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Application of Dural Suturing in Reconstruction of Sellar Floor for Cerebrospinal Fluid Leakage During Neuroendoscopic Intranasal Approach Surgery: A Meta-Analysis

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ABSTRACT

AIM: To assess the safety and efficacy of utilizing dural suturing as an adjunctive procedure for saddle floor reconstruction in patients undergoing endoscopic surgery in the sellar region.

MATERIAL and METHODS: According to the PRISMA guidelines, we searched the literature on sellar floor reconstruction in endoscopic sellar surgery. Fixed- or random-effects meta-analysis was used to pool the rate of return to postoperative cerebrospinal fluid (poCSF) leakage, repair operations, postoperative hospitalization, complete resection, infection, lumbar drainage (LD), and operative duration.

RESULTS: A total of six studies involving 723 participants were included in the current meta-analysis. The pooled results demonstrated that patients in the dural suturing group had a lower incidence of poCSF leakage [odds ratio (OR), 0.18; 95% confidence interval (CI), 0.07 – 0.44; p=0.0002] and repair operation [OR, 0.24; 95% CI, 0.07 – 0.78; p=0.02], as well as a shorter hospitalization period [standardized mean difference (SMD), -0.45; 95% CI, -0.62 – -0.28; p<0.00001]. There was no significant difference between the two groups in terms of the complete resection [OR, 1.06; 95% CI, 0.62 – 1.80; p=0.84], postoperative infection [OR, 0.49; 95% CI, 0.21 – 1.15; p=0.10] and lumbar drainage (LD) [OR, 0.28; 95% CI, 0.06 – 1.23; p=0.09]. Additionally, the dural suturing group may require a longer operative duration [SMD, 0.29; 95% CI, 0.02 – 0.56; p=0.03].

CONCLUSION: The results suggest that dural suturing can be advantageous in reducing postoperative complications and shortening postoperative hospitalization following neuroendoscopic surgery in the sellar region without increasing the risk of infection.

KEYWORDS: Neuroendoscope, Sellar base repair, Cerebrospinal fluid leak, Dural suture, Meta-analysis

ABBREVIATIONS: PoCSF: Postoperative cerebrospinal fluid, **NSF:** Nasal septal flap, **LD:** Lumbar drainage, **MeSH:** Medical Subject Headings, **OR:** Odds ratio, **NOS:** Newcastle-Ottawa Scale, **CI:** Confidence interval, **SMD:** Standard mean difference, **NETS:** Neuroendoscopic transsphenoidal surgery, I^2**:** I-square

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INTRODUCTION

The sellar region is an intricate anatomical area located at the cranial base that encompasses the pituitary gland and adjacent structures (17). Surgical interventions in this region require a high degree of precision and accuracy to prevent adverse sequelae (25). Saddle floor reconstruction is a critical surgical procedure aimed at restoring the structure and function of bony and soft tissues in the saddle region to prevent cerebrospinal fluid leakage and bleeding. Recent advances in technology and surgical techniques have led to significant progress in this field (19).

In recent years, the use of the neuroendoscope has gained widespread acceptance as a surgical tool for treating skull base lesions (23). This tool offers numerous advantages, including low invasiveness, clear visual fields, and panoramic visualization (18). Neuroendoscopic transsphenoidal surgery (NETS) is a promising technique that involves inserting an endoscope via the nasal cavity to access the sellar region. Compared to traditional open surgery, NETS is less invasive, offers a clear view of the surgical site, and reduces the risk of complications. Consequently, it has become the preferred surgical technique for treating pituitary tumors and other complications in the sellar region (3).

However, postoperative cerebrospinal fluid (CSF) leakage remains a significant concern (2,5,7). Recent advancements in materials, implants, and surgical techniques, such as computer-assisted surgery (CAS), have significantly improved the efficacy of saddle floor reconstruction. The available reconstruction methods for saddle floor repair include autologous fat transplantation and tamponade, abdominal or thigh fascia transplantation, and nasal septal flap (NSF) repair. Some studies suggest that dural suturing is an essential component of skull base reconstruction, and tight dural suturing significantly reduces the incidence of postoperative cerebrospinal fluid leakage and related complications. For instance, Xue et al. demonstrated that dural suturing significantly decreased the incidence of postoperative cerebrospinal fluid leakage (24). Additionally, Liu et al. reported that dural suturing was effective in reducing postoperative hospitalization and the use of lumbar drainage; however, they did not find a statistically significant difference in patients with poCSF leakage (13).

The safety and efficacy of utilizing dural suturing as an adjunct to saddle base reconstruction in patients undergoing endoscopic surgery in the saddle area remains uncertain as there is currently no consensus in the clinical literature. Therefore, we conducted a meta-analysis to evaluate the effectiveness and safety of dural suturing in preventing postoperative complications in the saddle area.

MATERIAL and METHODS

The research protocol for the present study was recorded in the Reporting Items for Systematic Reviews and Meta-Analyses (PROSPERO) registry. The study was conducted in accordance with the PRISMA statement (12) for reporting systematic reviews and meta-analyses, and we followed the Meta-Analyses of Observational Studies (MOOSE) standards (22) for conducting and reporting meta-analyses of observational studies. Notably, ethical approval was not deemed necessary for this meta-analysis.

Search Strategy

To identify studies that met the eligibility criteria for inclusion in our analysis, we conducted a comprehensive search in several electronic databases, including PubMed, Embase, Scopus, Cochrane, China National Knowledge Infrastructure (CNKI), VIP, WFSD, and the Chinese Biomedical (CBM). The search spanned from the inception dates of the databases up to December 1, 2022. We used various combinations of medical subject headings (MeSH) and non-MeSH terms related to neuroendoscopy, sellar floor reconstruction, and dural suturing to retrieve relevant studies. Additionally, we tailored retrieval strategies to each specific database to ensure comprehensive coverage of relevant literature. This methodology involved three main steps: 1) a thorough examination of the reference lists of all pertinent studies, 2) a manual search of key journals and abstracts from major annual conferences in the field, and 3) contacting experts to obtain any potential unpublished data. It is worth noting that the investigators independently performed the primary search, and any inconsistencies were resolved through consultation with an investigator who was not involved in the initial procedure.

