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RESEARCH ARTICLE

Contrast of oropharyngeal leak pressure and clinical performance of I-gel[™] and LMA ProSeal[™] in patients: A meta-analysis

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Abstract

Background

Conflicting outcomes have been reported for the i-gel[™] and laryngeal mask airway (LMA) ProSeal[™] in children and adults during general anesthesia. Randomized controlled trials (RCTs) that yielded wide contrast outcomes between i-gel[™] and LMA ProSeal[™] were included in this meta-analysis.

Methods

Two authors independently identified RCTs that compared i-gel[™] with LMA ProSeal[™] among patients receiving general anesthesia by performing searches in EMBASE, Cochrane, PubMed, and ScienceDirect. Discussion was adopted to resolve disagreements. Data were counted with Review Manger 5.3 and pooled by applying weighted mean difference (MD) and rlsk ratio (RR), and related 95% confidence intervals.

Results

A total of 33 RCTs with 2605 patients were included in the meta-analysis. I-gelTM provided a considerably lower oropharyngeal leak pressure [weighted average diversity (MD) = -1.53 (-2.89, -0.17), P = 0.03], incidence of blood staining on the supraglottic airway devices [RR = 0.44, (0.28, 0.69), P = 0.0003], sore throat [RR = 0.31 (0.18, 0.52), P<0.0001], and a short insertion time [MD = -5.61 (-7.71, -3.51), P<0.00001] than LMA ProSealTM. Compared with LMA ProSealTM, i-gelTM offered a significantly higher first-insertion success rate [RR = 1.03 (1.00, 1.06), P = 0.03] and ease of insertion [RR = 1.06 (1.01, 1.11), P = 0.03]. The gastric-tube-placement first insertion rate [RR = 1.04 (0.99, 1.10), P = 0.11], laryngospasm [RR = 0.76 (0.17, 3.31), P = 0.72], and cough [RR = 1.30 (0.49, 3.44), P = 0.60] between the two devices were similar.

Conclusions

Both devices could achieve a good seal to provide adequate ventilation. Compared with the used LMA ProSeal[™], the i-gel[™] was found to have fewer complications (blood stainning,

sore throat) and offers certain advantages (short insertion time, higher first-insertion success rate and ease of insertion) in patients under general anesthesia.

Introduction

The common modality of airway administration in pediatric and adult patients for short surgical operations during general anesthesia is <u>Supraglottic airway device</u> (SAD) [1, 2]. Sufficient ventilation, delivery of anesthetic agents and oxygenation are provided with low-risk respiratory <u>adverse events</u>, displacing the demand for traditional tracheal intubation [3]. The secondgeneration SADs with a gastric drain tube have been recommended to decrease the danger of reflux and <u>aspiration</u> of the first-generation tools [4]. I-gel[™] and LMA ProSeal[™] belong to second-generation SADs.

Given the single-use supraglottic airway, i-gel[™] shows a total insertion success rate of 100% with an anatomically designed and noninflatable mask made of a gel-like thermoplastic elastomer; a broadened and flattened stem with a hard bite block is adopted to decrease the axial rotation and malpositioning as a buccal stabilizer, and a port is provided for gastric tube interpolation [5]. The laryngeal mask airway (LMA) ProSeal[™] is a laryngeal mask tool with an altered cuff and a drain tube. If inflated, its altered cuff presses the bowl of the tool forwards while improving the seal in virtue of the larynx [6].

To quantify the effectiveness of airway sealing and protecting airway in tools, oropharyngeal leak pressure (OLP) is adopted [7, 8]. Several randomized controlled trials (RCTs) have reported to compare i-gelTM with LMA ProSeal[™]. Seven RCTs [9–15] observed higher OLP values in i-gel[™] compared with LMA ProSeal[™]. However, 15 studies [16–30] recorded lower OLP values in i-gel[™] compared with LMA ProSeal[™], and 8 other research [3, 31–37] found no difference. Therefore, RCTs alone cannot sufficiently offer adequate insights into the clinical applications of i-gel[™] and LMA ProSeal[™].

