-of-bias assessment

The results of the study quality assessment are presented in Table S6. All of the included RCTs exhibited low risks of bias in the randomization process, deviations from intended interventions, and outcome measurement domains. Although most RCTs had no missing data, one RCT reported, without a reasonable explanation, losing five patients to follow-up. Moreover, this RCT lacked adequate methods for addressing any potential bias.

3.4 | Stent characteristics

Among the four RCTs, only one used mFCSEMSs. The procedure involved four steps: needle puncture, guidewire insertion, dilation, and mFCSEMS placement. The mFCSEMSs used in the aforementioned RCT had a diameter of 8 mm and a length of 3–5 cm, with flaps at both ends angled at 90° (BONA-Soo stent; Standard Sci-Tech, Seoul, South Korea).

Four RCTs used DPSs with pigtail catheters of 7–10 Fr in diameter and 3–5 cm in length, and at least two catheters were placed.

Three RCTs used LAMSs. The stents were 15 × 10 mm in size (Hot Axios, Boston Scientific, Marlborough, MA, USA). The adequate diameter ensures the feasibility of future endoscopic necrosectomy.

3.5 | Primary outcomes

A direct meta-analysis was performed for the rate of clinical success; the results are presented in Figure 2. No significant difference was observed in the rate of clinical success between LAMSs and DPSs (RR: 1.02; 95% CI: 0.89–1.16; $I^2 = 53\%$) or between DPSs and mFCSEMSs (RR: 1.05; 95% CI: 0.75–1.18).

TABLE 1 Characteristics of the included studies.

First author (publication year)	Country	Study period	Gruop	Number of patients, *n*	Diameter of PFC (cm), mean ± SD	Age, mean ± SD	Male, *n* (%)	Etiology (gallstone/alcohol/idiopathic), %	PFC infection, *n* (%)	PFC Location (head, uncinate/body, tail),[a] *n*
Lee et al. (2014)[12]	Korea	2012/01–2013/05	DPS	25	8.9 ± 4.0	51.6 ± 14.0	19 (76%)	NA	8 (32%)	8/17
			mFCSEMs	25	8.4 ± 2.5	53.7 ± 14.6	22 (88%)		11 (44%)	7/18
Bang et al. (2019)[15]	USA	2016/02–2017/03	LAMS	31	10.2 ± 4.6	55.8 ± 15.6	20 (64.5%)	29/19.4/38.7	27 (87%)	9/22
			DPS	29	10.7 ± 6.8	60.3 ± 13.0	16 (55.2%)	17.2/34.5/41.4	26 (89.7%)	6/23
Kakadiya et al. (2023)[25]	India	2020/08–2021/07	LAMS	24	13.7 ± 3.5	35.4 ± 11.8	18 (75%)	41.7/37.5/20.8	NA	NA
			DPS	24	11.4 ± 3.4	38.2 ± 12.7	20 (83%)	41.7/41.7/12.5		
Karstensen et al. (2023)[14]	Denmark	2019/08–2022/02	LAMS	20	29.7 (18.7–31.4)[b]	59.4 ± 13.0	15 (75%)	70/25/5	19 (95%)	6/19
			DPS	22	21.5 (19.9–28.3)[b]	61.1 ± 14.3	17 (77%)	45.5/22.7/9.1	17 (77.3%)	5/16

Abbreviations: DPS, double pigtail plastic stent; LAMS, lumen-apposing metal stentl; mFCSEMS, modified fully covered self-expanding metal stent; NA, not available; PFC, pancreatic fluid collection.

[a]Some patients had pancreatic necrosis in multiple locations.

[b]Data are presented in terms of median (25th percentile–75th percentile) values.

TABLE 2 Summary of clinical outcomes in the included studies.