Eligibility Criteria

The following eligibility criteria were applied: 1) study design: retrospective investigation; 2) participation: patients with lesions located in the sellar region and peripheral regions who underwent endoscopic surgery and experienced varying degrees of cerebrospinal fluid leakage during surgery; 3) intervention type (primarily depends on the suturing of the artificial dura mater): utilization of artificial dura mater and other repair materials, including free flaps, bioprotein glue, and autologous fascia lata, for reconstructing the saddle floor; and (4) primary outcome measures: poCSF leakage, LD, and repair operation or postoperative hospitalization.

Exclusion Criteria

The exclusion criteria were as follows: 1) studies lacking source data (i.e., reliable and complete information on the variables under investigation); 2) participants with a history of mental health issues, pregnancy, hemorrhagic shock, life-threatening systemic damage, cardiac arrest, and severe illness as these factors may affect the study outcomes and introduce confounding variables; and 3) literature based on case studies, animal experiments, and research techniques that did not include dural suturing and other indicators of study outcomes.

Quality Assessment

Two independent reviewers assessed the quality of retrospective studies in a meta-analysis using the Newcastle-Ottawa Scale (NOS) (21). The assessment was based on three key domains: the selection of study groups (scored 0 – 4), comparability (scored 0 – 2), and assessment of outcomes (scored 0 – 3), with a maximum total score of 9. A score of 8 or above was indicative of a low risk of bias, a score of 6 – 7 suggested a moderate risk of bias, and a score of less than 5 indicated a high risk of bias.

Data Extraction

The study employed a pre-constructed data extraction form, and two reviewers, W.M.L. and Y.W.D., independently extracted the data. In cases of disagreement, a third reviewer, H.Z.Z., was consulted to settle disputes. If data were incomplete, assessors endeavored to contact the principal author of the study to gather and authenticate the data, when possible.

Statistical Analysis

This study was conducted to combine data from studies reporting event rates in patients treated with dural suturing versus standard medical treatment. The odds ratio (OR) with associated 95% confidence intervals (CI) was used as the measure of effect. Given the possibility of inconsistency in the result unit, measurement method, or acquisition time across studies, continuous outcomes were expressed as mean values and standard deviations and were analyzed using the standard mean difference (SMD) with 95% CI. We used fixed- and random-effect models with the inverse-variance method to synthesize the overall effect size (1). Statistical significance was determined using the equivalent Z-test, with a p-value<0.05 considered significant. We assessed heterogeneity among studies using the Cochran Q test with a significance level of p<0.1 and quantified it using the I^2 statistic. An I^2 value less than 50% represented low heterogeneity, 50% – 75% represented moderate heterogeneity, and greater than 75% represented significant heterogeneity (9). All statistical analyses were performed using RevMan 5.4.

RESULTS

Study Selection

According to the search strategy described above, a total of 1,644 relevant studies were retrieved, and after removing 530 duplicate articles, 1,114 studies remained. After screening the titles and abstracts, 706 studies were excluded as they did not meet the inclusion criteria. The remaining 402 articles underwent a full-text evaluation for eligibility and were further screened based on the exclusion criteria. Finally, six studies (four published in English and two in Chinese) met the inclusion criteria (Figure 1) (6,11,13,15,24,26).

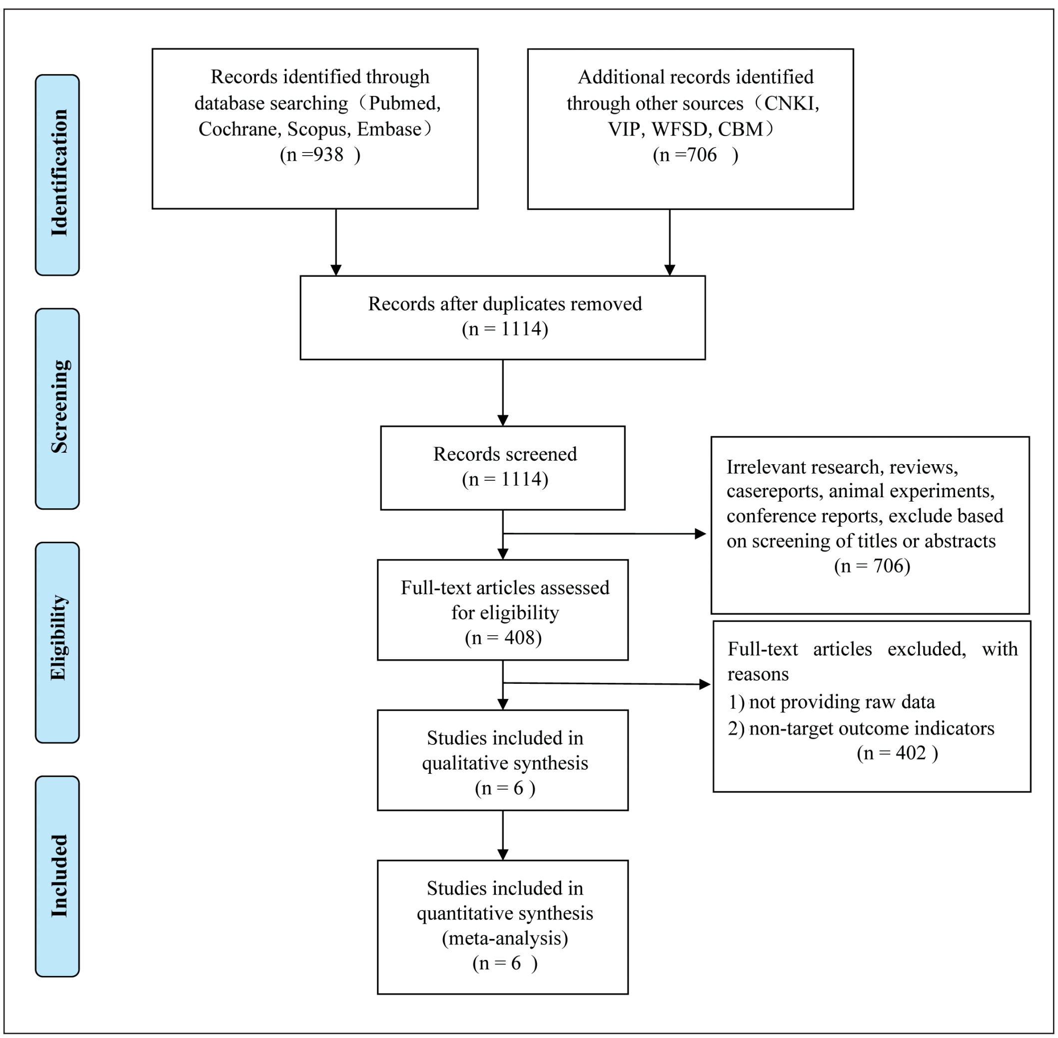

Figure 1: The literature screening process.

