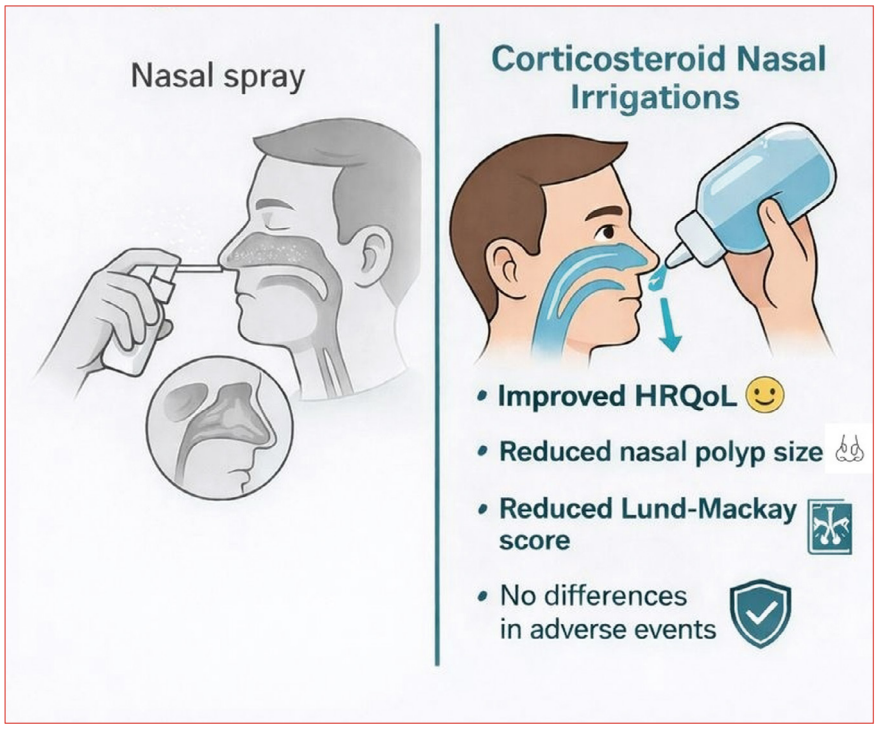
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Corticosteroid nasal irrigations *vs* sprays in chronic rhinosinusitis: a systematic review



Cover figure. Corticosteroid nasal irrigations improve health-related quality of life (HRQoL), reduce polyp size and Lund-Mackay scores, with no clear difference in adverse events compared with sprays in patients with chronic rhinosinusitis.

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Summary

Chronic rhinosinusitis (CRS) is a chronic inflammatory condition often treated with topical corticosteroids. While nasal sprays are standard, corticosteroid nasal irrigations may improve drug delivery and outcomes. Enhanced drug delivery in CRS is important because it promotes effective deposition of medication into the paranasal sinuses, thereby strengthening anti-inflammatory effects. This systematic review and meta-analysis, conducted per PRISMA guidelines and registered in PROSPERO (CRD420251053183), evaluated randomised controlled trials comparing corticosteroid nasal irrigations to sprays in adults with CRS. Six randomised controlled trials (RCTs) involving 370 participants were included. Irrigations significantly improved health-related quality of life compared to sprays (standardized mean difference [SMD] -0.62; 95% confidence interval [CI] -1.09 to -0.15; $p = 0.01$), particularly in patients with nasal polyps and those without prior endoscopic sinus surgery. Significant reductions were also observed in nasal polyp scores (MD -0.58; $p < 0.0001$) and Lund-Mackay radiologic scores (MD -1.79; $p = 0.01$). No significant differences were found in nasal endoscopy scores or adverse events. In conclusion, corticosteroid nasal irrigations are a safe and effective alternative to sprays for CRS management, offering better symptom control and objective improvements. Further studies are needed to refine delivery protocols, assess the cost-effectiveness of corticosteroid nasal irrigations versus sprays, and evaluate their relative efficacy in both nonsurgical and postsurgical patients, as well as in those with or without nasal polyps.

Keywords: chronic rhinosinusitis, meta-analysis, nasal irrigation, nasal spray, topical corticosteroids

