Is postoperative nasal packing after septoplasty safe? A systematic review and meta-analysis of randomized controlled studies*

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Abstract

Objectives: To systemically review and compare post-septoplasty complications between total nasal packing and other techniques.

Methodology: We searched electronic databases (PubMed, Scopus, and Cochrane Library) and additional sources. The most recent search was on November 30th, 2020. Randomized controlled trials (RCTs) comparing adverse events after post-septoplasty nasal packing versus other techniques were included. The outcomes were adverse events, including respiratory distress, oxygen desaturation, pain severity, bleeding, hematoma, sleep disturbance, infection, crusting, epiphora, dysphagia, perforation, adhesion, and residual septal deviation.

Results: There were 47 studies (4,087 participants) in this systematic review. Nasal packing was more likely to cause adverse events than other techniques. There were significant increases in respiratory distress, pain, sleep disturbance, crusting, epiphora, dysphagia, and adhesion. There were no statistically significant differences in oxygen desaturation, bleeding, hematoma, infection, perforation, and residual septal deviation. Subgroup analysis found that trans-septal suture was less likely to cause postoperative complications compared with total nasal packing.

Conclusion: Nasal packing after septoplasty was more likely to cause adverse events, including respiratory distress, pain, sleep disturbance, crusting, epiphora, dysphagia, and adhesion. Furthermore, there were no benefits of nasal packing in preventing bleeding, hematoma, and residual septal deviation when compared with other techniques. Routine nasal packing after septoplasty should be avoided. Trans-septal suture should be considered instead.

Key words: complication, meta-analysis, nasal packing, septoplasty, trans-septal suture

Introduction

Septoplasty is a common procedure for treating nasal obstruction caused by nasal septal deviation. Traditionally, bilateral anterior nasal packing is performed following septoplasty to prevent bleeding, septal hematoma, and adhesion between the septum and lateral nasal wall. Furthermore, it is thought to reduce the risk of residual septal deviation by stabilizing the remaining septum during the healing process⁽¹⁾. However, totally occlusive nasal packing has a tendency to cause adverse events, including respiratory distress, pain, infection, sleep disturbance,

crusting, epiphora, and dysphagia. The routine nasal packing after septoplasty has been questioned in the past decades. Many post-operative techniques have been introduced as alternatives to the nasal packing, such as trans-septal suturing, nasal splinting, trans-septal stapling, and inter-septal fibrin glue, etc. Trans-septal suture technique has been promoted since the 1980s and currently is the most widely used. This procedure is used to prevent the formation of septal hematoma, close the tear mucosa, and support the remaining cartilage⁽²⁾. However, tight trans-septal sutures can increase the risk of septal perforation⁽¹⁾. Intranasal septal splints are also used as an alternative to nasal packing to decrease bleeding, prevent adhesion, and stabilize the remaining septum⁽³⁾.

Previous meta-analyses compared the risks of post-septoplasty complications between nasal packing and trans-septal suture. There were no significant differences in the risks of bleeding, hematoma, perforation, and residual septal deviation⁽⁴⁻⁷⁾, while the risks of adhesion, and infection were inconclusive⁽⁴⁻⁷⁾. Transseptal suture significantly decreased postoperative pain compared to the nasal packing⁽⁵⁻⁷⁾. Nasal splinting was also analyzed in 2 meta-analyses which included both trans-septal suture and nasal splinting in the non-packing intervention. However, the subgroup analysis of nasal splinting was not done^(4,6). A metaanalysis by Banglawala et al., which included 2 randomized controlled trials (RCTs) and 12 observational studies found that post-septoplasty nasal packing did not seem to cause adverse cardiopulmonary changes⁽⁸⁾.

There are many RCTs that have not been included in the previous meta-analyses. In addition, many adverse events caused by post-septoplasty nasal packing have not been analyzed, especially respiratory distress, which could cause a serious morbidity and prolong hospitalization. This meta-analysis aimed to systemically review and compare post-operative complications between the post-septoplasty total nasal packing and other techniques.

Materials and methods

Information sources and search strategy

Three authors (CKT, NC, and BC) independently conducted searches for published, unpublished, and ongoing RCTs from electronic databases, via PubMed, Scopus, and the Cochrane library. The search began on November 15th, and the most recent search was on November 30th, 2020. The search terms were "(septoplasty OR (nasal septum surgery)) AND ((nasal packing) OR (trans-septal suture) OR (nasal splint))." We manually searched other sources from the Chulalongkorn Medical Library and those existing primary researches in previous meta-analyses.

Study selection

The inclusion criteria were RCTs relating to: 1) patients in all age groups who underwent septoplasty with or without turbinoplasty, 2) comparisons between post-operative nasal packing and other techniques, 3) at least one of the following post-operative outcome measures: respiratory distress, oxygen desaturation, pain severity, bleeding, hematoma, sleep disturbance, infection, crusting, epiphora, dysphagia, perforation, adhesion, and residual septal deviation, and 4) published in any language. Articles with the following exclusion criteria were eliminated if: 1) the patients underwent additional nasal surgery other than septoplasty and turbinoplasty 2) the reported data were incorrect or incomplete that could not provide outcome measures, and 3) repeated published literature.

Three authors (CKT, NC, and BC) independently reviewed titles and abstracts of the articles and selected the articles that met the selection criteria. Full-text of the selected articles were reviewed. The articles in other languages were translated. If there was any insufficient data, the corresponding author of that article was contacted for further information. Discrepancies were resolved by discussion among the authors or the decision of the fourth author (PH).

Quality assessment

Three authors (CKT, NC, and BC) independently evaluated quality of the included studies by assessing the risks of bias in accordance with the Cochrane Handbook for Systematic Reviews of Interventions Version 6.1. Risk of bias in each study was assessed in the following domains: selection bias, performance bias, detection bias, attrition bias, and reporting bias. Each domain was classified as low risk, high risk, or unclear risk. Low risk or high risk of bias was determined if the described methods met the criteria of low risk of bias or high risk of bias of that domain, respectively. Unclear risk of bias was selected when there was either a lack of information or uncertainty over the potential for bias. Discrepancies were resolved by discussion or through a fourth investigator (PH).

Data extraction

Two authors (CKT and NC) independently extracted and recorded the data. The extracted data were age of the patient, type of anesthesia, nasal packing materials, nasal packing duration, other techniques, follow-up time, and adverse events as follows: respiratory distress, oxygen saturation, pain severity score, bleeding, hematoma, sleep disturbance events, sleep disturbance score, infection, crusting, epiphora, dysphagia, perforation, adhesion, and residual septal deviation.

Statistical analysis

Data were pooled for meta-analysis. Subgroup analyses by alternative technique were performed. Odds ratio (OR) and 95% confidence interval (CI) were used for dichotomous data. Continuous data were presented as mean difference (MD) or standardized mean difference (SMD), standard deviation (SD) and 95% CI. The standard error, median, range, or 95% CI was imputed if the SD was not reported. Discrepancies in treatment effects among different trials were assessed using a heterogeneity (I2) statistic. An I2 of <40%, 40-60% and >60% represented low, moderate and substantial heterogeneity, respectively. When a heterogeneity was low, a fixed-effect model was used. A random effects model was used if a heterogeneity was high for a more conservative estimate of the differences. All statistical assessments were conducted using the Review Manager 5.4 software. Sensitivity analyses were performed based the following: high



Figure 1. PRISMA flow diagram of study searching strategy



Figure 2. Quality assessment summary for included studies: risk of bias graph.

methodological quality study, exclusion of studies that caused heterogeneity, and exclusion of studies with different pain score systems.

Results

Study selection

A total of 450 references were retrieved. After the titles and abstracts were reviewed, 385 studies were excluded from the study. Full-text of the remaining 65 RCTs were reviewed, 47 of which met the selection criteria and were included in this meta-analysis (Figure 1).

2	Α	в	С	D	Е	F	G		A	в	С	D	Е	F	G
Acioglu 2012	•	•	•	•	•	•	•	Li 2016			•	•	•	•	•
Al-Ragged 2007			•	•	•	•	•	Mustafa 2015			•	•	•	•	•
Ardehali 2009	•	•	•	•	•	•	•	Naghibzadeh 2011	•		•	•	•	•	•
Awan 2008	•	•	•	•	•	•	•	Naik 2015	•	•	•	•	•	•	•
Azaka 2012			•	•	•	•	•	Nunez 1991	•	•	•	•	•	•	•
Babu 2020			•	•	•	•	٠	Okris 2013			•	•	•	•	•
Bernado 2013	•	•	•	•	•	•	•	Ozbalkoc 2016	•		•	•		•	•
Caglar 2019			•	•	•	•	•	Plasencia 2016	•	•	•	•	•	•	•
Canoyu 2014			•	•	•	•	•	Ramalingam 2020	•	•	•	•	•	•	•
Cukurova 2012			•	•	•	•	•	Shao 2016			•	•	•	•	•
Dadgamia 2017	•	•	•	•	•	•	•	Thapa 2011	•	•	•	•	•	•	•
Dai 2014			•	•	•	•	•	Turhan 2012	•	•	•	•	•	•	•
Dalgic 2016			•	•	•	•	•	Vulusvamy 2012	•	•	•	•	•	•	•
Eski 2014			•	•	•	•	•	Wadhera 2014			•	•	•	•	•
Fang 2019	•	•	•	•	•	•	•	Wang 2011			•	•	•	•	•
Farooq 2016	•	٠	•	•	•	•	٠	Wang 2018			•	•	•	•	•
Ghimire 2012			•	•	•	•	•	Yadav 2019	•	•	•	•	•	•	•
Gunaydin 2011			•	•	•	•	•	Yang 2013			•	•	•	•	•
Guyuron 1989	•		•	•	٠	•	٠	Yigit 2002	•		•	•	•	•	•
Habesoglu 2010	•	•	•	•	•	•	•	Yildirim 2005	•	•	•		•	•	•
Kayahan 2017			•	•	•	•	•	Yilmaz 2013	•	•	•	•	•	•	•
Kazkayasi 2007			•	•		•	•	Yu 2013	•	•	•	•	•	•	•
Korkut 2010			•	•	•	•	•	Zeyyan 2010	•	•	•	•	•	•	•
Kula 2010			•	•	•	•	•			-	-	-	-	-	-
A; Random s	eque	nce g	enera	tion	Selec	tion l	pias),	B; Allocation concealment	t (Sele	ection	ı bias)	, C; B	lindin	g of	

participants and personnel (Performance bias), D; Blinding of outcome assessment (Detection bias), E; Incomplete outcome data (Attrition bias), F; Selective report (Reporting bias), G; Other bias

Figure 3. Methodology quality assessment for each included study.