Study Characteristics and Patient Demographics

Six studies were ultimately included in the analysis, all of which were based on retrospective research. Overall, 329 and 395 patients underwent reconstruction of the sellar floor with and without dural suturing, respectively. Five studies reported the impact of dural suturing on patients with CSF leakage during neuroendoscopic transnasal surgery. Five studies reported the effect of dural suturing on surgical time. The poCSF leakage, the ratio of LD, the ratio of repair operations, operative duration, and hospitalization were comparable between the intervention and control groups ($p>0.05$). There was no significant difference in the rate of the tumor complete resection and postoperative infection between the two patient groups ($p<0.05$). Tables I and II summarize the included studies' features.

Risk of Bias Assessment of Included Studies

Among the six retrospective studies, three were deemed to have a low risk of bias, indicating high quality. Two were rated as having a moderate risk of bias, also indicating high quality. Finally, one was considered to have a high risk of bias, indicating low quality. Table III presents the bias assessment results. Overall, the literature included in this study was generally less biased and of relatively high quality.

Table I: Materials and Methods of Sellar Floor Reconstruction in Suture Repairment Group and Non Suture Repairment Group

Study	Design	Grade of CSF leak*	Operative techniques	
			Suture	**Control**
Zhou et al. 2022 (26)	RS*	1-2	Grade 1 1) Collagen sponge 2) Dural suture 3) Artificial dura Grade 2 1) Intrasellar fat graft 2) Artificial dura 3) Dural suture 4) PNSF* 5) Iodophor gauze packing	Grade 1 1) Collagen sponge 2) Artificial dura Grade 2 1) Intrasellar fat graft 2) Artificial dura 3) PNSF 4) Iodophor gauze packing
DG et al. 2022 (6)	RS	2	1) In situ bone-membrane Mosaic 2) Dural suture	1) Artificial meninges and thigh fat 2) Fascia lata, PNSF and absorbable cotton
Liu et al. 2022 (13)	RS	1-3	1) Autologous fascia or fat, artificial meninges 2) Fibrin glue, gelatin sponge material 3) Autologous fat, artificial meninges 4) Dural suture	1) Autologous fascia or fat, artificial meninges 2) Fibrin glue, gelatin sponge material 3) Autologous fat, artificial meninges
Xue et al. 2019 (24)	RS	3	1) Artificial dura 2) Continuous suture of dura and fascia lata 3) Fat patch, PNSF	1) Fat and muscle, artificial dura mater 2) Collagen sponge, fat mesh, free fascial graft 3) Fibrin glue, PNSF
LQ et al. 2022 (11)	RS	3	1) Artificial meninges, autologous fat 2) Autologous fascia lata 3) Dural suture 4) HB flap*	1) Artificial meninges, autologous fat 2) Autologous fascia lata 3) HB flap
Nishioka et al. 2009 (15)	RS	N*	1) Small bone fragments, fibrin glue 2) Dural suture	1) Fibrin glue 2) Cartilage or bone discs of the nasal septum

Grade of CSF leak: *Grade 0, Absence of cerebrospinal fluid leak, confirmedn by Valsalva maneuver. Grade 1, Small "weeping" leak, confirmed by Valsalva maneuver, without obvious or with only small diaphragmatic defect. Grade 2, Moderate cerebrospinal fluid leak, with obvious diaphragmatic defect. Grade 3, Large cerebrospinal fluid leak, typically created as part of extended transsphenoidal approach through the supradiaphragmatic or clival dura for tumor access.* ***RS:*** *Retrospective cohort study;* ***PNSF:*** *Pedicle vascular nasoseptal flap;* ***HB flap:*** *Hadad-bassagasteguy.* ***N:*** *Non mentioned.*

Table II: Specific Basic Characteristics of the Included Studies

Study (first author)	Design	Grade of leak*	Numbers		poCSF leakage*		Infection		LD*		Repair operation		Complete resection		Operative duration (min)		Postoperative hospitalization (day)	
			Suture	control	Suture	control	Suture	control	Suture	control	Suture	control	Suture	control	Suture	control	Suture	control
Lv, 2022 (26)	RS*	1-2	61	82	1	8	0	1	1	10	1	1	59	77	165.8 ± 75.9	156.3 ± 65.7	9 ± 3.5	11 ± 3.5
Gao, 2022 (6)	RS	2	108	63	1	1	2	2	3	2	N*	N	93	54	112.2 ± 22.4	108.3 ± 25.1	5.8 ± 1.8	6.5 ± 1.7
Liu, 2022 (13)	RS	1-3	55	79	1	6	0	3	1	9	0	5	50	69	144.1 ± 52.0	135.1 ± 56.8	5.8 ± 1.6	7.1 ± 3.9
Hai, 2019 (24)	RS	3	36	43	1	9	3	4	35	28	1	3	31	39	327.6 ± 78	395.8 ± 89.4	12 ± 8.4	13 ± 7.6
Qin, 2022 (11)	RS	3	32	28	2	8	3	6	10	25	1	6	26	24	N	N	11 ± 5.6	16 ± 5.6
Hiroshi, 2009 (15)	RS	N	37	99	N	N	N	N	N	N	N	N	N	N	148 ± 42	119 ± 37	N	N