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Introduction

Chronic rhinosinusitis (CRS) is a long-term inflammatory condition of the mucosal lining of the nasal passages and paranasal sinuses. It is diagnosed when 2 or more cardinal symptoms are present for at least 12 weeks, with at least one being either nasal obstruction or nasal discharge. Other symptoms may include loss of smell and facial pain or pressure. The diagnosis is further supported by objective evidence of inflammation seen in nasal endoscopy or computed tomography (CT) scan [1]. The treatment of CRS focuses on reducing the inflammatory burden and restoring normal mucociliary function. Topical intranasal corticosteroids remain the first-line therapy for long-term management. While the presence of nasal polyps is clinically relevant, it does not alter the initial treatment approach [2]. Endoscopic sinus surgery (ESS) is recommended for patients who do not respond well to medical treatments, with one of its goals being to widen the natural ostia of the sinus cavities. This allows for more effective distribution of topical medication. Conventionally, corticosteroids are administered through nasal sprays. A limitation of these low-volume aerosols is their insufficient delivery into the paranasal sinuses. Recent studies have demonstrated that high-volume irrigations provide better penetration into the paranasal sinuses, compared with nasal sprays and potentially other delivery methods, such as nebulisation and atomisers [3-6]. Corticosteroid nasal irrigations are believed to provide broader mucosal coverage, especially in postoperative patients, potentially leading to better symptom relief and improved disease control [7]. Improved drug delivery is important in CRS because it ensures effective deposition of medication into the paranasal sinuses, enhancing anti-inflammatory action thereby reducing persistent symptoms and the need for systemic therapy [8]. Although the use of corticosteroid nasal irrigations is gaining attention, direct comparisons of their efficacy and safety with nasal sprays in CRS are scarce. This systematic review and meta-analysis is, to our knowledge, the first to focus specifically on this comparison, despite existing reviews on steroid nasal irrigations in CRS [7,9-11].

Materials and methods

This systematic review and meta-analysis was performed following the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) and the methodological framework provided by the Cochrane Handbook for Systematic Reviews of Interventions [12,13]. The study protocol was registered in advance with PROSPERO (Registration No. CRD420251053183).

Eligibility criteria

This review included randomised controlled trials (RCTs) comparing corticosteroid nasal irrigations to corticosteroid nasal sprays in adults (≥ 18 years) with CRS, with or without nasal polyps, used either as first-line treatment or following functional endoscopic sinus surgery. Studies were excluded if they were observational studies, protocols, abstracts, book chapters, review articles, or not written in English.

Search strategy

We conducted a comprehensive search in the PubMed, Embase and Cochrane Library databases from their inception through May 2025. The search terms used included ('steroid' OR 'corticosteroid') AND ('nasal irrigations' OR 'nasal lavage') AND ('nasal sprays' OR 'sprays') AND ('chronic rhinosinusitis' OR 'chronic sinusitis'). Additionally, we screened all references in the included articles for relevance and searched for ongoing trials on www.clinicaltrials.gov and https://trialsearch.who.int/ [14,15].

Study selection

Records retrieved through the search strategy were imported into EndNote X20 software, and duplicate studies were removed. The selection process was conducted by 2 independent reviewers (LS and DAAAN) who screened the titles and abstracts for relevance. The full-text articles were then assessed by the same reviewers to determine whether they met the inclusion criteria. Any disagreements were resolved through discussion, with the senior author (KA) consulted for final decisions.

Data extraction

Data extraction was carried out using a standardised data collection sheet in Microsoft Excel. The following elements were extracted from each study: first author, year of publication, country, study design, sample size, study arms, corticosteroids dosage and preparation, population, outcome measures and treatment period.

Outcomes

The primary outcomes focused on patient-reported measures, including the Sinonasal Outcome Test (SNOT)-22 or SNOT-21, to evaluate health-related quality of life (HRQoL). Secondary outcomes included objective measures, such as the nasal endoscopy score (Lund-Kennedy score or modified Lund-Kennedy score), nasal polyp score, and radiologic score (Lund-Mackay score). Safety was assessed based on the number of adverse events.

Risk of bias assessment

The revised Cochrane Risk of Bias 2 tool (RoB2) was used to assess the risk of bias in the eligible RCTs [16]. This tool evaluates 5 main domains of potential bias. Based on an established algorithm, an overall risk of bias judgement was assigned as either "low risk", "some concerns" or "high risk".

Grading quality of evidence

The GRADE approach was used to evaluate the quality of evidence for each outcome, considering 5 key domains: risk of bias, inconsistency, indirectness, imprecision and publication bias [17]. Based on these factors, the certainty of evidence for each outcome was rated as "high", "moderate", "low" or "very low".

Statistical analysis

Continuous outcomes were presented as either standardised mean differences (SMDs) or mean differences (MDs), while dichotomous outcomes were expressed as risk ratios (RRs). Confidence intervals (CIs) were set at 95%, with a p value of < 0.05 considered statistically significant. Data analysis was conducted using the RevMan web-based software (The Cochrane Collaboration, London, UK), applying a random-effects model to account for inter-study variability. Heterogeneity was assessed using the I^2 statistic, interpreted as follows: 0-40% (not important), 30-60% (moderate), 50-90% (substantial), and 75-100% (considerable). Subgroup analyses were carried out for HRQoL outcomes stratified by CRS phenotype (with or without nasal polyps) and prior surgical status (with or without previous surgery).

Results

Study selection

The study selection is illustrated in Figure 1. A total of 375 records were identified through database searches and registry entries. After removing duplicates, 354 records remained and were screened based on their titles and abstracts. Of these, 11 studies were retrieved in full text for detailed eligibility assessment. Five studies were excluded for the following reasons: one was published in a non-English language, one was only available as an abstract, 2 employed a different comparison group and one was a retrospective study. Ultimately, 6 RCTs met the inclusion criteria and were included in the meta-analysis [18-23]. The characteristics and details of the trials included are summarised in Table I.