First author (publication year)	Gruop	Treatments success, *n* (%)	Mortality, *n* (%)	Adverse events, *n* (%)	Duration of procedure (min), median (IQR)	Recurrence, *n* (%)	Length of hospital stay (days), mean ± SD
Lee et al. (2014)[12]	DPS	20/23 (87.0%)	0/25 (0%)	2/25 (8.0%)	29.5 (23.5–42)	0/22 (0%)	NA
	mFCSEMs	20/22 (90.9%)	0/25 (0%)	0/25 (0%)	15.0 (12.5–19.5)	1/23 (4.5%)	
Bang et al. (2019)[15]	LAMS	29/31 (93.5%)	0/31 (0%)	13/31 (41.9%)	15 (3–63)	1/31 (3.2%)	6.2 ± 9.0
	DPS	28/29 (96.6%)	0/29 (0%)	6/29 (20.7%)	40 (10–115)	0/29 (0%)	12.2 ± 21.1
Kakadiya et al. (2023)[25]	LAMS	22/24 (91.6%)	1/24 (4.1%)	1/24 (4.1%)	30 (28–54)	1/24 (4.1%)	8.5 (2–50)[a]
	DPS	23/24 (95.8%)	0/24 (0%)	1/24 (4.1%)	59 (36–67)	0/24 (0%)	5 (1–31)[a]
Karstensen et al. (2023)[14]	LAMS	18/20 (94.7%)	1/20 (5%)	1/20 (5%)	13.1 (3–22)	NA	58 (40–86)[a]
	DPS	21/22 (95.5%)	1/22 (4.5%)	4/22 (18.2%)	23.8 (15–41)		43 (40–67)[a]

Abbreviations: DPS, double pigtail plastic stent; LAMS, lumen-apposing metal stentl; mFCSEMS, modified fully covered self-expanding metal stent; NA, not available.

[a]Data are presented in terms of the median (25th percentile–75th percentile) values.

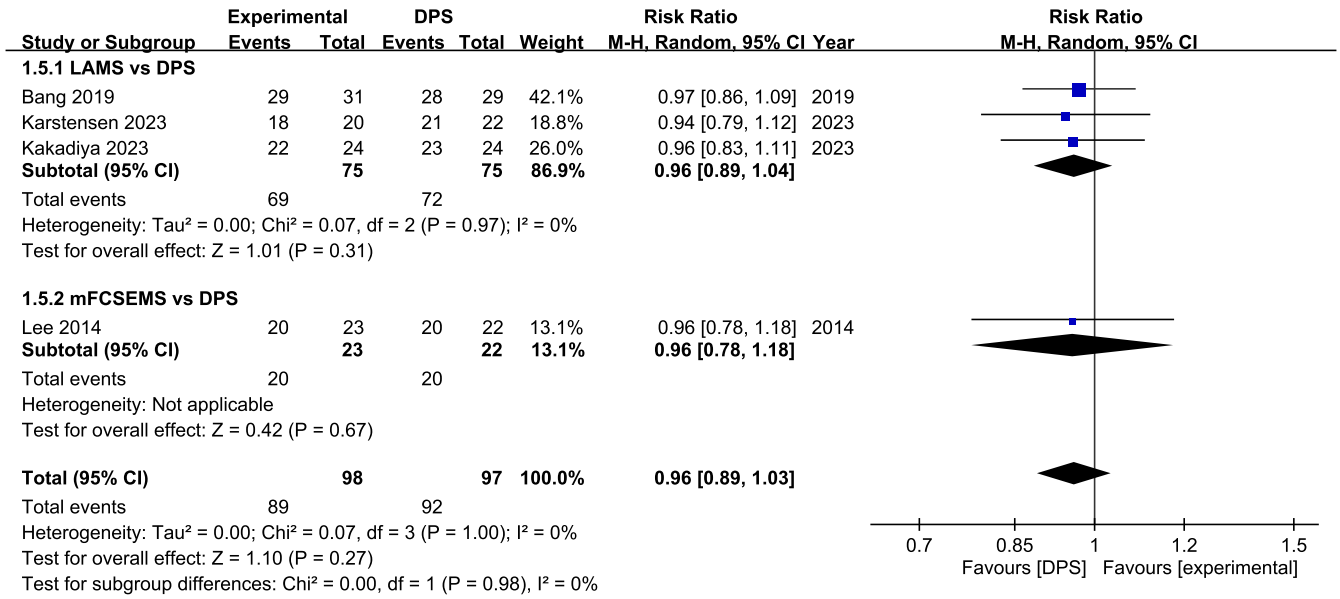

FIGURE 2 Comparisons of clinical success between LAMSs and DPSs and between mFCSEMSs and DPSs. DPS, double pigtail plastic stent; LAMS, lumen-apposing metal stent; mFCSEMS, modified fully covered self-expanding metal stent.

In the network meta-analysis for the rate of clinical success, the surface under the cumulative ranking curve values were 0.73, 0.53, and 0.24 for LAMSs, mFCSEMSs, and DPSs, respectively (Figure 3). No significant difference was observed between DPSs and LAMSs (odds ratio [OR]: 2.11; 95% CI: 0.51–8.78) or between mFCSEMSs and LAMSs (OR: 1.41; 95% CI: 0.13–15.06). Moreover, an indirect comparison of LAMSs with mFCSEMSs revealed no significant between-stent difference in the rate of clinical success (OR: 1.41; 95% CI: 0.13–15.06) (Figure 4).