**Data presented as mean or median.*
***poCSF leakage:** postoperative cerebrospinal fluid; **Grade of CSF leak:** Grade 1, small leak with no obvious diaphragmatic defect, Grade 2, moderate leak, Grade 3, large diaphragmatic or dural defect. **LD:** lumbar drainage; **RS:** Retrospective Cohort Study; **N:** the relevant content is not explained in the included articles.*

Table III: Risk of Bias Assessment for Non-Randomized-Controlled Trials

Domain	Assessment by outcome					
	Lv 2022 (26)	**Gao 2022 (6)**	**Liu 2022 (13)**	**Hai 2019 (24)**	**Qin 2022 (11)**	**Hiroshi 2009 (15)**
Bias due to confounding	Moderate risk	Low risk	Moderate risk	High risk	Moderate risk	High risk
Bias in selection of participants into the study	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk
Bias in classification of interventions	Moderate risk	Low risk	Moderate risk	Moderate risk	Moderate risk	Moderate risk
Bias due to deviations from intended interventions	No information	No information	No information	No information	No information	No information
Bias due to missing data	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk
Bias in measurement of outcomes	Low risk	Low risk	Low risk	Moderate risk	Low risk	Low risk
Bias in selection of the reported result	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk
Overall	Moderate risk	Low risk	Low risk	High risk	Moderate risk	High risk

Clinical Outcomes of Saddle Floor Reconstruction with or without Dural Suturing in Patients with Cerebrospinal Fluid Leak in Neuroendoscopic Transnasal Surgery

Comparison of Postoperative Cerebrospinal Fluid Leaks

Five studies (6,11,13,24,26) reported poCSF leakage in patients between the dural suturing group and the control group (n=292 vs. 295). We used OR to estimate the difference in poCSF leakage between the two groups of patients (Figure 2A). Heterogeneity tests showed no significant differences among the studies ($Chi^2 = 0.98$, $I^2 = 0\%$, p>0.1); thus, a fixed-effect model was used. The pooled OR was 2.44 (OR, 0.18; 95% CI, 0.07 – 0.44; p=0.0002), indicating that the incidence of poCSF leakage in patients who received dural suturing was significantly lower than that in the control group.

Comparison of Postoperative Repair Operations

We examined four studies (11,13,24,26) to assess the efficacy of postoperative repair operations in patients who received dural suturing in comparison to those in the control group (n=184 vs. 232). We employed OR to estimate the differences in the incidence of postoperative repair operations between the two groups (Figure 2B). Heterogeneity testing revealed small variations among the studies ($Chi^2=2.23$, $I^2=0\%$, p>0.1); thus, we used a fixed-effects model. The pooled OR was calculated to be 0.24 (OR, 0.24; 95% CI, 0.07 – 0.78; p=0.02), suggesting that the probability of postoperative repair operations was potentially lower in patients who underwent dural suturing compared to those in the control group. These findings provide important insights into the effectiveness of dural suturing in reducing the incidence of postoperative repair operations in patients.

Comparison of Postoperative Hospitalization Complete Resection, Infection, and Lumbar Drainage

Five studies (6,11,13,24,26) reported on postoperative hospitalization, complete resection, and infection between the suturing group and the control group (n=292 vs. 295). Postoperative hospitalization is a continuous variable, and we used the SMD to estimate the difference in postoperative hospitalization between the two groups. We utilized OR to estimate the difference in complete resection, infection, and LD between the two groups. Tests of heterogeneity showed non-uniform differences between studies, with fixed- and random-effects models applied to data with p>0.1 and p<0.1, respectively. The combined SMD for hospitalization was -0.45 (95% CI, -0.62 – -0.28; p<0.00001) (Figure 3A), the combined OR for complete resection was 1.06 (95% CI, 0.62 – 1.80; p=0.84) (Figure 3B), the combined OR for infection was 0.49 (95% CI, 0.21 – 1.15; p=0.10) (Figure 3C), and the combined OR for LD was 0.28 (random, 95% CI, 0.06 – 1.23; p=0.09) (Figure 3D), indicating that patients with dural suturing had