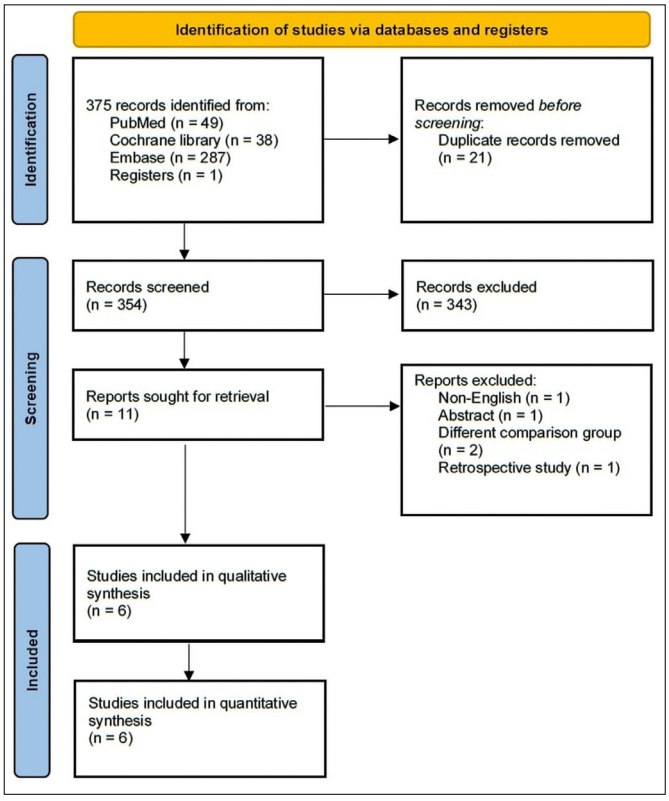


Figure 1. PRISMA flow diagram of study selection.

Participants

Six RCTs involving a total of 370 participants were included in the analysis. Among these, 185 were assigned to corticosteroid nasal irrigations, and 185 to corticosteroid nasal sprays. The studies were conducted across diverse geographical locations, including Australia, Canada, India, Thailand, United States and Pakistan. All participants were adults diagnosed with CRS, with or without nasal polyps. In 3 of the trials [18,19,23], the intervention was administered immediately following ESS.

Intervention

A variety of corticosteroids and dosages were used across the included studies for both treatment groups. In the corticosteroid nasal irrigation group, the following medications were administered: betamethasone (total dose 0.5 mg daily), mometasone (2 or 2.4 mg daily) and budesonide (0.5 or 1 mg daily). Betamethasone was administered as drops, mometasone through metered-dose pumps or capsules, and budesonide by mixing respules with saline. They were most often delivered using the NeilMed Sinus Rinse bottle (NeilMed Pharmaceutical, Santa Rosa, CA). Irrigations

Table I. Characteristics of the studies included.

First author, year	Country	Study design	Sample size	Study arms		Population	Outcome measures	Treatment duration
				Steroid irrigation	Steroid spray			
Akram, 2025 [18]	Pakistan	RCT	N = 90	Betamethasone 0.25 mg twice daily (N = 45)	Beclomethasone nasal spray once daily (N = 45)	CRS with nasal polyps after ESS	1) SNOT-22 2) LKS	3 months
Harvey, 2018 [19]	Australia	RCT	N = 44	Mometasone 2 mg once daily + placebo nasal spray (N = 21)	Mometasone nasal spray 2 mg once daily + placebo nasal irrigation (N = 23)	CRS with or without nasal polyps after ESS	1) VAS 2) SNOT-22 3) Global 4) Modified LKS	12 months
Jiramongkolchai, 2020 [20]	United States	RCT	N = 53	Mometasone 2.4 mg once daily + saline nasal spray (N = 26)	Mometasone furoate nasal spray 200 µg (2 puffs of 50 µg in each nostril) once daily + saline nasal irrigation (N = 27)	CRS without nasal polyps, without previous ESS	1) SNOT-22 2) Modified CGI scale 3) LKS 4) Serum cortisol	2 months
Meena, 2024 [21]	India	RCT	N = 120	Budesonide 0.5 mg twice daily (N = 60)	Fluticasone propionate nasal spray 200 µg (2 puffs of 50 µg in each nostril) twice daily (N = 60)	CRS with nasal polyps, without previous ESS	1) SNOT-22 2) NPS 3) LMS 4) UPSIT 5) Adverse events	3 months
Promsopa, 2025 [22]	Thailand	RCT	N = 24	Budesonide 0.25 mg twice daily + placebo nasal spray (N = 13)	Budesonide nasal spray 256 µg (2 puffs of 64 µg in each nostril) twice daily + placebo nasal irrigation (N = 11)	CRS with nasal polyps, without previous ESS	1) VAS-TNSS 2) SNOT-22 3) Modified LKS 4) NPS 5) Serum cortisol	3 months
Rotenberg, 2011 [23]	Canada	RCT (3 arms)	N = 39	Budesonide 0.5 mg twice daily (N = 20)	Budesonide nasal spray 128 µg (1 puff of 64 µg in each nostril) twice daily (N = 19)	CRS with nasal polyps after ESS	1) SNOT-21 2) LKS 3) LMS 4) IOP 5) Serum ACTH	12 months