3.6 | Secondary outcomes

The network meta-analysis revealed that the rate of adverse events was the lowest for mFCSEMSs (Figure S5). However, the direct meta-analysis indicated no significant difference in the rate of adverse events between LAMSs and DPSs (RR: 0.57; 95% CI: 0.09–3.61) or mFCSEMSs and DPSs (RR: 0.19; 95% CI: 0.01–3.78; Figure 5).

All of the four included RCTs reported data on mortality. Notably, no relevant patient death was reported by

Lee et al.,[12] the only research group that compared mFCSEMSs with DPSs. In the remaining three RCTs, which compared LAMSs and DPSs, no significant between-stent difference was observed in the rate of all-cause mortality (RR: 1.68; 95% CI: 0.22–13.11; $I^2 = 0\%$; Figure S2).

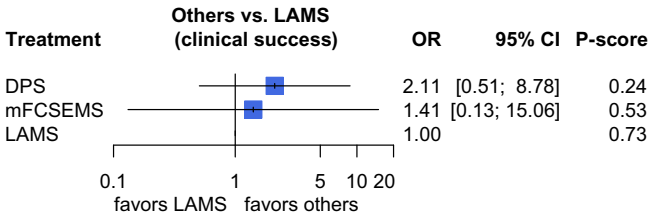

FIGURE 3 Results of our network meta-analysis for the rate of clinical success. DPS, double pigtail plastic stent; LAMS, lumen-apposing metal stent; mFCSEMS, modified fully covered self-expanding metal stent.

Three RCTs with a total of 150 participants compared the length of hospital stay between patients receiving an LAMS and those receiving a DPS; the results are presented in Figure S3. No significant between-stent difference was observed despite a high level of heterogeneity (mean difference: −4.82; 95% CI: −16.49 to 6.86; $I^2 = 89\%$).

The *P*-scores for the durations of procedures performed using LAMSs, mFCSEMSs, and DPSs were 0.85, 0.61, and 0.04, respectively (Figure S4). In terms of direct estimates, the duration of procedure using LAMS and mFCSEMS was significantly shorter compared to DPS. There is no significant difference between LAMS and mFCSEMS in the indirect estimate.

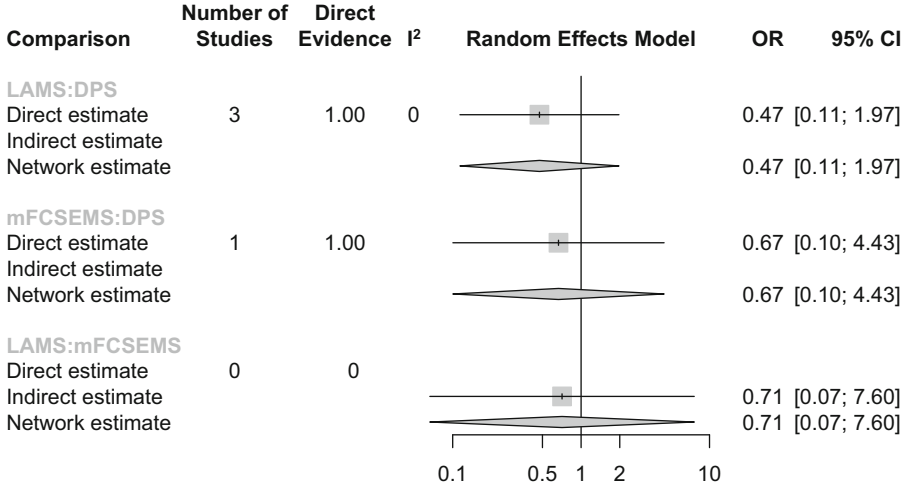

FIGURE 4 Direct and indirect estimates of the rate of clinical success. DPS, double pigtail plastic stent; LAMS, lumen-apposing metal stent; mFCSEMS, modified fully covered self-expanding metal stent.