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	Total nasal pa	cking	Other techni	iques		Odds Ratio		Odds Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% Cl	Year	M-H, Random, 95% Cl
1.1.1 Total nasal pac	king versus Tra	ns-septa	al suture					
Gunaydin 2011	95	100	31	100	22.9%	42.29 [15.65, 114.29]	2011	
Canoyu 2014	9	50	3	50	17.3%	3.44 [0.87, 13.56]	2014	
Ozbalkoc 2016	8	22	1	22	9.7%	12.00 [1.35, 106.80]	2016	
Dadgarnia 2017 Subtotal (95% CI)	14	36 208	1	36 208	10.2% 60.1 %	22.27 [2.73, 181.46] 14.44 [3.83, 54.50]	2017	
Total events	126		36					
Heterogeneity: Tau ² =	= 1.15; Chi ² = 8.6	0, df = 3	(P = 0.04); I ² =	65%				
Test for overall effect:	Z = 3.94 (P < 0.0	0001)						
1.1.2 Total nasal pac	king versus Nas	sal airwa	y integrated p	packing				
Farooq 2016 Subtotal (95% CI)	46	50 50	12	50 50	19.5% 19.5 %	36.42 [10.85, 122.17] 36.42 [10.85, 122.17]	2016	
Total events	46		12					
Heterogeneity: Not ap	oplicable							
Test for overall effect:	Z = 5.82 (P < 0.0	JUUUU1)						
1.1.3 Total nasal pac	king versus Nas	sal septu	ım retaining d	levice				
Vulusvamy 2012	28	40	5	40	20.4%	16.33 [5.14, 51.87]	2012	
Subtotal (95% CI)		40		40	20.4%	16.33 [5.14, 51.87]		
Total events	28		5					
Heterogeneity: Not ap	oplicable							
Test for overall effect:	Z = 4.74 (P < 0.0	00001)						
Total (95% CI)		298		298	100.0%	18.18 [8.21, 40.27]		•
Total events	200		53					
Heterogeneity: Tau ² =	= 0.46: Chi ² = 9.7;	8. df = 5	$(P = 0.08)$; $ ^2 =$	49%			H	······································
Test for overall effect:	Z = 7.15 (P < 0.0	00001)					0.001	0.1 1 10 1000
Test for subgroup dif	ferences: Chi ² =	1.28, df=	= 2 (P = 0.53).	I² = 0%				Other techniques Total hasal packing

Figure 4. Respiratory distress, odds ratio (OR), Total nasal packing versus other techniques: random-effect model.

Quality assessment

Quality of the included studies was evaluated and presented in Figure 2 and Figure 3. About 30% of the included studies had low risk of randomization and 25% had adequate concealment of allocations. Most of the studies had unclear risk of selection bias because the randomization and concealment of allocations were not mentioned in the methods. Seventy-five percent of the studies had high risk of performance bias due to lack of blinding of the participants which may influence the subjective outcomes such as sleep disturbance and pain severity. Most studies had no detection bias because the outcome measurements were not influenced by lack of blinding of the outcome assessors. Thirteen percent of the included studies had high risk of attrition bias due to a large proportion of drop-out participants without explanation. Two studies did not mention the missing data. Twenty-five percent of the included studies had reporting bias. Eight studies did not report complete statistical data of pain score. Three studies did not report numeric data of complication events, which were sleep disturbance, hematoma, and crusting. Six studies had "other bias" because these studies did not use visual analog scale (VAS) 0-10 for pain severity measurement.

Characteristics of the included studies

Forty-seven studies (4,087 participants) were included in this meta-analysis ⁽⁹⁻⁵⁵⁾. There were comparisons of nasal packing versus: trans-septal suture (28 studies), trans-septal suture with

nasal splint (4 studies), nasal airway integrated packing (6 studies), nasal septum retaining devices (nasal clip in one study and invented nasal retaining device in one study), and inter-septal fibrin glue (1 study). The combination of nasal packing and transseptal suture was compared with trans-septal suture (2 studies) and the combination of nasal packing and nasal splint was compared with nasal splint (1 study). There were 3-arm intervention studies that compared nasal packing versus: 1) trans-septal suture (the second arm) and the combination of nasal packing and trans-septal suture (the third arm,1 study), 2) trans-septal suture (the second arm) and nasal airway integrated packing (the third arm,1 study), 3) nasal splint (the second arm) and nasal airway integrated packing (the third arm, 1 study). Forty studies were published in English and 7 studies were published in other languages which were Chinese, and Turkish. Forty-five studies were conducted in adult and 2 studies did not mention the age of participants. Characteristics of the included studies are shown in Table 1.

Effects of interventions

A summary of post-operative complications of nasal packing compared with other techniques is presented in Table 2.

Respiratory distress

Six studies (596 participants) were included in this analysis. The total nasal packing significantly increased the odds of respiratory distress events compared to other procedures (OR 18.18;

	Total n	asal pac	king	Other	techniq	ues		Std. Mean Difference		Std. Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% Cl	Year	IV, Random, 95% Cl
1.3.1 Total nasal pack	king vers	us Trans	-septal	suture						
Nunez 1991	4.1	0.44	27	2.9	0.41	26	4.3%	2.78 [2.01, 3.55]	1991	
Ardehali 2009	5	5.64	57	2.1	5.64	48	4.6%	0.51 [0.12, 0.90]	2009	
Ghimire 2012	2.35	0.78	23	0.86	0.79	21	4.3%	1.86 [1.15, 2.58]	2012	
Dai 2014	5.96	1.92	30	4.3	1.53	30	4.5%	0.94 [0.41, 1.48]	2014	
Eski 2014	5.24	2.04	16	1.53	1.1	22	4.2%	2.33 [1.48, 3.17]	2014	
Mustafa 2015	38.33	9.129	30	22.67	6.397	30	4.4%	1.96 [1.34, 2.58]	2015	
Plasencia 2016	0.783	1.332	46	0.087	0.589	46	4.6%	0.67 [0.25, 1.09]	2016	-
Dalgic 2016	4.33	2.19	18	1.27	1.87	21	4.3%	1.48 [0.76, 2.20]	2016	
Li 2016	6.99	1.9	30	1.29	1.51	30	4.2%	3.28 [2.49, 4.07]	2016	
Ozbalkoc 2016	0.136	0.35	22	0.09	0.426	22	4.5%	0.12 [-0.48, 0.71]	2016	
Dadgarnia 2017	6.5	1.38	36	2.66	1.35	36	4.4%	2.78 [2.13, 3.44]	2017	
Wang 2018	3.4	0.4	20	0.6	0.5	20	3.2%	6.06 [4.53, 7.59]	2018	
Ramalingam 2020	42.2	5.4	41	32.2	4.4	41	4.5%	2.01 [1.48, 2.55]	2020	
Subtotal (95% CI)			396			393	56.1%	1.95 [1.33, 2.56]		•
Heterogeneity: Tau ² =	1.14; Ch	i ^z = 153.2	9, df = 1	2 (P < 0	.00001)	; I² = 92	2%			
Test for overall effect: J	Z = 6.21 ((P < 0.00	001)							
4 0 0 Combination of							-1			
1.3.2 Combination of	packing	and sutri	le versi	is frans	s-septal	sutrue	alone			
Awan 2008	7.318	2.239	44	2.136	1.503	44	4.5%	2.69 [2.11, 3.28]	2008	
Ozbalkoc 2016	0.09	0.426	22	0.09	0.426	22	4.5%	0.00 [-0.59, 0.59]	2016	
Yaday 2019 Subtatal (05% CI)	6.28	1.72	30	2.6	1.22	30	4.4%	2.44 [1.76, 3.11]	2019	
Subtotal (95% CI)	0.04.05		90			90	13.3%	1.71[-0.02, 3.44]		
Heterogeneity: Tau* =	2.24; Ch	r = 47.41	, df = 2	(P < 0.0	JUU1); I*	= 96%				
lest for overall effect: .	Z = 1.93 ((P = 0.05))							
133 Total nacal nack	cina vore	ue Trane	eontal	euturo	with enli	int				
Noil: 2015	ung vers	us mans	-septai	Suture	7 5 5		4 70/	0.0040.00.0.671	2015	
Naik 2015 Dahu 2020	5	1.00	90	2.1	1.55	94	4.7%	0.38 [0.09, 0.07]	20151	
Subtotal (95% CI)	5.5	1.5	110	2.5	1.03	114	4.270 8.0%	2.51 [1.00, 3.30]	2020	
Hotorogonoity: Tou? -	2.46° Chi	8-01 67	df = 1	/D ~ 0 0	10043-18	- 05%	0.370	1.41[-0.07, 5.45]		
Telefoyeneily, rau =	2.10, OH 7 = 4.227	(D = 0.40)	, ui – T	(F < 0.0)	5001), 1	- 90%				
restion overall ellect.	2 - 1.321	(F = 0.19)	,							
1.3.4 Total nasal pack	cina vers	us Nasal	airway	integra	ted pacl	kina				
Vu 2013	1 / 0	0.02	20	2 2 2 2	1 3	,11	4.6%	-0.67 [-1.1.2] -0.22[2012	
Rahu 2020	5.5	13	20	2.22	1.3	20	4.0 %	1 91 11 15 2 671	2013	
Subtotal (95% CI)	0.0	1.5	59		1.21	61	8.9%	0.60 [-1.92, 3,12]	2020	
Heterogeneity: Tau ² =	3 21: Chi	i ² = 32.61	df = 1	(P < ∩ ∩ I	יוייר001. אייר001	= 97%				
Test for overall effect:	7 = 0.47	(Ρ = 0 64)	, ai = 1 :)	0.00	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	- 51 30				
		0.01	r							
1.3.5 Total nasal pack	king vers	us Nasal	retaini	ng devid	es					
Vulusvamv 2012	7.27	2.35	40	2.57	2.45	40	4.5%	1.94 [1.40, 2.47]	2012	
Fang 2019	5.68	1.31	17	3.15	0.54	22	4.1%	2.60 [1.72, 3.48]	2019	
Subtotal (95% CI)			57			62	8.6%	2.18 [1.55, 2.80]		•
Heterogeneity: Tau ² =	0.08; Chi	i ² = 1.59,	df = 1 (F	e = 0.21)	; I ² = 379	%				
Test for overall effect: J	Z = 6.86 ((P < 0.00	001) `							
1.3.6 Total nasal pack	king vers	us Fibrin	glue							
Habesoglu 2010	6.09	1.64	23	2.43	1,37	21	4.2%	2.37 [1.58, 3.16]	2010	
Subtotal (95% CI)			23			21	4.2%	2.37 [1.58, 3.16]		▲
Heterogeneity: Not ap	plicable									
Test for overall effect:	Z = 5.90 ((P < 0.00	001)							
Total (95% CI)			741			747	100.0 %	1.79 [1.31, 2.28]		▲
Heterogeneity: Tau² =	1.30; Ch	i ² = 348.3	5, df = 2	22 (P < 0	.00001);	; I² = 94	%			
Test for overall effect; 2	Z=7.20 ((P < 0.00	001)							-4 -2 0 2 4 Other technique Total nasal nacking
Test for subgroup diffe	erences:	Chi² = 2.	58, df =	5 (P = 0.	75), I² =	0%				outor tooming to the header peeting

Figure 5. Pain score, Standardized mean difference (SMD), Total nasal packing versus other techniques: random-effect model.

95% Cl 8.21–40.27; p < 0.001). The heterogeneity was moderate (l2 = 49%; p= 0.08). The results are shown in Table 2 and Figure 4. The definition of respiratory distress was different among these six studies. A summary of respiratory distress definition among the included studies is presented in Table 3.

Oxygen desaturation

Six studies (319 participants) were included in this analysis. There was no statistically significant difference between the total nasal packing and other procedures (MD -2.01; 95% Cl -4.03 to 0.01; p=0.05). The heterogeneity was high (l2 = 98%; p < 0.001). The forest plot is shown in the electronic supplement (e-Figure 1).

Pain

Twenty-one studies (1,488 participants) were included in this analysis. The pain in the total nasal packing group was significantly worse than other procedures (SMD 1.79; 95% CI 1.31-2.28;

Table 1. Characteristics of included studies.