ACTH: adrenocorticotropic hormone; CGI: clinical global impressions; CRS: chronic rhinosinusitis; ESS: endoscopic sinus surgery; Global: global sinonasal function; IOP: intraocular pressure; LKS: Lund-Kennedy score; LMS: Lund-Mackay score; NPS: nasal polyp score; RCT: randomised controlled trial; SNOT-21: sinonasal outcome test-21; SNOT-22: sinonasal outcome test-22; TNSS: total nasal symptom score; VAS: visual analogue scale; UPSIT: University of Pennsylvania Smell Identification Test

were performed daily with the same dose, and no studies incorporated treatment pauses, tapering protocols or cyclic administration schedules. Further details of the interventions, including steroid types, dosage, frequency, irrigation volume, device type and delivery technique, are provided in Table II. In the corticosteroid nasal spray group, the following were used: beclomethasone (dosage not specified), mometasone (total dose 200 µg or 2 mg daily), fluticasone (400 µg daily) and budesonide (256 or 512 µg daily).

Risk of bias and quality of study

The risk of bias assessment evaluated 6 studies across 5 domains, as shown in Figure 2. Three studies [19,22,23] were rated as having a low overall risk of bias. Two studies [18,20], were found to have some concerns. Akram et al. [18] showed issues in the randomisation process and measurement of outcomes, as no information was provided regarding blinding. Jiramongkolchai et al. [20] showed concerns in the selection of the reported results, as the LMS outcome was not reported as outlined in the pre-specified analysis plan. One study, Meena et al. [21], was assessed as having a high overall risk of bias, primarily due to shortcomings in the randomisation process; it was a single-blinded study in which patients were aware of their assigned treatment. Overall, while the majority of studies demonstrated strong methodological quality, the presence of some concerns and one high-risk study suggests potential

Table II. Details on corticosteroid nasal irrigations.

Study	Agent	Dosage	Frequency	Irrigation volume	Device type	Delivery technique
Akram, 2025 [18]	Betamethasone drop	0.25 mg	Twice daily	250 ml normal saline	Squeeze bottle	Not mentioned
Harvey, 2018 [19]	Momethasone metred-pump	2 mg	Once daily	240 ml saline	NeilMed Sinus Rinse bottle	Not mentioned
Jiramongkolchai, 2020 [20]	Momethasone capsule	2.4 mg	Once daily	240 ml sodium chloride and sodium bicarbonate mixture	NeilMed Sinus Rinse bottle	Not mentioned
Meena, 2024 [21]	Budesonide respule	0.5 mg	Twice daily	240 ml normal saline	Not specified	Not mentioned
Promsopa, 2025 [22]	Budesonide respule	0.25 mg	Twice daily	100 ml normal saline	Not mentioned	Not mentioned
Rotenberg, 2011 [23]	Budesonide respule	0.5 mg	Twice daily	120 ml normal saline	NeilMed Sinus Rinse bottle	Not mentioned

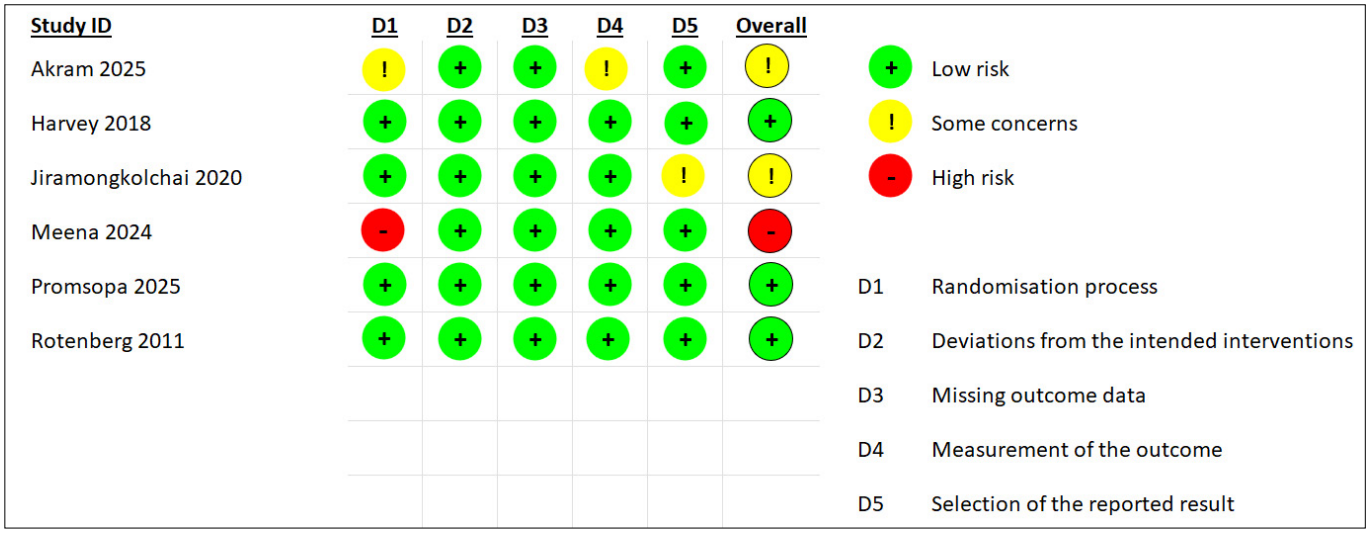


Figure 2. Risk of bias figure.

limitations that could affect the validity of the findings. The quality of evidence, as evaluated by the GRADE approach and summarised in Table III, was rated from low to high.