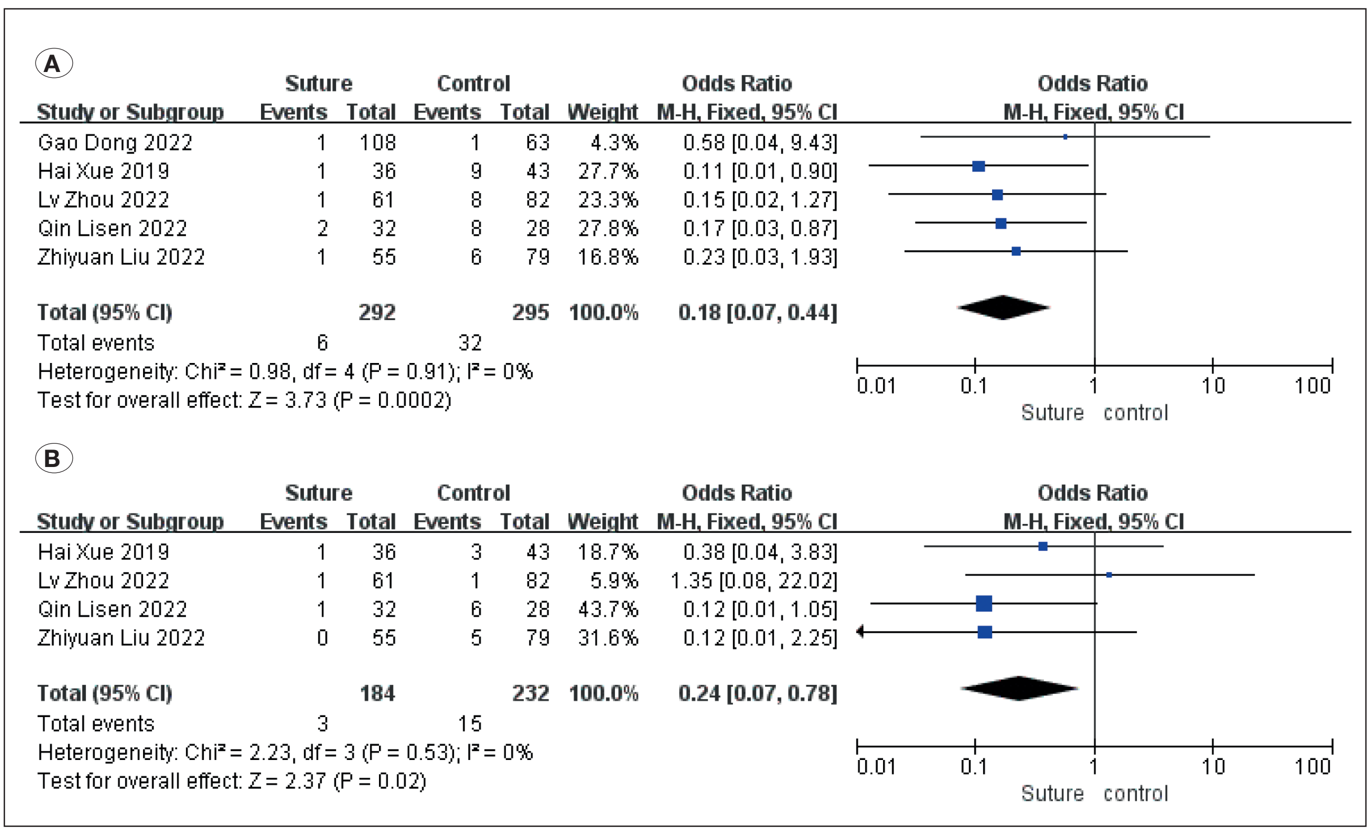

Figure 2: Forest chart comparing the postoperative primary clinical parameters between the dural suturing group and the control group in sellar floor reconstruction: **A)** Postoperative cerebrospinal fluid leakage; **B)** Postoperative re-repair. Significant differences were observed between the two groups.

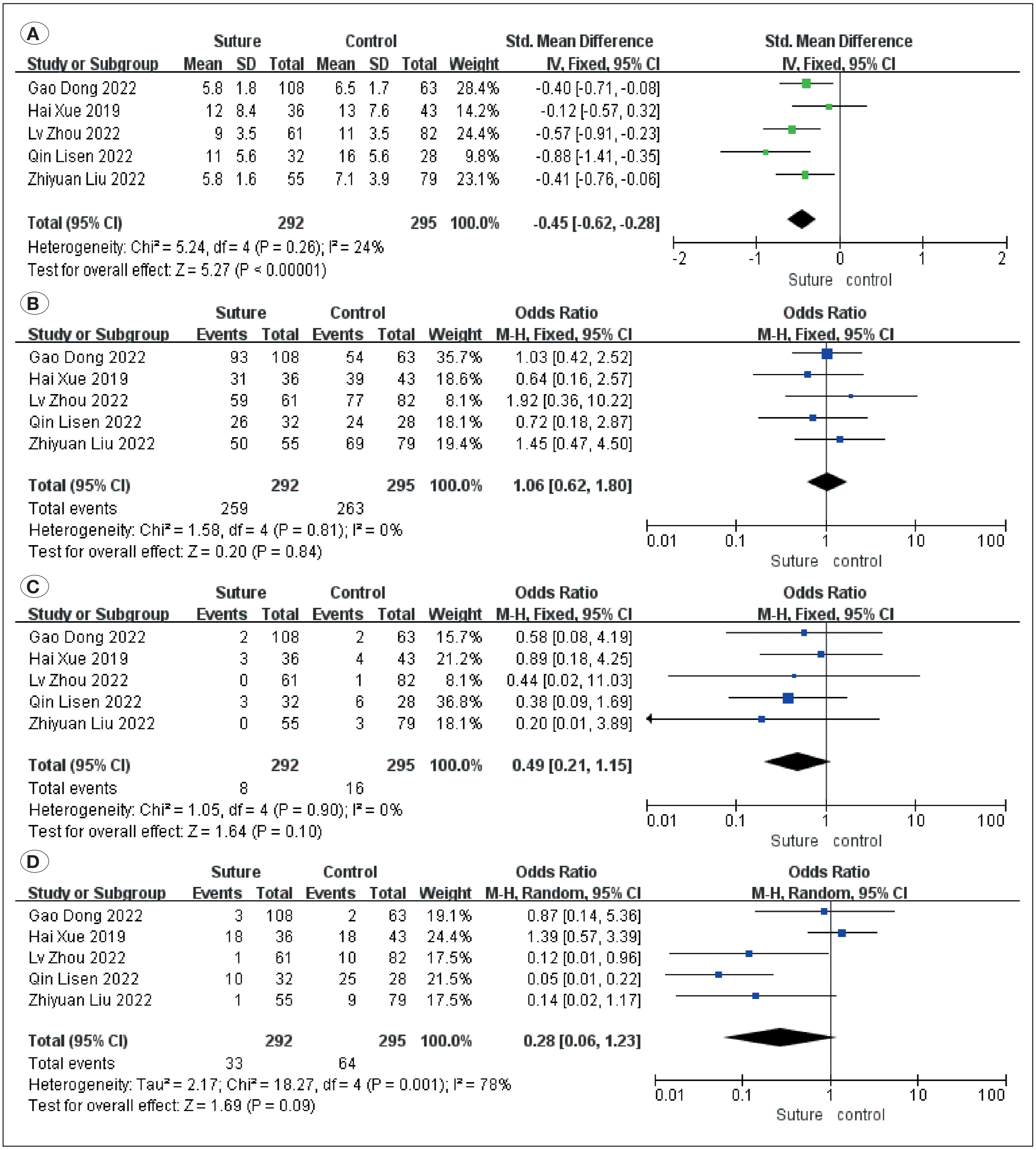

Figure 3: Forest plot comparing the main clinical outcomes after sellar floor reconstruction: **A)** Length of hospital stay; **B)** Total resection rate; **C)** Infection rate; **D)** Postoperative lumbar drainage. The length of hospital stay group showed significant differences, while the other groups showed no significant differences.

a shorter postoperative hospitalization. Meanwhile, there was no significant difference in complete resection, infection, and LD between the two patient groups.