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	vd rD		+	+	+		+		+	+	+	+	+	+		+	+	+		+	+	+	+	+
	łe ⊿		+	+	+		+		+	+	+	+	+	+		+	+		+	+		+	+	
	BL I			+	+	+					+		+			+		+	+	+	+		+	
	F			+			+		+	+	+	+		+		+	+	+	+	+		+	+	+
d)	Dp			+			+			+													+	
tcome	Epi		+	+	+		+			+													+	
no	ŗ		+																+	+	+			
	Inf			+			+		+		+	+		+		+			+		+		+	+
	۵.		+			+	+	+		+			+	+				+	+					
	SL		+	+			+			+													+	
	02														+				+					
	RD				+						+													
Fol- low upt			2w	1w	3m	3m	Ъ	48h	12m	13	3m	1×	Зm	Зm	Jd	1 wk	Ъd	1mo	5mo	12m	2m	N/A	3m	6w
Other intervention †			Vicryl 3-0	vicryl 4-0, 5d	vicryl 3-0 or 4-0	Vicryl 3-0	Suture (N/A), remove 7d	suture (N/A)	suture (N/A)	Vicryl 4-0	Vicryl 3-0 (2-4 stitched)	absorbable thread 5-0	Vicryl 4-0 (3-6 stitches)	Vicryl4-0	Vicryl 4-0	suture (N/A)	vicryl 4-0	suture (N/A)	Vicryl 3-0, 4-0	Vicryl 5-0	Vicryl 3-0	Vicryl 4-0, Wormald's conti- nuous suture	Vicryl 4-0 multiple random throws	Chromic cat gut4-0
Packing intervention†			Merocel, 24h	Ivalon,3d	ribbon gauze	Merocel, 3 d	polymer expansion sponge, 24h	Merocel, 48h	Merocel, 2d	merocel with tetracy- cline ointment, 1d	Merocel, 48h	polymer hemostatic sponge, 24h	merocel with nitrofura- zone ointment, 48h	Merocel, 48h	Merocel, 3d	Merocel, 2d	Merocel, 48h	ribbon gauze with antibiotics	Merocel, 48h	tetracycline-impregnant gauze, 24-48h	ribbin gauze soak by BIPP + soframycin, 48 h	Merocel, 2d	Netcell 5000, 48 hr	Fingerstall filled with gauze, smeared with vasline, 28 h
TOA			дA	ВA	N/A	ВA	GA	N/A	N/A	GA	ВA	N/A	GA	ВA	N/A	N/A	GA, LA	В	ВA	В	GA, LA	N/A	GA	GA
Age (years)		suture	>20	N/A	adults	18-76	19-45	17-55	18-64	18-45	18-54	17-67	18-61	18-61	20-30	18-64	17-72	10-50	16-55	15-63	13-52	Mean 36	19-62	18-61
size	Oth	septal	41	20	36	46	30	21	79	30	50	30	22	50	20	30	363	21	100	68	46	40	37	18
Sample	pack	s Trans-s	41	20	36	46	30	18	79	30	50	30	16	50	23	30	334	23	100	77	41	40	27	15
ear		versu	020	018	017	016	016	016	016	015	014	014	014	013	013	013	012	012	011	011	011	011	010	010
Authors Y		Total nasal packing	Ramalingam ⁽⁹⁾ 2	Wang ⁽¹⁰⁾ 2	Dadgarnia ⁽¹¹⁾ 2	Plasencia ⁽¹²⁾ 2	Li ⁽¹³⁾ 2	Dalgic ⁽¹⁴⁾ 2	Shao ⁽¹⁵⁾ 2	Mustafa ⁽¹⁶⁾ 2	Cayonu ⁽¹⁷⁾ 2	Dai ⁽¹⁸⁾ 2	Eski ⁽¹⁹⁾ 2	Okris ⁽²⁰⁾ 2	Turhan ⁽²¹⁾ 2	Yang ⁽²²⁾ 2	Cukurova ⁽²³⁾ 2	Ghimire ⁽²⁴⁾ 2	Gunaydin ⁽²⁵⁾ 2	Naghibzadeh ⁽²⁶⁾ 2	Thapa ⁽²⁷⁾ 2	Wang ⁽²⁸⁾ 2	Korkut ⁽²⁹⁾ 2	Kula ⁽³⁰⁾ 2

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Fol- low upt		12m	3m	48h	48h	6w	16m		10d	7d		3mo		NA	12m	6wk	4wk		14d		12wk
Other intervention +		Vicryl 4-0 (4 horizontal mattress stitches)	Vicryl 5-0	Chromic cat gut4/0 continuous suture	Vicryl 5-0	Dexon 3-0 Quiting suture	Chromic 4-0 quilting sutures		Vicryl 3-0	Vicryl 2-0		Shah nasal plate, 7-10d		Nasal splint	silicone splint with figure of 8 TSS by Ethilon 3-0, 1 w	fluoroplastic flexible splint with TSS by Mersilk 3-0	1mm thick silicone each side fixed by suture, 2w		Fibrin glue (Tiseel) 1 mL applied between cartilage and septal flap		cut ETT no4-5 or NG tube 16-20FR, with gauze packing
Packing intervention†		tetracycline-soaked mesh with nasal splint, 48 h	ribbon gauze with Anti- biotics, 24h	Merocel with antibiotics, 48h	finger glove, 48 h	Vaseline gauze	gauze with polysporin ointment, 24-48 h	ersus Trans-septal suture	Merocel+TSS, 1d	finger glove+TSS, 1d	asal splint	lvalon 1d with Shah nasal plate, 7-10d	int	Merocel, unknown duration	antibiotics impregnated gauze, 48h	antibiotics soaked nasal pack	sponge-like packing made from arum root, with antibiotics, 2dd		Merocel, 2d		Gauze packing
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Authors		Ardehali ⁽³¹⁾	Al-Ragged ⁽³²⁾	Kazkayasi ⁽³³⁾	Yildirim ⁽³⁴⁾	Nunez(35)	Guyuron ⁽³⁶⁾	Combination	Yadav ⁽³⁷⁾	Awan ⁽³⁸⁾	Combination	Bernado ⁽³⁹⁾	Nasal packing	Caglar ⁽⁴⁰⁾	Naik ⁽⁴¹⁾	Wadhera ⁽⁴²⁾	Azaka ⁽⁴³⁾	Nasal packing	Habesoglu ⁽⁴⁴⁾	Nasal packing	Farooq ⁽⁴⁵⁾

Table 1 continued.

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Abbreviations: Oth; Other intervention, TOA; Type of anesthesia, RD; Respiratory distress, O2; Oxygen saturation, SL; Sleep disturbance, P; Pain, Inf; Infection, Cr; Crusting, Epi; Epiphora, Dp; Dysphagia, Pf; Perforation, BL;bleeding, He; Hematoma, Ad; Adhesion, rD; Residual of the deviated nasal septum, N/A; Not available, BIPP; Bithmud iodine paraffin paste. + h=hour, d=day, w=week, m=month.

p < 0.001). The heterogeneity was high (I2 = 94%; p <0.001). The result is shown in Figure 5.

Bleeding

Twenty-eight studies (2,941 participants) were included in this analysis. There was no statistically significant difference between the total nasal packing and other procedures (OR 1.23; 95% CI 0.76–1.99; p= 0.40). The heterogeneity was moderate (I2 = 54%; P< 0.001). The forest plot is shown in the electronic supplement (e-Figure 2).

Hematoma

Thirty-two studies (3,355 participants) were included in this analysis. There was no statistically significant difference between the total nasal packing and other procedures (OR 2.12; 95% CI 0.73–6.12; P = 0.17). The heterogeneity was moderate (I2 = 46%; P = 0.04). The forest plot is shown in the electronic supplement (e-Figure 3).

Sleep disturbance

Seven studies (501 participants) were included in this analysis. The total nasal packing significantly increased the odds of sleep disturbance events compared to other procedures (OR 11.92; 95% Cl 4.95–28.66; P < 0.001). The heterogeneity was high (l2 = 71%; P = 0.002). The forest plot is shown in the electronic supplement (e-Figure 4).

Infection

Nineteen studies (1,531 participants) were included in this analysis. There was no statistically significant difference between the total nasal packing and other procedures (OR 2.21; 95% CI 0.84-5.78; P = 0.11). The heterogeneity was low (I2 = 0%; P = 0.57). The forest plot is shown in the electronic supplement (e-Figure 5).

Crusting

Eleven studies (947 participants) were included in this analysis. The total nasal packing significantly increased the odds of crusting events compared to other procedures (OR 4.26; 95% CI 1.70-10.69; P = 0.002). The heterogeneity was high (I2 = 70%; P <0.001). The forest plot is shown in the electronic supplement (e-Figure 6).

Outo	come	Studies	Participants	Statistical methods	Effect	95%Cl	p-value	l2 (p-value)
1	Respiratory distress	6	596	OR (RE)	18.18	8.21, 40.27	<0.001	49% (0.008)
2	Oxygen saturation	6	319	MD (RE)	-2.01	-4.03, 0.01	0.05	98% (<0.001)
3	pain severity	21	1,488	SMD (RE)	1.79	1.31, 2.28	<0.001	94% (<0.001)
4	Bleeding	28	2,941	OR (RE)	1.23	0.76, 1.99	0.40	54% (0.001)
5	Hematoma	32	3,355	OR (RE)	2.12	0.73, 6.12	0.17	46% (0.04)
6	Sleep disturbance	7	501	OR (RE)	11.92	4.95, 28.66	<0.001	71% (0.002)
7	Infection	19	1,513	OR (FE)	2.21	0.84, 5.78	0.11	0% (0.57)
8	Crusting	11	937	OR (RE)	4.26	1.70, 10.69	0.002	70% (<0.001)
9	Epiphora	9	657	OR (RE)	65.91	12.87, 337.42	<0.001	81% (<0.001)
10	Dysphagia	6	452	OR (RE)	59.78	5.52, 647.53	<0.001	91% (<0.001)
11	Perforation	21	2,394	OR (FE)	1.67	0.87, 3.19	0.12	0% (0.99)
12	Adhesion	32	3,003	OR (FE)	2.40	1.64, 3.51	<0.001	0% (0.65)
13	residual DNS	13	1,118	OR (FE)	0.93	0.59, 1.49	0.78	26% (0.22)

Table 2. A summary of post-operative complications of the total nasal packing, comparing to other alternatives techniques.

OR; Odd ratio, MD; Mean difference, SMD; Standardized mean difference, RE; Random effect model, FE; Fixed effect model DNS; deviation of nasal septum.

Table 3. A summary of respiratory distress definition among the included studies.

Study (author, year, reference number)	Respiratory distress definition
Gunaydin 2011 ⁽²⁵⁾	Extubation difficulty score > 1. Extubation was scored, based on the amount of secretion, the occurrence of laryngospasm, the need for oropharyngeal airway usage, and the effort of nasal breathing by an anesthesiologist. The score was in 0-4 scale: 0 easiest, 1 easy, 2 moderately difficult, 3 difficult, 4 most difficult.
Cayonu 2014 ⁽¹⁷⁾	 Respiratory events related to anesthesia in the operating theatre, defined as any unanticipated hypoxemia (hemoglobin oxygen saturation <90%) hypoventilation (respiratory rate <8 breaths/min or arterial carbon dioxide tension >50 mmHg) upper airway obstruction (stridor or laryngospasm) requiring an active and specific intervention (ventilation, tracheal intubation, opioid or muscle relaxant antagonism, insertion of oral/nasal airway or airway manipulation)
Ozbalkoc 2016 ⁽⁵⁴⁾	Anesthesia related parameters: Difficulty at extubation. Of note, this study also recorded other anesthesia related parameters which were not included in the forest plot (presence of laryngospasm after surgery, need for oropharyngeal airway, effort for nasal respiration)
Dadgarnia 2017 ⁽¹¹⁾	Presence of dyspnea symptoms in the first 48 hours after surgery, complaint by the patient
Faroog 2016 ⁽⁴⁵⁾	Presence of difficult recovery from general anesthesia, including unsmooth or late recovery considered by doctors
Vulsvamy 2012 ⁽⁵²⁾	Average oxygen saturation <95% from the 6-hour record of post-operative continuous oxygen saturation (SpO2) monitoring, every 30 minutes.

Epiphora

Nine studies (657 participants) were included in this analysis. The total nasal packing significantly increased the odds of epiphora events compared to other procedures (OR 65.91; 95% Cl 12.87-337.42; P <0.001). The heterogeneity was high (l2 = 81%; P <0.001). The forest plot is shown in the electronic supplement (e-Figure 7).