Primary outcomes

For HRQoL, 5 trials [18-22] assessed outcomes using the SNOT-22, and one trial [23] used the SNOT-21. Overall, corticosteroid irrigations significantly improved SNOT scores compared to corticosteroid sprays (SMD -0.62, 95% CI -1.09 to -0.15; p = 0.01; 6 RCTs; 370 participants; I^2 = 78%; moderate-certainty evidence) (Fig. 3A). Despite considerable heterogeneity (I^2 = 78%), a sensitivity analysis excluding Harvey et al. [19] did not change the overall effect. Subgroup analysis by CRS phenotype showed a significant benefit in patients with nasal polyps (SMD -0.91, 95% CI -1.36 to -0.45; $p < 0.0001$; 4 RCTs; 273 participants; I^2 = 64%). However, no meaningful conclusion can be drawn for patients without nasal polyps, as this finding is based on a single study (Fig. 3B). A greater benefit from corticosteroid irrigations was also seen in patients without a history of ESS (SMD -0.63, 95% CI -1.05 to -0.21; p = 0.003; 3 RCTs; 197 participants; I^2 = 43%), compared to those with prior ESS, in whom the effect was not statistically significant (SMD -0.62, 95% CI -1.61 to 0.38; p = 0.22; 3 RCTs; 173 participants; I^2 = 89%) (Fig. 3C).

Secondary outcomes

Nasal endoscopy score

Three trials assessed nasal endoscopy findings using the Lund-Kennedy score [18,20,23], and one trial used a modified Lund-Kennedy score [22], in which the scoring for scarring and crusting was omitted. The pooled analysis showed no