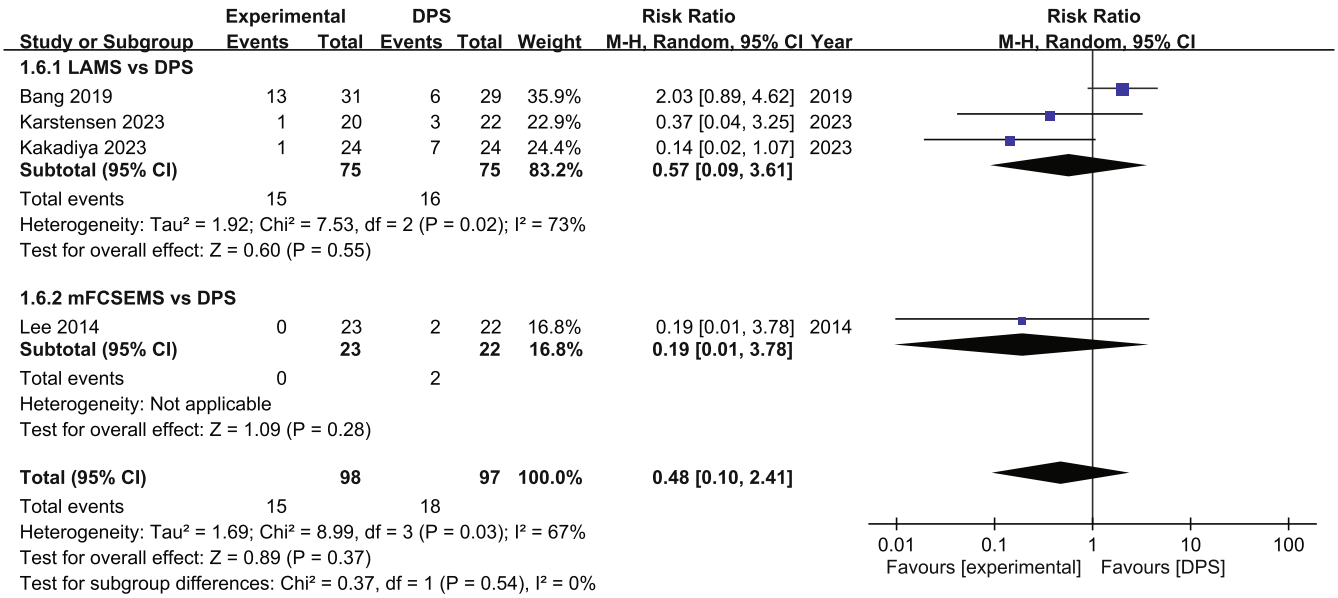

FIGURE 5 Comparisons of adverse events between LAMSs and DPSs and between mFCSEMSs and DPSs. DPS, double pigtail plastic stent; LAMS, lumen-apposing metal stent; mFCSEMS, modified fully covered self-expanding metal stent.

Because Lee et al.[12] did not present data on the length of hospital stay, we could not perform a network meta-analysis to estimate the hospitalization costs associated with various stents.

4 | DISCUSSION

We conducted a network meta-analysis of four RCTs (200 patients) to compare various drainage stents for necrotizing pancreatitis and PFCs in terms of their safety and efficacy.[12,14,15] Our findings revealed that the rate of clinical success was the highest for DPSs, whereas the rate of adverse events was the lowest for mFCSEMSs.

4.1 | Study significance and implications

mFCSEMSs were initially designed for patients with biliary strictures. However, from 1996 onward, these stents have been used for draining PFCs in patients with acute necrotizing pancreatitis.[26,27] Because of the relatively large diameter of mFCSEMSs, which allows for effective drainage of pus, these stents are regarded as alternatives for DPSs. However, mFCSEMSs are not specifically designed for the drainage of necrotic collection from necrotizing pancreatitis, and their use has been associated with the risks of stent migration, bleeding, and perforation. To address these concerns, biomedical researchers developed LAMSs. The aforementioned three types of stents have their own advantages and disadvantages. However, no network meta-analyses of only RCTs have compared these stents, which prompted us to conduct the present study.

We observed favorable outcomes with all three stents, each having its own advantages. The stent diameter is larger for mFCSEMSs than for DPSs; the large diameter enhances drainage efficacy and stent patency while avoiding tube occlusion and reintervention, thereby reducing the risk of secondary infections.[28] Although the between-stent difference in the risk of adverse events was nonsignificant, mFCSEMS use was associated with fewer adverse events. Evidence suggests a high rate of stent migration with mFCSEMSs, which likely increases the rate of perforation.[29] However, consistent with a previous study,[16] our network meta-analysis revealed that the rate of adverse events was the lowest with mFCSEMSs. This finding may be attributable to the fact that the only RCT using mFCSEMSs used devices with bilateral 90° angulation flanges. This design prevents the migration of the stent and subsequently reduces the risk of perforation and associated complications.[30] The simple technique, coupled with a short procedure duration, reduces the risk of periprocedural adverse events.