Dysphagia

Six studies (452 participants) were included in this analysis. The total nasal packing significantly increased the odds of dyspha-

gia events compared to other procedures (OR 59.78; 95% Cl 5.52-647.53; P <0.001). The heterogeneity was high (I2 = 91%; P <0.001). The forest plot is shown in the electronic supplement (e-Figure 8).

Perforation

Twenty-one studies (2,394 participants) were included in this analysis. There was no statistically significant difference between the total nasal packing and other procedures (OR 1.67; 95% CI 0.87-3.19; P = 0.12). The heterogeneity was low (I2 = 0%; P = 0.99). The forest plot is shown in the electronic supplement

(e-Figure 9).

Adhesion

Thirty-two studies (3,003 participants) were included in this analysis. The total nasal packing significantly increased the odds of adhesion events compared to other procedures (OR 2.40; 95% CI 1.64–3.51; P <0.001). The heterogeneity was low (I2 = 0%; P = 0.65). The result is shown in Figure 6.

Residual deviation of the nasal septum

Thirty studies (1,118 participants) were included in this analysis There was no statistically significant difference between the total nasal packing and other procedures (OR 0.93; 95% Cl 0.59–1.49; P = 0.78). The heterogeneity was low (I2 = 26%; P = 0.22) The forest plot is shown in the electronic supplement (e-Figure 10).

Subgroup analysis by the techniques

Total nasal packing versus trans-septal suture

There were 30 studies comparing postoperative complications between total nasal packing and trans-septal suture. The results favored the trans-septal suture over the nasal packing, for decreasing respiratory distress, pain, sleep disturbance, crusting, epiphora, dysphagia, and adhesion. There were no significant differences in oxygen saturation, bleeding, hematoma, infection, perforation, and residual deviation of the nasal septum. A summary of postoperative complications between nasal packing and trans-septal suture is presented in the electronic supplement (e-Table 1).

Combination of nasal packing and trans-septal suture versus transseptal suture alone

There were 3 studies comparing the nasal packing and transseptal suture combination versus trans-septal suture alone. The sleep disturbance, epiphora, and dysphagia were significantly higher in the combination technique. There were no significant differences in pain severity, infection, bleeding, and hematoma. Other outcomes could not be analyzed due to insufficient number of studies.

Total nasal packing versus trans-septal suture with nasal splint There were 5 studies comparing total nasal packing versus trans-septal suture with splint. The crusting was worsened in the total nasal packing. There were no significant differences in pain severity, bleeding, hematoma, perforation, and adhesion. Other outcomes could not be analyzed due to insufficient number of studies.

Total nasal packing versus nasal airway integrated packing There were 8 studies comparing total nasal packing versus nasal airway integrated packing. However, there was only 1 study for each of the following outcomes that statistically favored the nasal airway integrated packing: respiratory distress, sleep disturbance, and epiphora. There were no statistical differences in oxygen saturation, pain severity, infection, dysphagia, perforation, bleeding, hematoma, and adhesion. None of the studies compared the residual deviated nasal septum.

Combination of nasal packing and nasal splint, nasal retaining devices, and fibrin glue

There was an insufficient number of the studies for each analysis.

Sensitivity analysis

We performed a sensitivity analysis based on methodological characteristics. The analysis of high-quality studies showed a consistency of results in most of the outcomes. The number of high-quality studies in crusting were too few to perform a sensitivity analysis. Some outcomes of the meta-analysis had significant heterogeneities. Therefore, a sensitivity analysis of these outcomes was performed by excluding the studies that contributed the most to the I2. The sensitivity analyses after excluding the outliers showed consistent results.

Different types of pain score were used among the studies to assess the pain severity outcome. The most frequently used was visual analog scale (VAS), the score ranged from 0 to 10. The sensitivity analysis was performed in the studies that used the VAS 0–10. We found that the mean difference of VAS in nasal packing group was higher than other techniques by 3 points. Results are shown in the electronic supplement (e-Figure 11).

Publication bias

The funnel plots of most outcomes revealed that the distribution of the studies was reasonably symmetrical which suggested no evidence of publication bias. However, the funnel plots of epiphora and dysphagia events revealed asymmetrical distribution which suggested the publication bias. The funnel plots are shown in the electronic supplement (e-Figure 12).

Discussion

The results of this meta-analysis demonstrated that nasal packing after septoplasty was more likely to cause adverse events, including respiratory distress, pain, sleep disturbance, crusting, epiphora, dysphagia, and adhesion. Nasal packing did not show benefits in preventing bleeding, hematoma, and residual nasal septum deviation when compared with other techniques. Subgroup analyses results favored the trans-septal suture over the nasal packing, for decreasing respiratory distress, pain, sleep disturbance, crusting, epiphora, dysphagia, and adhesion. There were no significant differences in oxygen desaturation, infection, septal perforation, bleeding, hematoma, and residual nasal septum deviation. Adding nasal packing to trans-septal suture increased sleep disturbance, epiphora, and dysphagia but did not decrease bleeding and hematoma. Trans-septal suture with splint had benefit over nasal packing only in decreasing the crust but no significant differences in other outcomes. There were insufficient randomized control studies of other techniques, including the nasal airway integrated packing, nasal retaining devices, and fibrin glue, for the subgroup analyses. In-line with the previous meta-analyses⁽⁴⁻⁷⁾, the results of this study did not find any significant differences between the nasal packing and trans-septal suture in bleeding, hematoma, perforation, and residual septal deviation. Our study also found that the trans-septal suture had a significant advantage over the nasal packing in decreasing post-operative pain. The analysis of adhesion outcome is consistent with the previous meta-analyses by Kim et al. and Wang et al.^(6,7), which concluded that the nasal packing had a higher adhesion rate than trans-septal suture. However, the other meta-analyses by Banglawala (2013) et al. and Certal et al.^(4,5) did not find a significant difference in adhesion rate. There was no difference in infection rate which is consistent with the previous meta-analyses⁽⁵⁻⁷⁾. A meta-analysis performed by Banglawala (2014) et al.⁽⁸⁾ did not find significant oxygen desaturation caused by nasal packing, which is consistent with our study. However, we found that nasal packing caused respiratory distress which is more important than desaturation due to the possibility of causing serious consequences.

The safety of nasal packing after septoplasty should be strongly considered because this meta-analysis showed both statistically and clinically significant increases in adverse events (respiratory distress, sleep disturbance, crusting, epiphora, dysphagia, and adhesion) when compare to other techniques. In addition, the sensitivity analysis of pain score showed an increase in VAS by 3 out of the 10-point pain score. Furthermore, it did not have advantages over other techniques in the prevention of bleeding, hematoma, and residual septal deviation. As for clinical implications, this meta-analysis suggested that routine nasal packing after septoplasty should be avoided since it could cause adverse events, especially respiratory distress. The technique with sufficient evidence that can be used as an alternative to the nasal packing is trans-septal suture. Future research with welldesigned RCTs, comparing other techniques to the trans-septal suture should be performed.

This is the first meta-analysis that assessed respiratory distress, sleep disturbance, crusting, epiphora, and dysphagia in addition to other outcomes. The alternative techniques other than trans-

septal suture were also included in this meta-analysis. Moreover, our analysis also included the primary studies that were not published in English. The limitations of our study included the measurements of the primary outcome that were different among the studies; for example, the definition of respiratory distress event was different in each included study and most of them were subjective outcomes reported by either anesthesiologists or patients. Nevertheless, we thought that those events could be pooled as the respiratory distress event, because they were all unwanted adverse outcomes that could cause serious consequences. The low quality of the included studies was another limitation, such as the studies with no explanations about the randomization and allocation concealment. Most of the included studies had high risk of performance bias. The postoperative procedure could not be blinded; therefore, we had to be cautious since it could influence the subjective outcomes. In addition, the funnel plots showed publication bias in epiphora and dysphagia. The high heterogeneity of the included studies was due to the data being pooled from studies with different surgical techniques, anesthetic techniques and outcome measurement tools. We accepted the inherent heterogeneity and used a random-effects model for analysis and performed a sensitivity analysis by excluding the outliers that caused the most heterogeneity. The sensitivity analysis showed a consistency of results. Further well-designed research should be performed regarding these limitations.

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Authorship contribution

CKT, PH: designed the concept. CKT, NC, BC: performed data searching, study selection, quality assessment. PH: resolved the discrepancies. CKT, NC: extracted data. CKT: analyzed data. CKT, PH: interpreted data. CKT, drafted the article. NC, BC, PH: provided the feedback, revised the article. CKT: wrote manuscript, sent for English language editing. CKT, PH: approved the final version of manuscript.

Conflict of interest

None.

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This manuscript contains online supplementary material

E-figure 1. Oxygen saturation, mean difference (MD), Total nasal packing versus other techniques: random-effect model.

	Total nas	sal packing) Other	technique	s		Mean Difference		Mean Difference
Study or Subgroup	Mean	SD To	tal Mean	SD T	otal	Weight	IV, Random, 95% Cl	Year	IV, Random, 95% Cl
1.2.1 Total nasal pack	ang versus	s trans-se		77	40	14.204	4 00 1 7 04 0 4 51	2005	
Kazkavasi 2007	96.3	4.93	40 09.43	0.45	40 19	19.4%	-0.40 [-0.96, 0.16]	2005	-
Turhan 2012	90.3	0.82	23 94.65	0.79	20	19.5%	-4.35 [-4.83, -3.87]	2012	-
Subtotal (95% CI)			81		79	53.0 %	-3.11 [-6.33, 0.11]		
Heterogeneity: Tau ² =	7.46; Chi²: 7 – 4.00 (D	= 112.36, d = 0.050	lf = 2 (P ≺ 0.0	00001); I ² =	: 98%)			
restior overall ellect.	Z = 1.69 (P	= 0.06)							
1.2.2 Total nasal pack	king versus	s Nasal airv	way integra	ted packin	ıg				
Yigit 2002	88.92	8.48	20 94.26	6.94	20	9.3%	-5.34 [-10.14, -0.54]	2002 —	
Zeyyan 2010 Yu 2012	96.9	1.04	20 96.3	2.89	19	18.0%	0.60 [-0.78, 1.98]	2010	1
Subtotal (95% CI)	97.00	0.34	39 97.00 79	0.39	80	47.0%	-0.13 [-1.47, 1.20]	2013	•
Heterogeneity: Tau ² =	0.80; Chi ² :	= 5.46, df =	2 (P = 0.07)	; I² = 63%					
Test for overall effect: 2	Z = 0.19 (P	= 0.85)							
Total (95% Cl)		1	160		159	100.0%	-2.01 [-4.03, 0.01]		
Heterogeneity: Tau ² =	5.39: Chi ² :	- = 301.96. d	lf=5(P<0.0	00001); I ^z =	: 98%				
Test for overall effect: 2	Z = 1.95 (P	= 0.05)						-10 Total nasa	-5 U 5 10 Linacking Other technique
Test for subgroup diffe	erences: Cl	hi² = 2.81, c	df = 1 (P = 0.	09), I² = 64	.4%			i otarina da	patient contract
				(
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		×							
4									

E-figure 2. Bleeding, odds ratio (OR), Total nasal packing versus other techniques: random-effect model.