To compare the superior airway sealing and certain advantages in patients under general anesthesia between the two SADs, 33 randomized controlled trials (RCTs) that yielded wide contrast outcomes between i-gel[™] and LMA ProSeal[™] were included in this meta-analysis. OLP was the primary result, and the first insertion success rate, insertion ease, intubation time, gas-tric-tube first insertion rate, and adverse events related to the SADs were the secondary results. In addition, subgroups analysis were performed in consideration of confounding elements, including age, type of operation, neuromuscular blocker (NMB) application, and the evaluation approach for OLP.

Materials and approaches

The registration of meta-analysis was performed in PROSPERO (CRD42022312261), in inplasy.com (INPLASY2022100013) and on the foundation of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses reports [38].

Literature search

Eligible studies were made by searching e-databases EMBASE, Cochrane, PubMed, and the ScienceDirect. All studies were made in April 2022. The search items are shown below: (a) "i-gel[™] and "i-gel[™] laryngeal mask"; (b) "Laryngeal Mask Airway ProSeal," "PLMA," and "LMA ProSeal[™]"; (c) "random controlled trial," "random," and "randomly." The pivotal words were connected applying "AND" (for "i-gel[™]," "ProSeal Laryngeal Mask Airway," and

"randomized") and "OR" (for "i-gel[™]" and "i-gel[™] laryngeal mask"). The search was performed in English.

Research selection

Only published prospective RCTs that compared i-gel[™] with LMA ProSeal[™] were included. Case reports, correspondence, reviews, manikin research, animal studies, and non-English articles were excluded.

Data collection

The information below were gathered: the first author's name, year of publication, the number of patients, age, type of operation, NMB application, premedication, mode of ventilation, evaluation approach for OLP, first-insertion success rate, ease of insertion, device insertion time, gastric-tube first-insertion success rate, and adverse events related to the SADs (sore throat, laryngospasm, blood-soiled devices, and cough). The information was collected by two independent authors (Yuan Tan and Jingyao Jiang). Discussion was adopted to resolve disagreements.

Risk of bias evaluation

The risk of bias in RCTs was evaluated by using Cochrane collaboration standards. The criteria were as follows: randomization, concealment of allocation, blinding, incomplete data, selective reporting, and other bias. Each item was judged to be at high, unclear, or low risk of material bias.

Statistical analysis

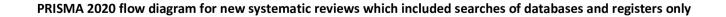
Data were counted with Review Manger 5.3 and pooled by applying weighted mean difference (MD) and rlsk ratio (RR), and related 95% confidence intervals. The random-effects model was applied if $I^2 > 50\%$, which indicated high heterogeneity, and the fixed-effects model was used when $I^2 < 50\%$. Possible explanations for great heterogeneity were searched for with a sensitivity analysis. Subgroups were explored in consideration of confounding elements, including age, kind of operation, NMB application, and the promising role of the evaluation approach for OLP. Inspection of funnel plots (if the number of trials was beyond 10) was adopted to test the publication bias of including articles by visually.

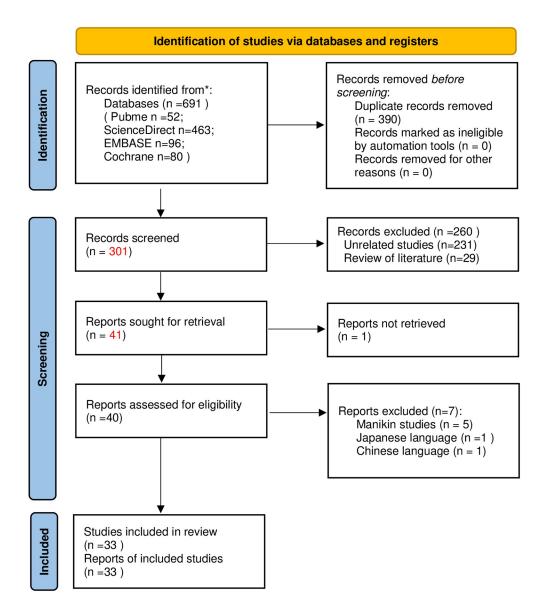
Results

Fig 1 illustrates the particular procedures and research selection. The initial search yielded 691 articles (PubMed = 52, Embase = 96, ScienceDirect = 463, Cochrane Library = 80). After excluding duplications, 301 studies were examined. Next, 260 of the 301 studies were excluded because of unrelated studies and reviews. Apart from 1 not retrieved report, the remaining 40 studies were continued to be examined. Then, 7 of 40 studies were excluded based on the exclusion criteria. Finally, a total of 33 studies were included in this meta-analysis [3, 9–37, 39–41]. Tables 1 and 2 show the features and methodological quality of RCTs, respectively.