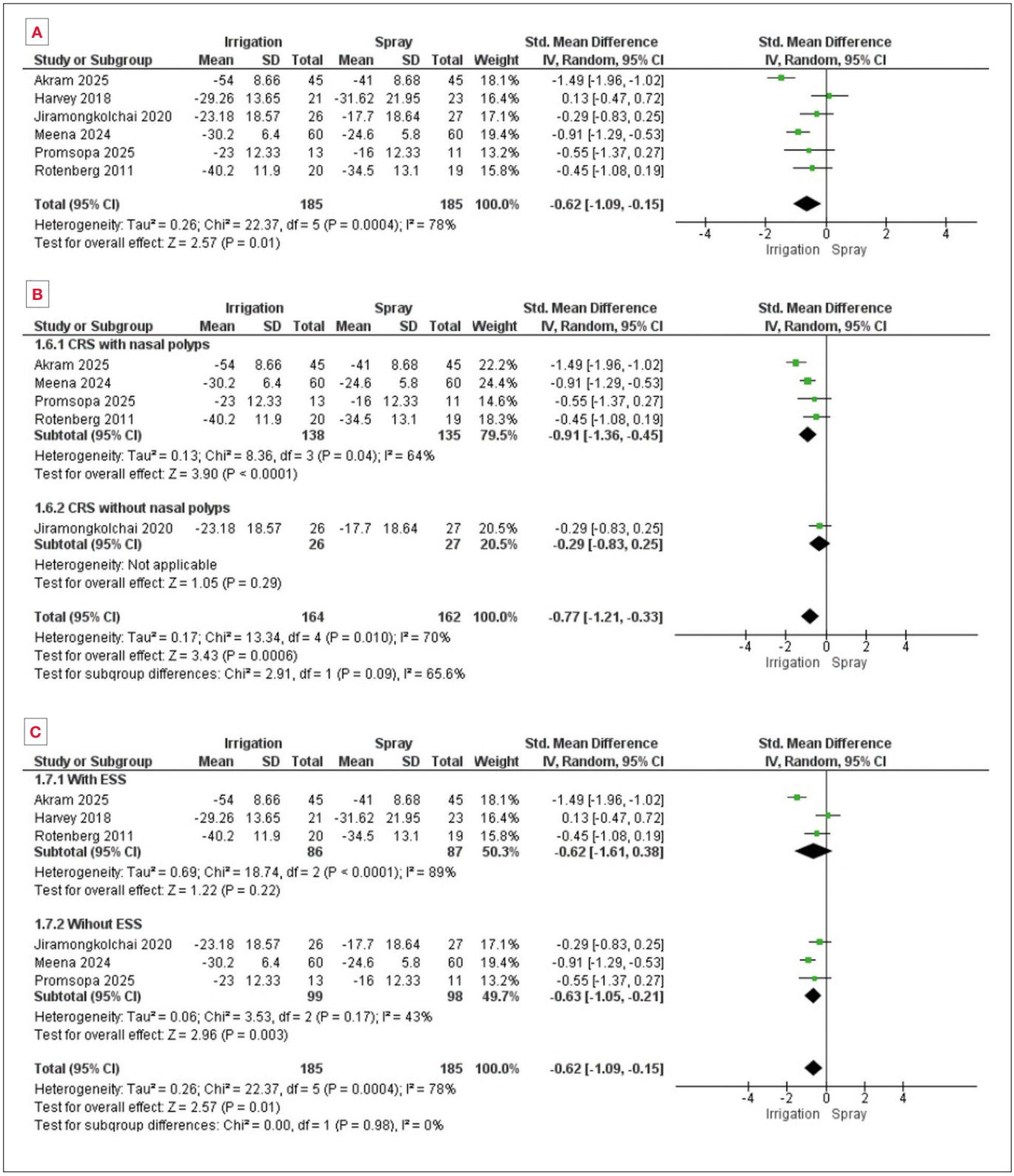


Figure 3. Primary outcomes for corticosteroid nasal irrigations *versus* sprays. **A)** Overall SNOT score; **B)** SNOT score in CRS with and without nasal polyps; **C)** SNOT score in patients with and without ESS.

Table III. Summary of findings for corticosteroid nasal irrigations compared to nasal sprays for chronic rhinosinusitis.

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	No of participants (studies)	Certainty of the evidence (GRADE)
	Risk with steroid spray	Risk with steroid irrigation			
Health-related quality of life score	-	SMD 0.62 SD lower (1.09 lower to 0.15 lower)	-	370 (6 RCTs)	⊕⊕⊕◯ Moderate [a]
Nasal endoscopy score	-	SMD 0.55 SD lower (1.41 lower to 0.31 higher)	-	206 (4 RCTs)	⊕⊕◯◯ Lowa [a,b]
Nasal polyp score	The mean change in nasal polyp score was 1.15	MD 0.58 lower (0.84 lower to 0.32 lower)	-	144 (2 RCTs)	⊕⊕⊕⊕ High
Lund-Mackay score	The mean change in Lund-Mackay score was 10.83	MD 1.79 lower (3.21 lower to 0.38 lower)	-	203 (3 RCTs)	⊕⊕⊕⊕ High
Adverse events	169 per 1,000	188 per 1,000 (100 to 352)	RR 1.11 (0.59 to 2.08)	144 (2 RCTs)	⊕⊕⊕⊕ High

**The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI). CI: confidence interval; MD: mean difference; RR: risk ratio; RCTs: randomised controlled trials; SMD: standardised mean difference.*
Explanations
[a]Visual inconsistency and statistically high heterogeneity; [b]Confidence interval includes both benefit and no effect
GRADE Working Group grades of evidence
High certainty: very confident that the true effect lies to that of the estimate of the effect.
Moderate certainty: moderately confident in the effect of estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of the effect.

significant difference in nasal endoscopy scores, with considerable heterogeneity across studies (SMD -0.55, 95% CI -1.41 to 0.31; $p = 0.21$; 4 RCTs; 206 participants; $I^2 = 88\%$; low-certainty evidence). Further subgroup analysis stratified by surgical status showed no significant differences in scores in either post-surgical or surgery-naïve patients (Fig. 4A).

Nasal polyp score

Nasal polyp size was assessed in only 2 trials using a 0-3 grading scale per nostril (total score 0-6), which differs from the standard nasal polyp score of 0-4 per nostril (total score 0-8) [21,22]. A significant reduction in nasal polyp scores was observed in the nasal irrigation group compared to the spray group (MD -0.58, 95% CI -0.84 to -0.32; $p < 0.0001$; 2 RCTs; 144 participants; $I^2 = 0\%$; high-certainty evidence) (Fig. 4B).

Lund-Mackay score

Three trials assessed Lund-Mackay scores [19,21,23]. Corticosteroid nasal irrigations significantly reduced Lund-Mackay scores compared to nasal sprays (MD -1.79, 95% CI -3.21 to -0.38; $p = 0.01$; 3 RCTs; 203 participants; $I^2 = 57\%$; high-certainty evidence) (Fig. 4C).

Adverse events

Two trials reported the number of adverse events [21,22]. No significant difference was observed between the irrigation and spray groups (RR 1.11, 95% CI 0.59 to 2.08; $p = 0.76$; 2 RCTs; 144 participants; $I^2 = 0\%$) (Fig. 4D). Adverse events were generally mild and comparable between the 2 groups. The most frequently reported events included nasal irritation, transient epistaxis, saline aspiration, ear fullness and headache. No severe adverse events or systemic side effects were reported in either group. Two studies assessed serum cortisol levels [20,22], and one study evaluated serum adrenocorticotropic hormone levels [23]; all values remained within the normal range before and after treatment. Furthermore, Rotenberg et al. reported that no patients demonstrated significant changes in intraocular pressure measurements [23].