Comparison of Operative Duration

Five studies (6,13,15,24,26) were conducted to compare operative duration between the dural suturing group and the control group (n=261 vs. 323). We used SMD to estimate the difference in operative duration between the two groups (Figure 4). The heterogeneity test indicated significant differences among the studies (Chi^2=7.33, I^2=59%, p<0.1); therefore, we employed a random-effects model. The sensitivity analysis using RevMan 5.4 indicated that Nishioka et al.'s study (15) had a large deviation, and excluding that data and combining the SMD yielded a value of 0.29 (95% CI, 0.02 – 0.56; p=0.03), suggesting that patients undergoing dural suturing may have longer operative duration than that of the control group.

Subgroup Analysis

Using subgroup analysis, this study investigated the effect of dural suturing on poCSF leakage and LD in patients with Grade 1 – 2 and Grade 3 leakage of CSF (Figure 5). The results of the subgroup analysis showed that the use of dural suturing in patients with Grade 1 – 2 CSF leaks during surgery had the potential to achieve a trend towards statistical differences in the prevention of poCSF leaks (OR = 0.22; 95% CI, 0.04 – 1.11; p=0.07). On the other hand, dural suturing in patients with Grade 3 leakage of CSF can effectively prevent postoperative CSF leakage (OR=0.14; 95% CI, 0.04 – 0.50; p=0.003). However, there was no significant difference in postoperative LD between patients with low to moderate flow CSF leakage or high flow CSF leakage who underwent dural suturing and those who did not (OR=0.34; 95% CI, 0.05 – 2.54; p=0.30); (OR=0.21; 95% CI, 0.02 – 2.59; p=0.22) (Figure 6).

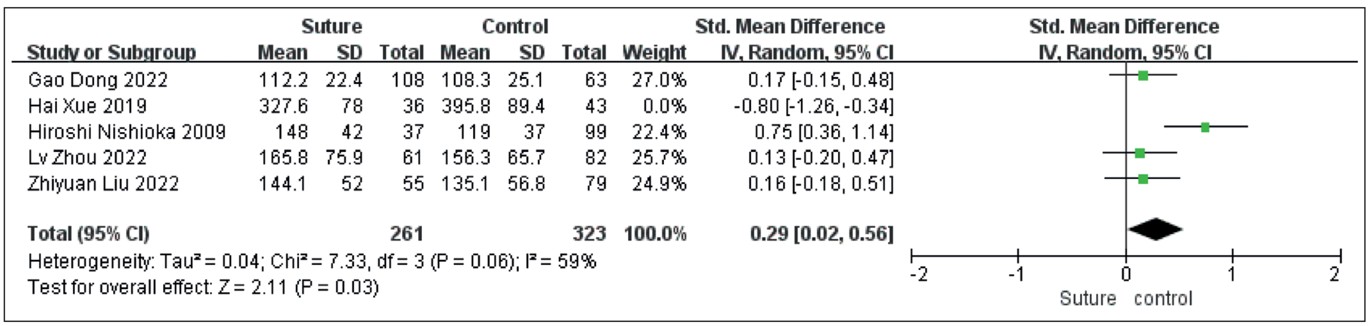

Figure 4: Forest plot comparing the length of surgery at sellar floor reconstruction: There was significant difference between the two groups.

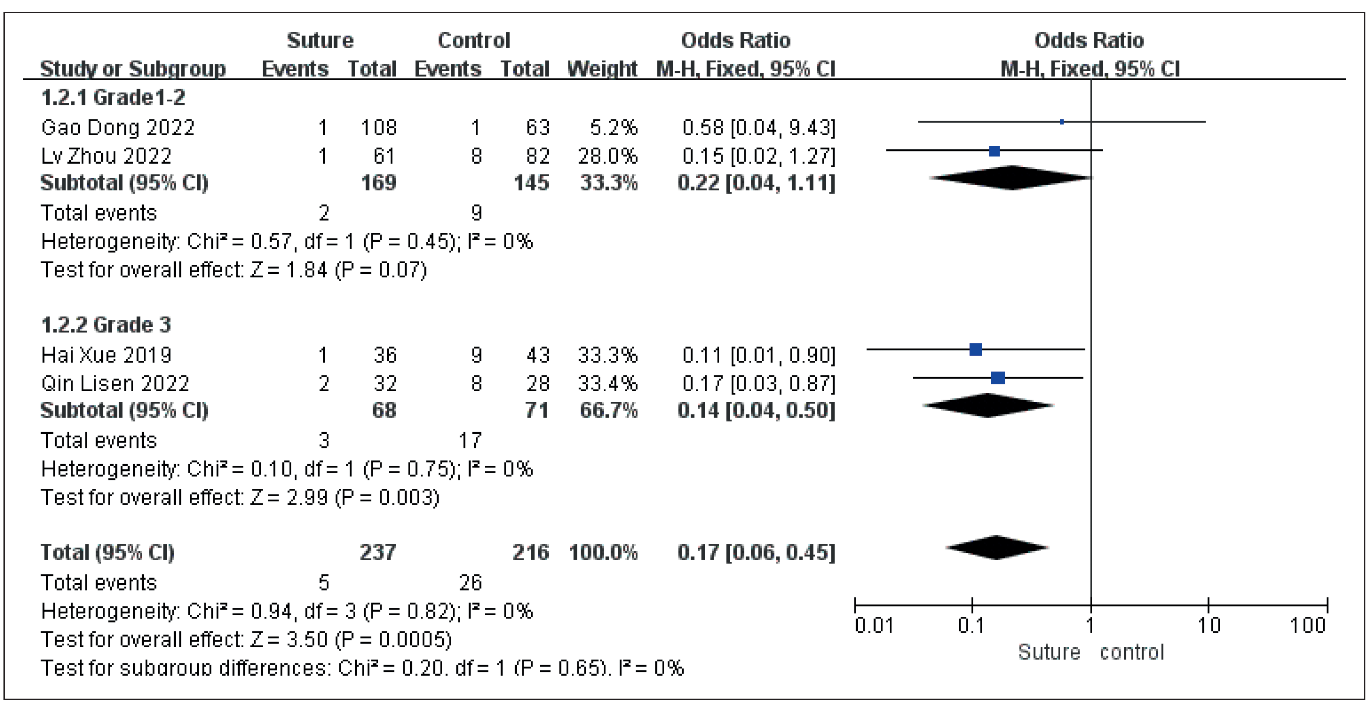

Figure 5: Forest plot comparing subgroup analyses of cerebrospinal fluid leakage after sellar floor reconstruction.