E-figure 3. Hematoma, odds ratio (OR), Total nasal packing versus other techniques: random-effect model.

	rotai nasai pa	cking	Other techn	iques		Odds Ratio		oudorado
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% Cl	Year	M-H, Random, 95% Cl
1.5.1 Total hasal pa	cking versus Tra	ns-septa	i suture		7 700			
Al-Ragged 2007	4	84	0	85	7.7%	9.56 [0.51, 180.37]	2007	
Ardehali 2009	U	57	U	48		Not estimable	2009	
Korkut 2010	0	27	0	37		Not estimable	2010	
Gunaydin 2011	0	100	2	100	7.4%	0.20 [0.01, 4.14]	2011	
Naghibzadeh 2011	1	77	1	68	8.2%	0.88 [0.05, 14.37]	2011	
Wang 2011	1	40	0	40	6.9%	3.08 [0.12, 77.80]	2011	
Cukurova 2012	0	334	0	363		Not estimable	2012	
Okris 2013	0	50	1	50	6.9%	0.33 (0.01, 8,21)	2013	
Yang 2013	0	30	n	30		Not estimable	2013	
Canovu 2014	0	50	ů N	50		Not estimable	2014	
Dei 2014	0	20	1	20	0.400	2.07/040.24451	2014	
Dai 2014	2	30	1	30	9.4%	2.07 [0.18, 24.19]	2014	
ESKI 2014	U	16	U	22		Not estimable	2014	
Mustafa 2015	1	30	0	30	6.9%	3.10 [0.12, 79.23]	2015	
Dalgic 2016	0	18	0	22		Not estimable	2016	
Li 2016	3	30	2	30	11.9%	1.56 [0.24, 10.05]	2016	
Shao 2016	0	79	0	79		Not estimable	2016	
Kavahan 2017	0	20	0	21		Not estimable	2017	
Dadgarnia 2017	0	36	1	36	6 9%	0.32/0.01/8/231	2017	
Wong 2010	0	20		20	0.370	Not optimoble	2017	
Vvarių 2016 Damalininais 2020	0	20	14	20	40.400	1101 eStimable	2010	
Ramalingam 2020	39	41	14	41	13.4%	37.61 [7.90, 179.10]	2020	
Subtotal (95% CI)		1169		1202	85.0%	2.09 [0.63, 6.95]		
Total events Heterogeneity: Tau ² :	51 = 1.86: Chi² = 18.8	30. df = 9	22 (P = 0.03): P	²= 52%				
Test for overall effect	: Z = 1.21 (P = 0.2	:3)	0 = 0.000,1					
1.5.2 Combination o	f packing and su	true vers	us Trans-se	eptal suti	ue			
Awan 2008	3	44	0	44	7.6%	7.51 [0.38, 149.74]	2008	
Yadav 2019	- 0	21	1	29	6.8%	0.44 0.02 11 39	2019	
Subtotal (95% CI)	v	65	'	73	14.4%	1.96 [0.12.31.76]	2010	
Total overte	2		1			nee [en 12, e ni e]		*
Total events	3 - 4 54: 052- 4 00		ا - جارد د م	0.70				
Heterogeneity: Lau*	= 1.51; Chi* = 1.6	J, at = 1 (P = 0.21); F:	= 37%				
Test for overall effect	:: Z = 0.47 (P = 0.6	(4)						
1.5.3 Combination of	f nasal packing a	nd nasa	l splint versu	ıs Nasal	splint			
Bernado 2013	0	37	0	36		Not estimable	2013	
Subtotal (95% CI)		37		36		Not estimable		
Total events	0		0					
Total events Heterogeneity: Not a	0 nnlicable		0					
Total events Heterogeneity: Not a Test for overall effect	0 pplicable :: Not applicable		0					
Total events Heterogeneity: Not a Test for overall effect 1.5.4 Total nasal pa	0 pplicable :: Not applicable c king versus Tr a	ns-septa	0 I suture with	n splint				
Total events Heterogeneity: Not a Test for overall effect 1.5.4 Total nasal par	0 pplicable :: Not applicable c king versus Tra i	ns-septa	0 I suture with	n splint		Not optimable	2014	
Total events Heterogeneity: Not a Test for overall effect 1.5.4 Total nasal par Wadhera 2014	0 pplicable :: Not applicable c king versus Tra i 0	n s-sept a 30	0 I suture with 0	n splint 30		Not estimable	2014	
Total events Heterogeneity: Not a Test for overall effect 1.5.4 Total nasal pa Wadhera 2014 Naik 2015	0 pplicable :: Not applicable c king versus Tra 0 0	n s-sept a 30 90	0 I suture with 0 0	a splint 30 94		Not estimable Not estimable	2014 2015	
Total events Heterogeneity: Not a Test for overall effect 1.5.4 Total nasal pac Wadhera 2014 Naik 2015 Caglar 2019	0 pplicable :: Not applicable c king versus Tra 0 0 0 0	n s-sept a 30 90 30	0 I suture with 0 0 0	a splint 30 94 30		Not estimable Not estimable Not estimable	2014 2015 2019	
Total events Heterogeneity: Not a Test for overall effect 1.5.4 Total nasal pac Wadhera 2014 Naik 2015 Caglar 2019 Subtotal (95% CI)	0 pplicable :: Not applicable cking versus Trai 0 0 0	ns-septa 30 90 30 150	0 I suture with 0 0 0	n splint 30 94 30 154		Not estimable Not estimable Not estimable Not estimable	2014 2015 2019	
Total events Heterogeneity: Not a Test for overall effect 1.5.4 Total nasal pac Wadhera 2014 Naik 2015 Caglar 2019 Subtotal (95% CI) Total events	0 pplicable :: Not applicable c king versus Trai 0 0 0	ns-septa 30 90 30 150	0 I suture with 0 0 0	n splint 30 94 30 154		Not estimable Not estimable Not estimable Not estimable	2014 2015 2019	
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Total events Heterogeneity: Not a Test for overall effect 1.5.4 Total nasal pac Wadhera 2014 Naik 2015 Caglar 2019 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect	0 pplicable :: Not applicable cking versus Trai 0 0 0 pplicable :: Not applicable	ns-septa 30 90 30 150	0 I suture with 0 0 0 0	a splint 30 94 30 154		Not estimable Not estimable Not estimable Not estimable	2014 2015 2019	
Total events Heterogeneity: Not a Test for overall effect 1.5.4 Total nasal pac Wadhera 2014 Naik 2015 Caglar 2019 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.5 Total nasal pac	0 pplicable :: Not applicable cking versus Trai 0 0 0 pplicable :: Not applicable cking versus Nas	ns-septa 30 90 30 150	0 I suture with 0 0 0 0 0	a splint 30 94 30 154 packing		Not estimable Not estimable Not estimable Not estimable	2014 2015 2019	
Total events Heterogeneity: Not a Test for overall effect 1.5.4 Total nasal pac Wadhera 2014 Naik 2015 Caglar 2019 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.5 Total nasal pac Acioglu 2012	0 pplicable :: Not applicable cking versus Trai 0 0 0 pplicable :: Not applicable cking versus Nas 0	ns-septa 30 90 30 150 al airwa 89	0 I suture with 0 0 0 0 0 0 9 9 9 9 9 9 9 9 9 9 9 9 9	a splint 30 94 30 154 packing 30		Not estimable Not estimable Not estimable Not estimable	2014 2015 2019 2012	
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Total events Heterogeneity: Not a Test for overall effect 1.5.4 Total nasal pac Wadhera 2014 Naik 2015 Caglar 2019 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.5 Total nasal pac Acioglu 2012 Yu 2013 Yilmaz 2013 Farooq 2016 Kayahan 2017 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.6 Total nasal pac Fang 2019 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect	0 pplicable :: Not applicable cking versus Tran 0 0 0 pplicable :: Not applicable cking versus Nas 0 0 0 0 0 0 0 0 0 0 0 0 0	ns-septa 30 90 30 150 al airwa 89 39 22 50 20 20 20 20 31 7 7 7	I suture with 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	n splint 30 94 30 154 packing 30 41 25 50 20 166		Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable	2014 2015 2019 2013 2013 2013 2016 2017 2019	
Total events Heterogeneity: Not a Test for overall effect 1.5.4 Total nasal par Wadhera 2014 Naik 2015 Caglar 2019 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.5 Total nasal par Acioglu 2012 Yu 2013 Yilmaz 2013 Farooq 2016 Kayahan 2017 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.6 Total nasal par Fang 2019 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect	0 pplicable :: Not applicable cking versus Tran 0 0 0 pplicable :: Not applicable cking versus Nas 0 0 0 0 0 0 0 0 0 0 0 0 0	ns-septa 30 90 30 150 al airwa 89 39 22 50 20 20 20 al retain 17 17	0 I suture with 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	a splint 30 94 300 154 packing 30 41 25 50 20 166 22 22 22 22		Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable	2014 2015 2019 2013 2013 2013 2016 2017 2019	
Total events Heterogeneity: Not a Test for overall effect 1.5.4 Total nasal pac Wadhera 2014 Naik 2015 Caglar 2019 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.5 Total nasal pac Acioglu 2012 Yu 2013 Yilmaz 2013 Farooq 2016 Kayahan 2017 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.6 Total nasal pac Fang 2019 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect	0 pplicable :: Not applicable cking versus Tran 0 0 0 pplicable :: Not applicable cking versus Nas 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ns-septa 30 90 30 150 al airwa 89 39 22 20 20 20 20 20 20 17 17	I suture with 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	a splint 30 94 30 154 packing 30 41 25 50 20 166		Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable	2014 2015 2019 2012 2013 2013 2013 2017 2019	
Total events Heterogeneity: Not a Test for overall effect 1.5.4 Total nasal pac Wadhera 2014 Naik 2015 Caglar 2019 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.5 Total nasal pac Acioglu 2012 Yu 2013 Yilmaz 2013 Farooq 2016 Kayahan 2017 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.6 Total nasal pac Fang 2019 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.7 Total nasal pac Heterogeneity: Not a Test for overall effect	0 pplicable :: Not applicable cking versus Tran 0 0 0 0 0 0 0 0 0 0 0 0 0	ns-septa 30 90 30 150 al airwa 89 39 22 50 20 20 20 al retain 17 17 17	I suture with 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	a splint 30 94 30 154 packing 30 41 25 50 20 166		Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable	2014 2015 2019 2012 2013 2013 2013 2017 2019 2019	
Total events Heterogeneity: Not a Test for overall effect 1.5.4 Total nasal par Wadhera 2014 Naik 2015 Caglar 2019 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.5 Total nasal par Acioglu 2012 Yu 2013 Yilmaz 2013 Farooq 2016 Kayahan 2017 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.6 Total nasal par Fang 2019 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.7 Total nasal par Heterogeneity: Not a Test for overall effect	0 pplicable :: Not applicable cking versus Tran 0 0 0 0 pplicable :: Not applicable cking versus Nas 0 0 0 0 0 0 0 0 0 0 0 0 0	ns-septa 30 90 30 150 al airwa 89 39 22 50 20 220 al retain 17 17 17 in glue 21 21	0 I suture with 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	a splint 30 94 30 154 packing 30 41 25 50 20 166 22 22 22 22 23 23 23		Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable	2014 2015 2019 2012 2013 2013 2016 2017 2019 2019	
Total events Heterogeneity: Not a Test for overall effect 1.5.4 Total nasal pac Wadhera 2014 Naik 2015 Caglar 2019 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.5 Total nasal pac Acioglu 2012 Yu 2013 Yilmaz 2013 Farooq 2016 Kayahan 2017 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.6 Total nasal pac Fang 2019 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.7 Total nasal pac Habesoglu 2010 Subtotal (95% CI) Total events	0 pplicable :: Not applicable cking versus Tran 0 0 0 0 pplicable :: Not applicable cking versus Nas 0 0 0 0 0 0 0 0 0 0 0 0 0	ns-septa 30 90 30 150 al airwa 89 39 22 20 20 20 20 20 20 20 20 21	0 I suture with 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	a splint 30 94 30 154 packing 30 41 25 50 20 166 22 22 22 23 23 23		Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable	2014 2015 2019 2012 2013 2013 2016 2017 2019 2019	
Total events Heterogeneity: Not a Test for overall effect 1.5.4 Total nasal par Wadhera 2014 Naik 2015 Caglar 2019 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.5 Total nasal par Acioglu 2012 Yu 2013 Yilmaz 2013 Farooq 2016 Kayahan 2017 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.6 Total nasal par Fang 2019 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.7 Total nasal par Heterogeneity: Not a Test for overall effect 1.5.7 Total nasal par Heterogeneity: Not a	0 pplicable :: Not applicable cking versus Tran 0 0 pplicable :: Not applicable cking versus Nas 0 0 0 pplicable :: Not applicable cking versus Nas 0 0 pplicable :: Not applicable cking versus Fibr 0 0 pplicable cking versus Fibr 0 pplicable ck	ns-septa 30 90 30 150 al airwa 89 39 22 50 20 20 20 20 20 20 20 21 in glue 21 21	I suture with 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	a splint 30 94 30 154 packing 30 41 25 50 20 166 22 22 22 23 23 23		Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable	2014 2015 2019 2012 2013 2013 2013 2017 2019 2019	
Total events Heterogeneity: Not a Test for overall effect 1.5.4 Total nasal par Wadhera 2014 Naik 2015 Caglar 2019 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.5 Total nasal par Acioglu 2012 Yu 2013 Yilmaz 2013 Farooq 2016 Kayahan 2017 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.6 Total nasal par Fang 2019 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.7 Total nasal par Heterogeneity: Not a Test for overall effect 1.5.7 Total nasal par Heterogeneity: Not a Test for overall effect	0 pplicable :: Not applicable cking versus Tran 0 0 pplicable :: Not applicable cking versus Nas 0 0 0 pplicable :: Not applicable cking versus Nas 0 0 pplicable :: Not applicable cking versus Fibr 0 pplicable :: Not applicable cking versus Fibr 0 0 pplicable :: Not applicable cking versus Fibr 0 0 pplicable :: Not applicable cking versus Fibr 0 0 pplicable :: Not applicable cking versus Fibr 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ns-septa 30 90 30 150 al airwa 89 39 22 50 20 20 20 20 al retain 17 17 17 in glue 21 21	0 I suture with 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	a splint 30 94 30 154 packing 30 41 25 50 20 166 22 22 22 23 23 23		Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable Not estimable	2014 2015 2019 2012 2013 2013 2013 2017 2019 2019	
Total events Heterogeneity: Not a Test for overall effect 1.5.4 Total nasal par Wadhera 2014 Naik 2015 Caglar 2019 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.5 Total nasal par Acioglu 2012 Yu 2013 Yilmaz 2013 Farooq 2016 Kayahan 2017 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.6 Total nasal par Fang 2019 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.7 Total nasal par Heterogeneity: Not a Test for overall effect 1.5.7 Total nasal par Heterogeneity: Not a Test for overall effect 1.5.7 Total nasal par Heterogeneity: Not a Test for overall effect	0 pplicable :: Not applicable :: Not applicable	ns-septa 30 90 30 150 al airwa 89 39 22 50 20 20 20 al retain 17 17 17 in glue 21 21	0 I suture with 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	a splint 30 94 30 154 packing 30 41 25 50 20 166 22 22 22 23 23 23		Not estimable Not estimable	2014 2015 2019 2012 2013 2013 2013 2017 2019 2019	
Total events Heterogeneity: Not a Test for overall effect 1.5.4 Total nasal par Wadhera 2014 Naik 2015 Caglar 2019 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.5 Total nasal par Acioglu 2012 Yu 2013 Yilmaz 2013 Farooq 2016 Kayahan 2017 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.6 Total nasal par Fang 2019 Subtotal (95% CI) Total events Heterogeneity: Not a Test for overall effect 1.5.7 Total nasal par Heterogeneity: Not a Test for overall effect 1.5.7 Total nasal par Heterogeneity: Not a Test for overall effect 1.5.7 Total nasal par Heterogeneity: Not a Test for overall effect	0 pplicable :: Not applicable :: Not applicable	ns-septa 30 90 30 150 al airwa 89 39 20 20 20 20 20 21 17 17 17 17 17	0 I suture with 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	a splint 30 94 30 154 packing 30 41 25 50 20 166 22 22 22 23 23 1676	100.0%	Not estimable Not estimable	2014 2015 2019 2012 2013 2013 2016 2017 2019 2019	
Total events Heterogeneity: Not a Test for overall effect 1.5.4 Total nasal pac Wadhera 2014 Naik 2015 Caglar 2019 Subtotal (95% Cl) Total events Heterogeneity: Not a Test for overall effect 1.5.5 Total nasal pac Acioglu 2012 Yu 2013 Yilmaz 2013 Farooq 2016 Kayahan 2017 Subtotal (95% Cl) Total events Heterogeneity: Not a Test for overall effect 1.5.6 Total nasal pac Fang 2019 Subtotal (95% Cl) Total events Heterogeneity: Not a Test for overall effect 1.5.7 Total nasal pac Heterogeneity: Not a	0 pplicable :: Not applicable :: Not applicable :: Not applicable :: Not applicable :: Not applicable :: Not applicable :: Not applicable :: Not applicable :: Not applicable :: Not applicable :: Not applicable	ns-septa 30 90 30 150 al airwa 89 39 22 20 20 20 20 20 20 21 17 17 17	0 I suture with 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	a splint 30 94 30 154 packing 30 41 25 50 20 166 22 22 22 23 23 1676	100.0%	Not estimable Not estimable	2014 2015 2019 2013 2013 2013 2013 2013 2013 2019 2019	