None of the four RCTs performed a direct head-to-head comparison of LAMSs with mFCSEMSs. However, an indirect comparison revealed that the rate of clinical success was similar between mFCSEMSs and LAMs but that of adverse events was lower for mFCSEMS than for LAMSs. Both stents ensure a large fistula size for drainage. Within the precise range of fistula size, a larger hole may lead to more bidirectional shift of food materials between the enteric cavity and PFC cavity, thereby increasing the risk of secondary cystic infection.[16] The optimal fistula sizes for drainage and necrosectomy remain to be determined.

The rates of adverse events and clinical success were lower with LAMSs than with DPSs. The low rate of adverse events may be explained by between-procedure differences. The advantage of LAMSs lies in their one-step deployment, which reduces the duration of endoscopy, dose, and duration of sedatives, and risk of the pancreas being pushed aside during the procedure (leading to perforation). The larger diameter of LAMSs ensures more effective drainage and allows for future necrosectomy, which helps prevent tube occlusion and subsequent reintervention.

In meta-analyses, conclusions can only be drawn after careful consideration of between-study heterogeneity. Methodologically, heterogeneity was estimated by evaluating the risk of bias in each study (Table S6). As for clinical heterogeneity, minor between-study differences were observed in demographic characteristics, such as patient age, patient sex, and pancreatitis etiology. Kakadiya et al.[25] enrolled younger patients. Between-study differences were noted in the prevalence of comorbidities and preprocedural systemic inflammatory response syndrome. The RCTs also differed in terms of PFC characteristics. Although the RCTs mostly included patients with WONs, the RCT by Lee et al.[12] predominantly included those with pseudocysts. Furthermore, the RCTs reported a predominance of collections in the pancreatic body or tail; the PFCs were larger in the RCT by Karstensen et al.[14] than in other RCTs. For detailed information, see Table 1.

4.2 | Strengths and limitations

This study has several strengths. To the best of our knowledge, our study is the first to include a network meta-analysis of RCTs on between-stent comparisons. Although Park et al.[16] performed a network meta-analysis on this topic, the certainty of evidence was low because they included both observational studies and RCTs, which led to a high level of between-study heterogeneity. By contrast, we focused solely on RCTs, thereby minimizing systematic errors. Our findings align with

those of relevant studies, confirming that all three stents can ensure favorable clinical outcomes. This advantage provides endoscopists with additional choices when managing patients who cannot tolerate prolonged procedures or afford expensive devices.

Our study has some limitations. First, the small number of RCTs and the small size of the total cohort reduced the statistical power of our findings. However, in network meta-analyses, the ranks and tendencies of outcomes are crucial; nonetheless, future studies are needed to draw precise conclusions. Second, the limited number of RCTs might have introduced transitivity errors; the effect from the study by Lee et al.[12] was likely overestimated because it was the only study that compared DPSs with mFCSEMSs. Nevertheless, The alignment between our findings and those of observational studies demonstrates a compelling trend. Third, although all patients had symptomatic PFCs, PFCs encompass a spectrum of conditions ranging from noninfective pseudocysts to WONs. Thus, caution must be exercised when applying our findings to patients with specific PFCs, particularly those with relatively severe conditions, such as WONs due to necrotizing pancreatitis. Fourth, even when a specific type of stent is used, stent length, diameter, and flange vary across brands. Different stent designs may lead to different outcomes and adverse events, which should be considered before intervention. Finally, we graded the certainty of evidence for all study outcomes as "low" to "very low," primarily attributable to the methodological weaknesses and small sample sizes of the included RCTs. Systematic reviews should be conducted at regular intervals to update the literature with findings from latest RCTs on this crucial topic.

4.3 | Conclusion

In summary, all three types of stents have a high clinical success rate in the treatment of necrotizing pancreatitis, but the rate of complications is lowest with mFCSEMS, and the procedure time is shortest with LAMS. Clinicians can choose the most suitable stent drainage based on the patient's physical condition and disease severity. More RCTs are needed to validate this conclusion.

AUTHOR CONTRIBUTIONS

Study design: XWL, CHW, and LCL. *Methodology*: XWL and CHW. *Data extraction*: XWL, CS, and LYL. *Data verification*: SWC, CCH, and CHW. *Data and statistical analyses*: XWL, KS, CS, and CJJ. *Study quality and risk-of-bias assessments*: CHW, CS, and LCL. *Writing—original draft preparation*: XWL, CHW, and CYH. *Writing—review and editing*: LCL. All authors have read and approved the final version of the manuscript.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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