Discussion

Main findings

The Cover figure highlights the main results of this study. Compared with corticosteroid nasal sprays, nasal irrigations provide greater improvements in HRQoL, particularly in patients with nasal polyps and those who have not undergone ESS. Nasal irrigations are also associated with significant reduction in nasal polyps and Lund-Mackay scores, although no significant difference was observed in nasal endoscopy scores. Regarding safety, corticosteroid nasal irrigations showed no significant differences in adverse events compared with nasal sprays, and no serious complications were reported. There are concerns regarding the apparently high steroid doses used in nasal irrigations, as irrigation regimes deliver milligram-level doses, whereas nasal sprays typically deliver microgram-level doses. The rationale for this dosing strategy is that the retained effec-

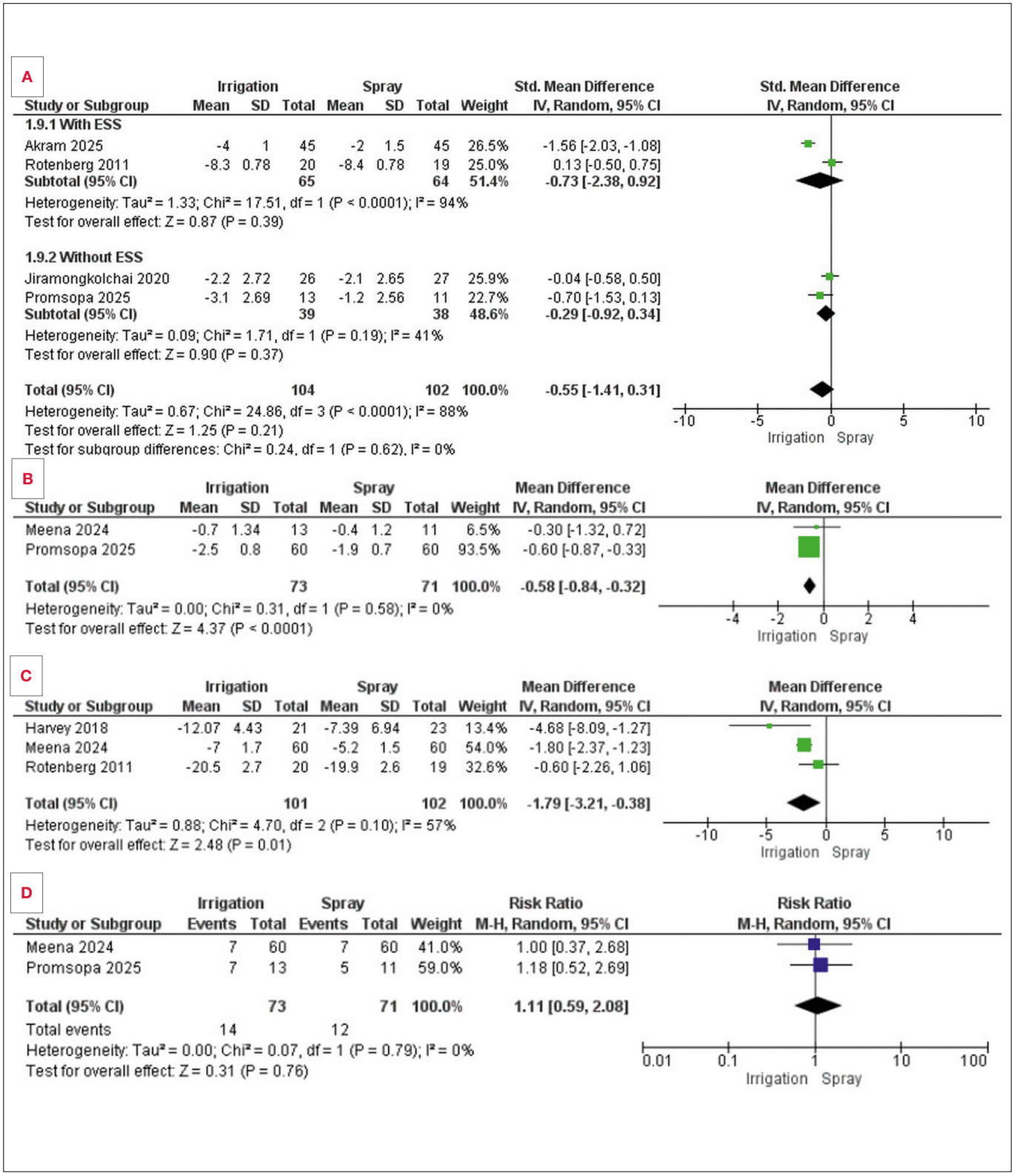


Figure 4. Secondary outcomes for corticosteroid nasal irrigations versus sprays; **A)** Nasal endoscopy score; **B)** Nasal polyp score; **C)** Lund-Mackay score; **D)** Adverse events.

tive dose of corticosteroid irrigations is low: approximately 6% in post-ESS patients and even lower (around 2%) in non-ESS patients, with the remaining 94% of the irrigation volume running off and being discarded [24]. In contrast, nasal sprays actually achieve substantially higher local retention (approximately 30% versus 6%) [25]. Despite this higher retained dose, the poorer performance of corticosteroid nasal sprays is mainly due to inadequate delivery of medication to the paranasal sinus cavities [26]. Based on these findings, Harvey et al. explained the dose-equivalence rationale, noting that when 2 mg dose of mometasone is delivered via irrigation, only approximately 100-200 µg (5-8% of 2 mg) is retained [19]. Jiramongkolchai et al. likewise indicated that, based on this literature and pharmacist consultation, a daily dose of 2.4 mg of mometasone delivered by nasal irrigation was considered equivalent to the daily dose delivered by mometasone nasal spray (200 µg per day) [20].