E-figure 4. Sleep disturbance, odds ratio (OR), Total nasal packing versus other techniques: random-effect model.

	Total nasal pa	cking	Other tech	niques		Odds Ratio		Odds Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% Cl	Year	M-H, Random, 95% Cl
1.6.1 Total hasal pac	King versus fra	ns-septa	ai suture		45.00	40.40.00.40.04.50	2042	
Korkut 2010 Dedgernie 2017	22	27	11 ว	37	15.2%	10.40 [3.13, 34.53]	2010	
Subtotal (95% CI)	11	63	2	73	27.7%	9.23 [3.54, 24.07]	2017	
Total events	33		13			0.20 [0.0 ., 2]		
Heterogeneity: Tau ² =	= 0.00: Chi ² = 0.1	1. df = 1	(P = 0.74); I ²	= 0%				
Test for overall effect	Z = 4.55 (P < 0.0	00001)	. ,,					
1.6.2 Combination of	packing and su	true vers	sus Trans-s	eptal sutr	ue			
Awan 2008	36	44	7	44	15.8%	23.79 [7.81, 72.41]	2008	
Yadav 2019	23	30	3	30	13.4%	29.57 [6.85, 127.64]	2019	
Subtotal (95% CI)		74		74	29.2 %	25.76 [10.62, 62.48]		
Total events	59		10					
Heterogeneity: Tau ² =	= 0.00; Chi ² = 0.0	5, df = 1 i	(P = 0.82); I ²	= 0%				
lest for overall effect	: Z = 7.19 (P < 0.0	JUUU1)						
1.6.3 Combination of	nasal packing a	and nasa	l splint vers	us Nasal	splint			
Bernado 2013	23	37	17	36	17.1%	1.84 (0.72, 4.67)	2013	
Subtotal (95% CI)	20	37		36	17.1%	1.84 [0.72, 4.67]	2010	
Total events	23		17					
Heterogeneity: Not a	oplicable							
Test for overall effect	Z = 1.28 (P = 0.2	20)						
1.6.4 Total nasal nac	king versus Nas	sal airwa	vintegrated	Inacking				
Faroog 2016	40	50	12	50 SI	17.0%	12 67 [4 90 32 73]	2016	
Subtotal (95% CI)	40	50	12	50	17.0%	12.67 [4.90, 32.73]	2010	•
Total events	40		12					
Heterogeneity: Not ap	oplicable							
Test for overall effect	Z = 5.24 (P < 0.0	00001)						
1.6.5 Total nasal pac	king versus Fibr	rin glue						
Habesoglu 2010	16	21	1	23	8.9%	70.40 [7.48, 662.30]	2010	
Subtotal (95% CI)		21		23	8.9%	70.40 [7.48, 662.30]		
Total events	16		1					
Heterogeneity: Not a	oplicable							
Test for overall effect	: Z = 3.72 (P = 0.0	0002)						
Total (95% CI)		245		256	100.0%	11.92 [4.95, 28.66]		•
Total events	171		53					
Heterogeneity: Tau ² =	= 0.94; Chi ² = 20.	39, df = 6	6 (P = 0.002)	; I² = 71%				
Test for overall effect	Z = 5.53 (P ≤ 0.0	00001)						Other technique Total nasal packing
Test for subgroup dif	ferences: Chi² =	20.23, df	'= 4 (P = 0.0	005), I ^z = 1	80.2%			etter terminger i star haven parting

E-figure 5. Infection, odds ratio (OR), Total nasal packing versus other techniques: fixed-effect model.

	Total nasal pac	king	Other techniq	ues		Odds Ratio		Odds Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% Cl	Year	M-H, Fixed, 95% Cl
1.8.1 Total nasal pack	ing versus Trar	is-septa	al suture					
Ardehali 2009	4	57	0	48	8.5%	8.16 [0.43, 155.49]	2009	
Korkut 2010	0	27	0	37		Not estimable	2010	
Kula 2010	2	15	0	18	6.5%	6.85 [0.30, 154.61]	2010	
Gunaydin 2011	0	100	0	100		Not estimable	2011	
Thapa 2011	5	41	3	44	43.1%	1.90 [0.42, 8.50]	2011	
Wang 2011	0	40	0	40		Not estimable	2011	
OKris 2013 Vena 2012	U	50	U	50		Not estimable	2013	
rang zora Conouu 2014	1	30	1	3U 50	10.00		2013	
Dai 2014	, 0	20	0	20	10.0%	Not estimable	2014	
Dalgic 2016	0	18	0	22		Not estimable	2014	
Shan 2016	0	79	1	79	25.3%		2016	
Kavahan 2017	Ő	20	O	21	20.070	Not estimable	2017	
Wang 2018	0	20	0	20		Not estimable	2018	
Subtotal (95% CI)		577		589	100.0%	2.21 [0.84, 5.78]		
Total events	12		5					
Heterogeneity: Chi² = 2	2.95, df = 4 (P =)	0.57); I²∘	= 0%					
Test for overall effect: 2	Z = 1.61 (P = 0.1)	1)						
			_					
1.8.2 Combination of p	acking and sut	rue vers	sus Trans-sept	tal sutr	ue a			
Awan 2008	0	44	0	44		Not estimable	2008	
Subtotal (95% CI)		44		44		Not estimable		
Total events	0		0					
Heterogeneity: Not app	olicable							
l est for overall effect: l'	vot applicable							
183 Combination of n	asal nacking a	nd nasa	l solint versus	Nasal	soliot			
Remado 2013	nasar packing a	37	0	36	opinit	Not estimable	2013	
Subtotal (95% CI)	0	37	0	36		Not estimable	2013	
Total events	n		Ω					
Heterogeneity: Not app	olicable		Ŭ					
Test for overall effect: N	Not applicable							
1.8.4 Total nasal pack	ing versus Trar	is-septa	al suture with s	splint				
Caglar 2019	0	30	0	30		Not estimable	2019	
Subtotal (95% CI)		30		30		Not estimable		
Total events	0		0					
Heterogeneity: Not app	olicable							
l est for overall effect: N	vot applicable				7			
1 8 5 Total nasal nack	ing versus Nas	al airwa	v integrated na	acking				
Vilmot 2012	ng ver sus nus. 0	22	nitegratea pi 0	26		Not octimable	2012	
Subtotal (95% CI)	Ŭ	22	0	25		Not estimable	2013	
Total events	0		Û					
Heterogeneity: Not app	olicable		-					
Test for overall effect: N	Not applicable							
1.8.6 Total nasal pack	ing versus Nas	al retain	ing devices					
Kayahan 2017	0	20	0	20		Not estimable	2017	
Fang 2019	0	17	0	22		Not estimable	2019	
Subtotal (95% CI)		37		42		Not estimable		
Total events	0		0					
Heterogeneity: Not app	olicable							
l'est for overall effect: l	votapplicable							
Total (95% Cl)		747		766	100.0%	2 21 [0 04 5 70]		
Total evente	10	141	5	100	100.070	2.21 [0.04, 3.70]		
Heterogeneity: Chiž - 3	⊥ ۱∠ مر Af = 4	0.67\.12.	- 0%					
Test for overall effect: 7	7 = 1.61 (P = 0.1	0.07), ⊫∘ 1)	- 5 /0					0.001 0.1 1 10 1000
Test for subaroup diffe	rences: Not ann	licable						Other technique Total nasal packing

E-figure 6. Crusting, odds ratio (OR), Total nasal packing versus other techniques: random-effect model.