Sensitivity Analysis and Publication Bias

We evaluated the influence of each study on the combined SMD and OR values by sequentially removing individual studies. The results showed that only one study by Xue et al. (24) on operative duration significantly impacted the stability of the results (SMD=0.10; 95% CI, -0.31 – 0.51; p=0.64), and the stability of the other results did not change significantly (Figure 4). This confirmed the validity and reliability of the study. The funnel plot in Figure 7 did not show any significant publication bias. Therefore, the results of this study are statistically stable and reliable.

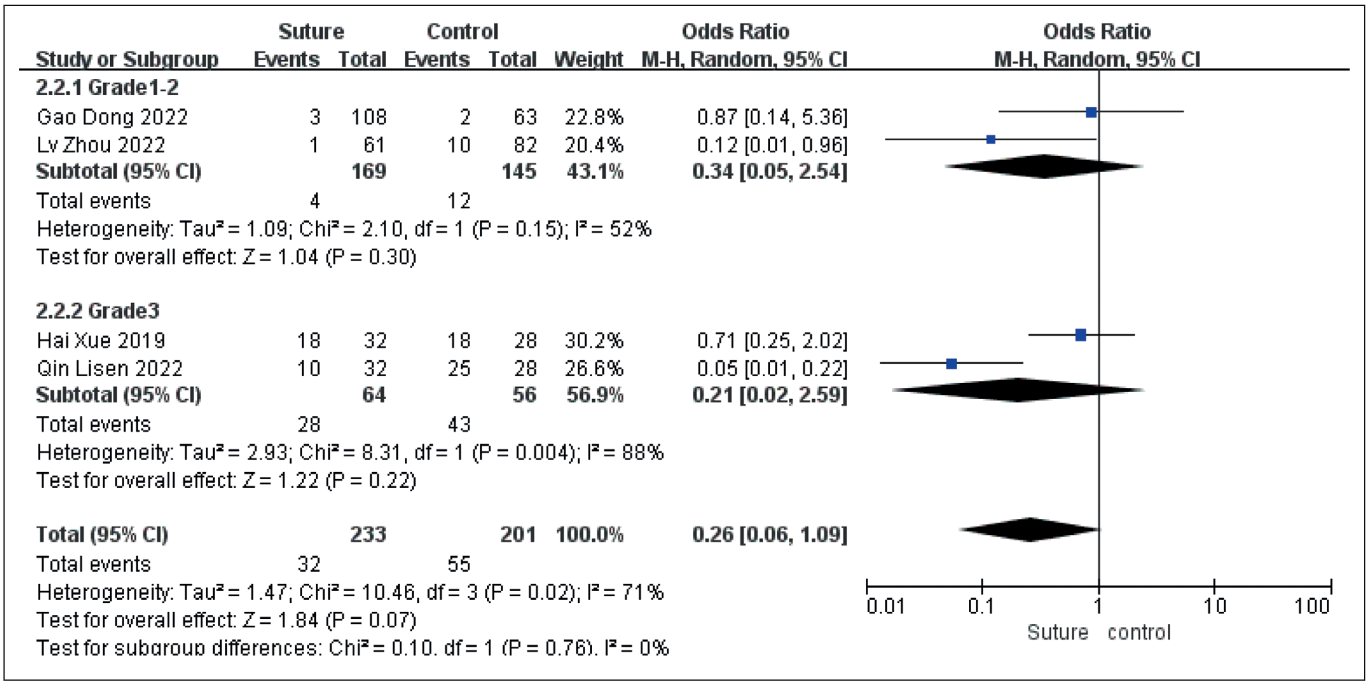

Figure 6: Forest plot comparing subgroup analyses of lumbar drainage after sellar floor reconstruction.