Comparison with other studies

The International Consensus Statement on Allergy and Rhinology: Rhinosinusitis 2021 (ICAR-RS-2021) addressed the use of corticosteroid nasal irrigations in 2 contexts [27]. In CRS without nasal polyps, corticosteroid nasal irrigations are recommended for postoperative patients and may be considered an option for non-surgical patients, based on evidence from 2 high-quality RCTs [19,28] and 3 prospective cohort studies [29-31]. In CRS with nasal polyps, corticosteroid nasal irrigations are strongly recommended following ESS, particularly for patients with moderate to severe disease or those who are not adequately controlled with standard corticosteroid nasal sprays, based on 5 RCTs [19,28,32-24] and one meta-analysis [9]. In comparison, the European Position Paper on Rhinosinusitis and Nasal Polyps 2020 (EPOS 2020) is unable to make recommendations regarding corticosteroid nasal irrigations due to the low to very low quality of evidence for alternative delivery methods and the lack of direct comparative studies [1]. Owing to the negligible penetration of topical solutions into the paranasal sinus cavities before ESS, corticosteroid nasal irrigations are generally considered after ESS [24,27]. However, subgroup analysis in our study showed that improvement in HRQoL was more pronounced in patients without prior ESS, which is inconsistent with the prevailing concept. One possible explanation is that patients requiring ESS tend to have more severe or refractory disease, as surgery is typically reserved for those who do not respond adequately to medical therapy. This greater underlying disease severity may contribute to the smaller observed treatment effect in the post-ESS group. Supporting this interpretation, baseline mean SNOT scores in studies of non-surgical patients ranged from 50 to 55.8 [20-22], whereas studies involving post-ESS patients reported a wider and generally higher range of baseline mean SNOT scores, from 47.7 to 84.6 [18,19,23]. Calvo-Henriquez et al. [7], in their systematic review, also noted that it remains unclear whether prior ESS enhances the outcomes of corticosteroid nasal irrigations, as the available evidence is limited and contradictory [28,35,36].

Implications for clinical practice and suggestions for future studies

Our review suggests that nasal irrigations may deliver corticosteroids more effectively than nasal sprays in patients with CRS. This finding is clinically important, as it supports the consideration of corticosteroid nasal irrigations as part of treatment strategies to improve patient outcomes. Among the various topical corticosteroid delivery methods, including drops, nebulisation, stents, and direct sinus infiltration, nasal irrigation stands out because of its simplicity and demonstrated effectiveness [37]. It would be valuable for future research to assess the cost-effectiveness of nasal irrigations compared with sprays; to evaluate their relative efficacy in non-surgical versus post-surgical patients, taking into account the type and adequacy of prior surgery; and to examine outcomes in CRS patients with and without nasal polyps, as data in these subpopulations remain limited. The wide variation in corticosteroid types and dosages across studies further highlights the need for standardised treatment protocols. The use of standardised outcome measures would also facilitate more meaningful data pooling and meta-analysis.

Limitations of the study

This review has several limitations. Notably, high heterogeneity was observed across most analyses, which may be attributed to variations in corticosteroid type, dosage and delivery methods among the included studies. In addition, evidence regarding CRS without nasal polyps is limited, with only a single study available for this subgroup, thereby restricting the depth of analysis. We were also unable to stratify most secondary outcomes by postoperative versus surgery-naïve status because of insufficient data, although such stratification may reveal clinically important differences in objective outcomes between these populations. Finally, the small number of studies included in the meta-analysis precluded a reliable assessment of publication bias.

Conclusions

Corticosteroid nasal irrigations appear to be a safe and potentially effective treatment option for patients with CRS,

particularly those with nasal polyps and those who have not undergone ESS. They are associated with improvements in health-related quality of life, as well as reductions in nasal polyp size and Lund-Mackay scores. With no clear differences in adverse events compared with nasal sprays, and only minor events such as nasal irritation, transient epistaxis, saline aspiration, ear fullness, and headache reported, corticosteroid nasal irrigations may represent a viable alternative to sprays in selected patient populations, although further studies are needed to confirm these findings.

Conflict of interest statement

The authors declare no conflict of interest.

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Author contributions

LS, DAAAN: study design, article search, article selection, data extraction, review drafting; KA: study design, pooled analysis and critical revision.

Ethical consideration

Not applicable.

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