()

	Total nasal pac	king O	ther technic	ues		Odds Ratio		Odds Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% Cl	Year	M-H, Random, 95% Cl
1.10.1 Total hasal pa	icking versus Tra	ins-septai	suture	07	40.00	24 22 4 25 4 20 23	0040	
KORKUT 2010 Mulatafa 2015	15	27	2	37	12.9%	21.88 [4.35, 109.93]	2010	
Mustala 2015 Dodgornio 2017	30	30 26	4	00 26	9.9%	309.22 [18.47, 0960.13] 40.00 [4.40.07.0]	2015	· · ·
Subtotal (95% CI)	0	93		103	34.5%	31.94 [5.58, 182.62]	2017	
Total events	53		7			- ···· · ·····, ······ ·		
Heterogeneity: Tau ² :	= 1.15; Chi ² = 3.88	, df = 2 (P	= 0.14); I ² =	49%				
Test for overall effect	: Z = 3.89 (P ≺ 0.0)	001)						
1.10.2 Combination	of packing and su	true versi	us Trans-se	ptal su	true			
Awan 2008	44	44	5	44	10.0%	639.18 [34.25, 11929.64]	2008	+
Yadav 2019	28	30	0	30	9.7%	695.40 [31.99, 15115.66]	2019	
Subtotal (95% CI)		74		74	19.6%	665.27 [79.75, 5549.41]		
Total events	72		5					
Heterogeneity: Tau ² :	= 0.00; Chi ² = 0.00	l,df=1 (P∶ 0004)	= 0.97); I² =	0%				
l est for overall effect	: Z = 6.01 (P < 0.0)	0001)						
1.10.3 Combination	of nasal packing a	and nasal	splint versu	ıs Nasa	l splint			
Bernado 2013	15	37	1	36	11.8%	23.86 [2.94, 193.57]	2013	
Subtotal (95% CI)	15	57	4	30	11.8%	23.80 [2.94, 193.57]		
Heterogeneity: Not a	10 nnlicahla		1				K	
Test for overall effect	7 = 2 97 (P = 0 0	03)						
1.10.4 Total nasal pa	acking versus Tra	ins-septal	suture with	ı splint				
Wadhera 2014	20	30	0	30	10.1%	119.10 [6.61, 2146.63]	2014	
Subtotal (95% CI)		30		30	10.1%	119.10 [6.61, 2146.63]		
l otal events	20		U					
Heterogeneity: Not a	ppiicable · 7 – 2 24 /P – 0 0	04\						
restion overall ellect	. Z = 3.24 (F = 0.0)	01)						
1.10.5 Total nasal pa	acking VS Nasal a	irway inte	grated pac	king				
Farooq 2016	40	50	30	50	14.1%	2.67 [1.09, 6.52]	2016	
Subtotal (95% CI)	10	50	20	50	14.1%	2.67 [1.09, 6.52]		-
Hotorogonoity: Not a	40 nolicable		30					
Test for overall effect	7 = 215 (P = 00)	3)						
	. 2 - 2.10 () - 0.0.							
1.10.7 Total nasal pa	acking VS Nasal r	etaining d	evices					
Vulusvamy 2012	40	40	3	40	9.8%	867.86 [43.37, 17366.86]	2012	
Subtotal (95% CI)		40		40	9.8%	867.86 [43.37, 17366.86]		
Total events	40		3					
Heterogeneity: Not a	pplicable . 7 – 4 42 (D + C C)	00042						
i est for overall effect	. Z = 4.43 (P < 0.0)	0001)						
Total (95% CI)		324		333	100.0%	65.91 [12.87, 337.42]		
Total events	240		46					
Heterogeneity: Tau ² :	= 4.72; Chi ² = 43.1	6, df = 8 (F	P < 0.00001)	; I ² = 81	%			
Test for overall effect	: Z = 5.03 (P < 0.0)	0001)			~~ ~~			Other technique Total nasal packing
l est for subgroup dif	terences: Chi ^z = 3	16.41, df =	5 (P < 0.000	U1), I ² =	86.3%			

E-figure 7. Epiphora, odds ratio (OR), Total nasal packing versus other techniques: random-effect model.

~	Total nasal pac	king	Other techn	iques		Odds Ratio		Odds Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% Cl	Year	M-H, Random, 95% Cl
1.10.1 Total hasal pad	King versus Tra	ns-sep	tai suture					
Korkut 2010	15	27	2	37	12.9%	21.88 [4.35, 109.93]	2010	
Mustafa 2015	30	30	4	30	9.9%	359.22 [18.47, 6986.13]	2015	
Dadgarnia 2017	8	36	1	36	11.7%	10.00 [1.18, 84.78]	2017	
Subtotal (95% CI)		93	_	105	34.5%	31.94 [5.58, 182.02]		
Total events	53							
Heterogeneity: Tau ² = Test for overall effect: 2	1.15; Chi≝= 3.88 Z = 3.89 (P ≤ 0.00	, df = 21 001)	(P = 0.14); P=	= 49%				
1.10.2 Combination of	f packing and su	true ve	rsus Trans-s	septal su	true			
Awan 2008	44	44	5	44	10.0%	639.18 [34.25, 11929.64]	2008	
Yadav 2019	28	30	0	30	9.7%	695.40 [31.99, 15115.66]	2019	
Subtotal (95% CI)		74		74	19.6%	665.27 [79.75, 5549.41]		
Total events	72		5					
Heterogeneity: Tau ² =	0.00; Chi ² = 0.00	. df = 1	(P = 0.97); I ² =	= 0%				
Test for overall effect: 2	Z = 6.01 (P < 0.00	0001)						
1.10.3 Combination of	r nasal packing a	and nas	al splint vers	sus Nasa	al splint			
Bernado 2013	15	37	1	36	11.8%	23.86 [2.94, 193.57]	2013	
Subtotal (95% CI)		37		36	11.8%	23.86 [2.94, 193.57]		
Total events	15		1					
Heterogeneity: Not app	plicable							
Test for overall effect: 2	Z = 2.97 (P = 0.00	03)						
1.10.4 Total nasal pac	king versus Tra	ns-sep	tal suture wi	th splint				
Wadhera 2014 Subtotal (95% Cl)	20	30 30	0	30 30	10.1% 10.1 %	119.10 [6.61, 2146.63] 119.10 [6.61, 2146.63]	2014	
Total events	20		0					
Heterogeneity: Not app	plicable							
Test for overall effect: J	Z = 3.24 (P = 0.00	D1)						
1.10.5 Total nasal pac	king VS Nasal a	irway ii	ntegrated pa	cking				
Farooq 2016	40	50	30	50	14.1%	2.67 [1.09, 6.52]	2016	
Subtotal (95% CI)		50		50	14.1%	2.67 [1.09, 6.52]		◆
Total events	40		30					
Heterogeneity: Not app	plicable							
Test for overall effect: J	Z = 2.15 (P = 0.03	3)						
1.10.7 Total nasal pac	king VS Nasal r	etainino	1 devices					
Vulusvamy 2012	40	40	3	40	9.8%	867 86 [43 37 17366 86]	2012	•
Subtotal (95% CI)	10	40	Ŭ	40	9.8%	867.86 [43.37. 17366.86]	2012	
Total events	40		3			,		
Heterogeneity: Not an	nlicable							
Test for overall effect:	pricable 7 = 4 43 (P < 0 0)	1001)						
reactor overall ellect.	2 - 4.45 (1 - 0.00	50017						
Total (95% CI)		324		333	100.0%	65.91 [12.87, 337.42]		
Total events	240		46					-
Heterogeneity: Tau ² =	4 72: Chiế = 43 1	$\theta_{\rm c}$ df = 8	2 (P < 0.0000	1): I₹ = 81	196			
Test for overall effect: 2	7 = 5.03 (P ≤ 0.0)	0, ar = 0 1001)	(i = 0.0000	17,1 = 01	0			0.001 0.1 1 10 1000
Test for subgroup diffe	arences: Chi ² - 3	6 A1 df	-5/P≤0.00	1001\ I≷-	- 96 3%			Other technique Total nasal packing
restror subgroup and		0.41, 01	- 0 () - 0.00		- 00.070			

E-figure 8. Dysphagia, odds ratio (OR), Total nasal packing versus other techniques: random-effect model.

Study of Subgroup	Total nasal pa	acking Totol	Other techni	ques	Moight	Odds Ratio	Veer	Odds Ratio
1 11 1 Total nasal na	cking versus T	rans.sen	tal suture	TULAI	weight	M-H, Rahuoth, 95% Ci	real	M-n, Kandoin, 95% Ci
Korkut 2010 Subtotal (95% Cl)	18	27 27 27	0	37 37	14.9% 14.9%	146.05 [8.05, 2648.60] 146.05 [8.05, 2648.60]	2010	
Total events	18		0					
Test for overall effect:	Z = 3.37 (P = 0.	.0007)						
1.11.2 Combination of	of packing and s	sutrue ve	rsus Trans-s	eptal su	true			
Awan 2008	42	44	2	44	16.9%	441.00 [59.32, 3278.47]	2008	
Yaday 2019 Subtatal (05% CI)	30	30	6	30	14.9%	229.92 [12.34, 4285.19]	2019	
Subtotal (95% CI)	70	74	0	74	J1.0%	358.00 [08.40, 1872.07]		
Heterogeneity: Tau ² = Test for overall effect:	: 0.00; Chi² = 0.1 : Z = 6.97 (P ≤ 0.	14, df= 1 .00001)	o (P = 0.71); I ² =	0%				
1.11.3 Total nasal pa	cking versus T	rans-sep	tal suture wit	h splint				
Wadhera 2014 Subtotal (95% CI)	13	30 30	2	30 30	17.6% 17.6 %	10.71 [2.15, 53.35] 10.71 [2.15, 53.35]	2014	
Total events Heterogeneity: Not ap	13 oplicable		2					
Test for overall effect:	Z = 2.89 (P = 0.	.004)						
1.11.4 Total nasal pa	cking versus N	lasal airw	ay integrated	packin	g			
Farooq 2016 Subtotal (95% CI)	22	50 50	16	50 50	18.8% 18.8 %	1.67 [0.74, 3.77] 1.67 [0.74, 3.77]	2016	★
Total events Heterogeneity: Not ap Test for overall effect:	22 oplicable : Z = 1.23 (P = 0.	.22)	16					
1.11.5 Total nasal pa	cking versus N	lasal reta	ining devices					
Vulusvamy 2012 Subtotal (95% Cl)	38	40 40	2	40 40	16.9% 16.9 %	361.00 [48.33, 2696.63] 361.00 [48.33, 2696.63]	2012	
Total events	38		2					
Heterogeneity: Not ap	oplicable							
l est for overall effect:	Z=5.74 (P ≤ 0.	.00001)						
Total (95% CI)		221		231	100.0%	59.78 [5.52, 647.53]		
Total events	163		28					
Heterogeneity: Tau ² = Test for overall effect:	= 7.70; Chi² = 53 : Z = 3.37 (P = 0.	3.71, df = 5 .0008)	5 (P < 0.00001); I² = 91	%			0.001 0.1 1 10 1000
Test for subgroup diff	ferences: Chi ² =	: 51.96, di	f= 4 (P < 0.00	001), I ^z =	92.3%			Other technique Total hasal packing
			0					

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E-figure 9. Perforation, odds ratio (OR), Total nasal packing versus other techniques: fixed-effect model.