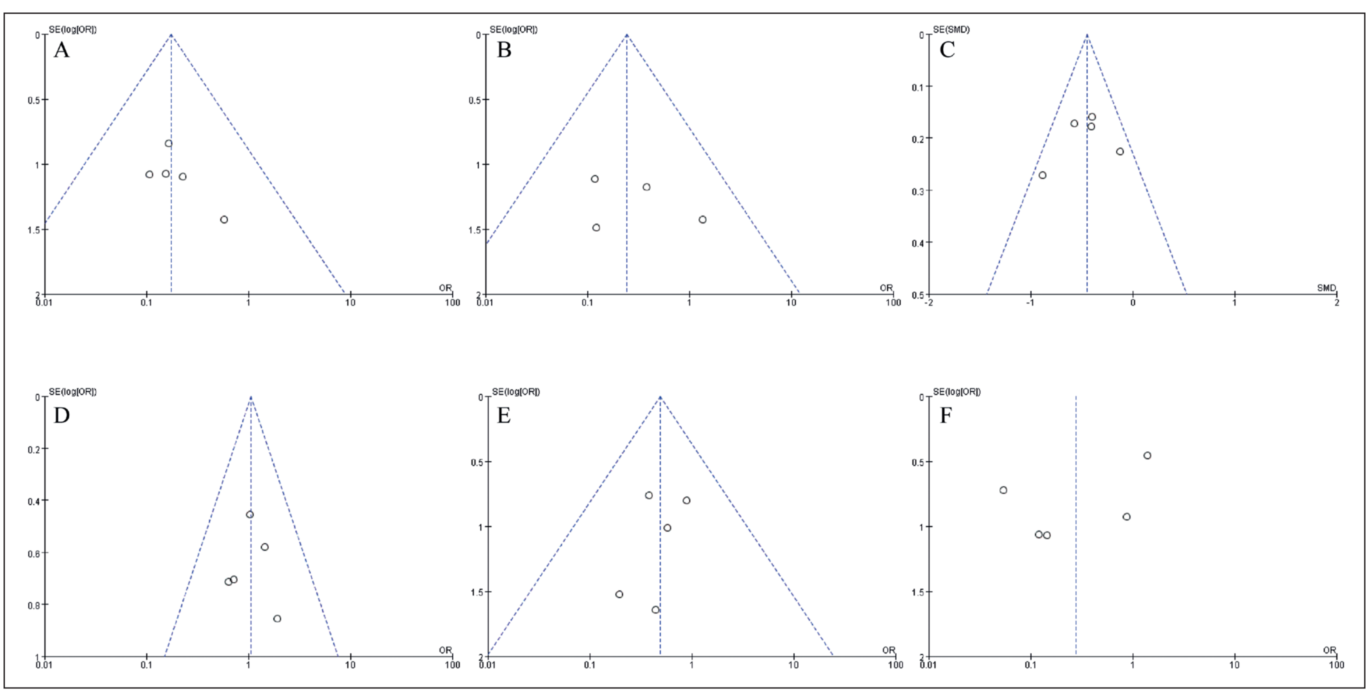

Figure 7: Detection of publication bias.

DISCUSSION

This study presents a meta-analysis that evaluates the safety and efficacy of using dural suturing as an adjunct to saddle base reconstruction. Our findings are summarized as follows. First, dural suturing was more beneficial for patients with poCSF leakage, repair operation, and postoperative hospitalization when compared to the control group. Second, there was no significant difference in the rate of total complete resection and postoperative infection among patients in the suture group. Third, there was a trend toward a statistical difference in postoperative LD, with final pooled p>0.05. Finally, the operative duration may have been higher in the sutured group than in the control group.

Surgery in the saddle area represents a significant challenge in the field of neurosurgery. Intraoperative and postoperative cerebrospinal fluid leakage and hemorrhage are common complications in this region (8,10,16). Saddle base reconstruction serves as the final stage of surgery in this region and scholars have modified and applied it in various ways. The basic principle of saddle floor reconstruction is a fine multilayered reconstruction. Specifically, it aims to provide rigid support for the saddle floor tissues to prevent herniation of brain tissue through the surgical channel and to close the cranial cavity, creating a physical barrier between the intracranial and extracranial regions to prevent cerebrospinal fluid leakage or retrograde infection. The incidence of postoperative cerebrospinal fluid leakage has been significantly reduced through continuous improvements in reconstruction techniques and repair materials. Autologous bone grafts, allogeneic bone grafts, fibrin glue, nasal septum flaps, fascia, adipose tissue, and artificial dura are among the materials commonly used in saddle base reconstruction (10). However, the use of these materials may have some adverse effects, including reduced postoperative nasal self-purification leading to empty nose syndrome and anosmia, long-term postoperative pain at the site of fascial acquisition, and the need for prophylactic lumbar drainage (4). The latter procedure is invasive and can lead to secondary infections. Moreover, it requires patients to remain in a supine position throughout the postoperative period, thus causing them significant inconvenience and pain (14).

Dural suturing has been shown to be a promising approach for minimizing dural defects, restoring the saddle floor in a more anatomically correct manner, and reducing the need for autologous or artificial materials, thereby mitigating the drawbacks associated with the above repair methods. In this article, numerous studies were searched to screen the final six retrospective controlled studies to assess the safety and efficacy of dural suturing as an adjunct to saddle base reconstruction in patients undergoing endoscopic surgery. A summary analysis of the dural suturing group compared to the control group, including the incidence of poCSF leakage and postoperative repair operation and operative duration, suggested significant differences between the two groups. Dural suturing was used as the final postoperative repair stage in the saddle area when resection of the lesion was complete, and the dural suture did not, as a matter of course, impact the patient's rate of complete surgical resection. Theoretically, if poCSF leakage was significantly lower in the dural suturing group than in the control group, there should be a statistical difference in postoperative infection and LD. However, when we pooled the analysis of postoperative infection rates and LD in patients between the two groups, we could only find data that tended to cause statistical differences (Figure 3D). This may be related to the small sample size, the longer operative time in the dural suturing group, and the longer exposure of the operative area to air. Many scholars believe that the technical difficulty of this procedure is primarily limited to the initial attempts and can be effectively mitigated with sufficient practice, resulting in the suture times being maintained within acceptable levels (6,13,15,24,26). This achievement can significantly decrease the duration of intraoperative exposure, which, in turn, may lower the likelihood of postoperative infection and limit the risk of LD, thus facilitating the patient's recovery (20,27).

The meta-analysis has several limitations. First, as it exclusively incorporates studies published in Chinese and English, it may be predisposed toward linguistic bias. Second, the meta-analysis's scope is restricted to only six studies, with a relatively small and inadequate sample, making further subgroup analyses challenging. Third, due to the limited data available, we were unable to fully examine the sources of heterogeneity, and some confounding variables may have contributed to it. For example, Nishioka et al.'s study (15) had fewer outcome indicators for patients undergoing saddle surgery, possibly resulting in bias. Fourth, the data's limitations precluded us from conducting a pooled analysis of the sensitivity and specificity of the indicators of interest.

CONCLUSION

This systematic review and meta-analysis have some limitations that may have affected the results. Nonetheless, it is the first meta-analysis investigating the effectiveness of dural suturing as an adjunctive technique in postoperative saddle floor reconstruction in the saddle area. The findings indicate that dural suturing can offer dependable protection of saddle floor structures leading to better patient prognosis and a reduction in postoperative complications. Consequently, this study provides new insights into the possible advantages and disadvantages of using dural suturing in this particularly clinical scenario.

AUTHORSHIP CONTRIBUTION

Study conception and design: WL, YWD

Data collection: WL, YWD

Analysis and interpretation of results: WL, YWD

Draft manuscript preparation: WL, YWD

Critical revision of the article: ZP, HZ

Other (study supervision, fundings, materials, etc...): WL, YWD

All authors (WL, YWD, ZP, HZ) reviewed the results and approved the final version of the manuscript.

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