	Total nasal pa	cking	Other techr	niques		Odds Ratio		Odds Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% Cl	Year	M-H, Fixed, 95% Cl
1.12.1 Total nasal pa	cking versus Tra	ans-sep	tal suture					
Guyuron 1989	0	23	0	22		Not estimable	1989	
Al-Ragged 2007	2	84	0	85	3.3%	5.18 [0.25, 109.57]	2007	
Ardehali 2009	2	57	1	48	7.2%	1.71 [0.15, 19.45]	2009	
Korkut 2010	1	27	1	37	5.6%	1.38 [0.08, 23.17]	2010	
Kula 2010	0	15	1	18	9.1%	0.38 [0.01, 9.93]	2010	
Wang 2011	1	100	0	100	3.4%	3.03 [0.12, 75.28]	2011	
Gunaydin 2011	2	77	1	68	7.1%	1.79 [0.16, 20.15]	2011	
Naghibzadeh 2011	0	40	0	40		Not estimable	2011	
Cukurova 2012	11	334	8	363	50.9%	1.51 [0.60, 3.80]	2012	
Ghimire 2012	1	23	0	21	3.4%	2.87 [0.11, 74.28]	2012	
Yang 2013	1	50	0	50	3.3%	3.06 [0.12, 76.95]	2013	
Okris 2013	0	30	0	30		Not estimable	2013	
Canoyu 2014	0	50	0	50		Not estimable	2014	
Dai 2014	0	30	0	30		Not estimable	2014	
Mustafa 2015	0	30	0	30		Not estimable	2015	
Shao 2016	1	79	1	79	6.8%	1.00 [0.06, 16.27]	2016	
Li 2016	0	30	0	30		Not estimable	2016	
Wang 2018	0	20	0	20		Not estimable	2018	
Subtotal (95% CI)		1099		1121	100.0%	1.67 [0.87, 3.19]		
Total events	22		13					
Heterogeneity: Chi ² =	1.89, df = 9 (P =	0.99); I²	= 0%					
Test for overall effect:	Z = 1.55 (P = 0.1	2)						
4 40 0 7 4 1								
1.12.2 Total hasal pa	CKING VERSUS 11	ans-sep	tai suture w	nn spiint				
Azaka 2012	0	20	0	14		Not estimable	2012	
Wadhera 2014	0	30	0	30		Not estimable	2014	
Subtotal (95% CI)	_	50	_	44		Not estimable		
Total events			0					
Heterogeneity: Not ap	plicable							
Test for overall effect:	Not applicable							
1 12 2 Total pacel pa	aking vorous Na	a lair:	au into arata	d nacking				
1.12.3 Total hasal pa	ching versus Na	isai airw	ay integrate	u packin	9	N1-1	204.2	
Yu 2013 Subtotal (05% CD	U	39	U	41		Not estimable	2013	
Subtotal (95% CI)		29		41		Noresumable		
i utai events	U		U					
Heterogeneity: Not ap	iplicable							
Test for overall effect:	мотарысары							
Total (95% CI)		1188		1206	100.0%	1.67 [0.87, 3.19]		•
Total events	22		13					Ť
Heterogeneity: Chi ² =	1 89 df = 9 (P =	n 99\∙ I≅	= 0%				⊢	
Test for overall effect:	Z = 1.55 (P = 0.1)	2)	0.0				Ö.0	001 0.1 1 10 1000
Test for subaroun diff	erences: Not an	~/ nlicable						Other technique Total nasal packing
rection candroap ann	5.5.1000. Hot up	enconoro						

E-figure 10. Residual septal deviation, odds ratio (OR), Total nasal packing versus other techniques: fixed-effect model.

	Total paci	king	Other technic	ues		Odds Ratio		Odds Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% Cl	Year	M-H, Fixed, 95% Cl
1.14.1 Total nasal pa	cking versu	is Tran	s-septal sutu	re				
Guvuron 1989	5	84	5	85	12.8%	1.01 [0.28, 3.63]	1989	
Al-Radded 2007	6	57	5	48	13.3%	1.01 [0.29, 3.55]	2007	_
Ardehali 2009	3	36	4	36	10.0%	0.73 (0.15, 3.51)	2009	
Wang 2011	3	30	1	30	2.5%	3.22 [0.32, 32,89]	2011	
Naghibzadeh 2011	0	23	0	21		Not estimable	2011	
Ghimire 2012	3	23	9	22	21.8%	0.22 [0.05, 0.95]	2012	
Yang 2013	9	77	11	68	28.1%	0.69 [0.27, 1.77]	2013	_ _
Dai 2014	8	30	2	30	4.0%	5.09 (0.98, 26,43)	2014	
Shao 2016	0	40	0	40		Not estimable	2016	
Dadgarnia 2017	0	20	0	20		Not estimable	2017	
Wang 2018	0	30	0	30		Not estimable	2018	
Subtotal (95% CI)	-	450	-	430	92.4%	0.93 [0.57, 1.51]		•
Total events	37		37			- / -		
Heterogeneity: Chi ² =	9.43 df = 6	(P = 0)	15): I ² = 36%					
Test for overall effect:	Z = 0.30 (P	= 0.77)						
	(,						
1.14.2 Total nasal pa	cking versu	ıs Tran	s-septal sutu	re with	splint			
Wadhera 2014	0	79	0	79		Not estimable	2014	
Subtotal (95% CI)		79		79		Not estimable		
Total events	0		0					
Heterogeneity: Not ap	plicable							
Test for overall effect:	Not applica	ble						
1.14.3 Total nasal pa	cking versu	is Nasa	al retaining de	vice				
Vulusvamy 2012	3	40	3	40	7.6%	1.00 [0.19, 5.28]	2012	·
Subtotal (95% CI)		40		40	7.6%	1.00 [0.19, 5.28]		
Total events	3		3					
Heterogeneity: Not ap	plicable							×
Test for overall effect:	Z=0.00 (P	= 1.00)						
Total (95% CI)		569		549	100.0%	0.93 [0.59, 1.49]		•
Total events	40		40					
Heterogeneity: Chi ² =	9.44, df = 7	(P = 0.1)	22); I² = 26%					
Test for overall effect:	Z=0.28 (P	= 0.78)						Other technique Total pasal packing
Test for subgroup diff	ferences: Cł	hi² = 0.0	01, df = 1 (P = 0	0.93), I²	= 0%			other teeningue - rotal habar packing
		-						

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E-figure 11. Pain severity VAS 0-10, mean difference (MD) Total nasal packing versus other techniques: random-effect model.

	Total na	asal packi	ing	Other	techniq	les		Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% Cl
1.5.1 Total nasal pac	king vers	us Trans-	septal	suture				
Ardehali 2009	5	5.64	57	2.1	5.64	48	4.4%	2.90 [0.73, 5.07]
Dadgarnia 2017	6.5	1.38	36	2.66	1.35	36	6.2%	3.84 [3.21, 4.47]
Dai 2014	5.96	1.92	30	4.3	1.53	30	6.0%	1.66 [0.78, 2.54]
Dalgic 2016	4.33	2.19	18	1.27	1.87	21	5.5%	3.06 [1.77, 4.35]
Eski 2014	5.24	2.04	16	1.53	1.1	22	5.8%	3.71 [2.61, 4.81]
Li 2016	6.99	1.9	30	1.29	1.51	30	6.0%	5.70 [4.83, 6.57]
Nunez 1991	4.1	0.44	27	2.9	0.41	26	6.4%	1.20 [0.97, 1.43]
Wang 2018	3.4	0.4	20	0.6	0.5	20	6.4%	2.80 [2.52, 3.08]
Subtotal (95% CI)			234			233	46.8%	3.09 [2.07, 4.12]
Heterogeneity: Tau ² = Test for overall effect: 1 5 3 Combination of	1.93; Chi Z = 5.90 (² = 189.85 (P < 0.000)	5, df = 7 01)	(P < 0.0	00001); I	² = 969	ó	
1.5.2 Compination of	Packing a	and sutrue	e versu	S Trans	s-septar	surrue	alone	5404400 500
Awan 2008 Madau 2010	7.318	2.239	44	2.136	1.503	44	6.1% c.4.e/	5.18 [4.39, 5.98]
YadaV 2019 Subtotal (05% CN	6.28	1.72	30	2.6	1.22	30	6.1% 12 2%	3.68 [2.93, 4.43]
Heterogeneity: Tau ² = Test for overall effect:	0.97; Chi Z = 5.89 (² = 7.20, d (P < 0.000)	74 If=1(P 01)	= 0.003	7); I² = 86	74 3%	12.2%	4.43 [2.95, 5.90]
1.5.3 Total nasal naci	kina vers	us Trans-	sental	suture	with soli	nt		
Robu 2020	6 F	12	20	2.6	1 02	 20	6.204	2 00 (2 27 2 22)
Dabu 2020 Naik 2015	0.0 E	1.3	20	2.0	7.66	20	0.2% 1.10	3.00 [2.27, 3.73]
INAIK 2015 Subtotal (95% CI)	5	1.00	90 110	Z.1	7.55	94	4.4%	2.90 [0.72, 5.08] 2.99 [2.30, 3.69]
Subtotal (95% CI)	0.00.06	z_0.01 d	110 K= 170	- 0.020		114	10.5%	2.99 [2.30, 3.00]
Test for overall effect:	Z = 8.50 ((P < 0.000)	01)	- 0.93)), I ⁻ = 0 %			
1.5.4 Total nasal pac	king vers	us Nasal a	airway	integra	ted pack	king		
Babu 2020	5.5	1.3	20	3	1.27	20	6.1%	2.50 [1.70, 3.30]
Yu 2013 Subtotal (95% CI)	1.48	0.83	39 59	2.22	1.3	41 61	6.3% 12.4%	-0.74 [-1.22, -0.26] 0.86 [-2.31, 4.04]
Heterogeneity: Tou?-	514 CM	Z- 46 06	df = 1 /		00043-12	- 0.00	12.470	5.00 [-2.5 i, 4.04]
Test for overall effect:	Z = 0.53 (P = 0.59)	ar – T (I	0.01	5001), F	- 3070		
1.5.5 Total nasal pac	king vers	us Nasal i	retainin	g devic	es			
Fang 2019	5.68	1.31	17	3.15	0.54	22	6.2%	2.53 [1.87, 3.19]
Vulusvamy 2012	7.27	2.35	40	2.57	2.45	40	5.8%	4.70 [3.65, 5.75]
Subtotal (95% CI)			57			62	12.0%	3.57 [1.45, 5.70]
Heterogeneity: Tau ² = Test for overall effect:	2.15; Chi Z = 3.30 (² = 11.70, (P = 0.001)	df=1 (0)	P = 0.0(006); 1 ° =	91%		
1.5.6 Total nasal pac	king vers	us Fibrin g	glue					
Habesoglu 2010 Subtotal (95% CI)	6.09	1.64	23 23	2.43	1.37	21 21	6.0% 6.0 %	3.66 [2.77, 4.55] 3.66 [2.77, 4.55]
Heterogeneity: Not ap	plicable							
Test for overall effect:	Z=8.06 (P < 0.000	01)					
Total (95% CI)			557			565	100.0 %	3.06 [2.26, 3.85]
Heterogeneity: Tau² = Test for overall effect: Test for subgroup diff	2.54; Chi Z = 7.53 (erences:	² = 444.01 P < 0.000 Chi² = 6.10	l, df = 11 01) 3. df = 5	6 (P < 0 i (P = 0.	i.00001); .29), I² =	; I≊ = 96 18.5%	%	
			•					

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E-figure 12. Funnel plots: all outcomes.