1. OLP

According to the pooled analysis of data from 30 trials [3, 9–37], i-gel^{∞} offered a considerably lower OLP than LMA ProSeal^{∞} [MD = -1.53 (-2.89, -0.17), I^2 = 97%, P = 0.03] (Fig 2). Upon certification by sensitivity analysis, the pooled result was not altered by a single research. In consideration of substantial heterogeneity, the influence of confounding elements was





*Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers).

**If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools.

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

For more information, visit: http://www.prisma-statement.org/

Fig 1. Flow chart of meta-analysis.

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Surgery			Premedication		NMB		Ventilation	OLP measuremen	men
Elective hernioplasty, laparoscopic cholecystectomy, tibial plating, humerus plating and skin grafting	nolecystectomy, tibial plating, l	numerus plating and skin	Midazolam 1mg IV	ţIV	Rocuronium 0.9 mg/kg	9 mg/kg	Controlled	Audible leak	leak
Elective gynaecological or orthopaedic surgery	ic surgery		Midazolam 0.05–0.1 kg orally	-0.1 mg/	No		Controlled	Manometer	ter
Elective laparoscopic cholecystectomy	y		Ranitidine 50 mg IV	g IV	Vecuronium 0.08-0.1mg/ kg IV	08-0.1mg/	Controlled	Audible leak	leak
Lower-extremity orthopaedic surgery			No		Rocuronium 0.6 mg/kg IV	6 mg/kg IV	Controlled	Manometer	ter
Lower abdominal, inguinal and orthopedic surger	pedic surger		Midazolam 0.3mg/kg orally	ng/kg orally	No		Spontaneous	<u> </u>	ter
Short stay elective surgery			Midazolam 0.5 mg/kg orally	ng/kg orally	No		Controlled	Manometer	ter
Elective surgeries <1hour			Midazolam 0.5 mg/kg orally	ng/kg orally	No		Spontaneous		ter
Laparoscopic gynecologic operation			No		Rocuronium 0.6 mg/kg IV	6 mg/kg IV	Controlled	Manometer	ter
Surgery	Premedication	NMB	Ventilation	OLP measuremen	Author/Year	Age	Group	Nur	Number
Elective surgeries of less than one hour duration	Midazolam 0.3mg/kg orally	No	Spontaneous	Manometer	Singh [17] 2009	adult	i-gel LMA-ProSeal	Seal 30	
Elective surgery	No	No	Spontaneous	Audible leak	Gasteiger [18] 2010	19-70y	i-gel LMA-ProSeal	Seal 76	
Elective surgery	Alprazolam 0.25 mg orally	Rocuronium 0.6 mg/ kg IV	Controlled	Manometer	Sharma [19] 2010	adult	i-gel LMA-ProSeal	Seal 30	
Elective surgery	Midazolam 0.5mg/kg orally	No	Not reported	Audible leak	Shin [20] 2010	adult	i-gel LMA-ProSeal	Seal 53	
Elective surgery	Diazepam 5mg orally	Atracurium 0.5 mg/ kg IV	Controlled	Not reported	Das [9] 2012	1-6y	i-gel LMA-ProSeal	Seal 30	
Elective short surgical procedures	No	No	Spontaneous	Audible leak	Gasteiger [32] 2012	1.5-6y	i-gel	51 51	
Elective short duration pediatric surgery	Midazolam 0.5mg/kg orally	Atracurium 0.5 mg/ kg IV	Controlled	Audible leak	Goyal [10]	2-5y	i-gel LMA-ProSeal	Seal 40	
Elective surgery	Midazolam 0.05 mg/kg intramuscular	Vecuronium 0.1 mg/ kg IV	Controlled	Audible leak	Jeon [<u>13</u>] 2012	18-65y	i-gel LMA-ProSeal	Seal 15	
Short surgical procedures	Midazolam 0.02 mg/kg IV	No	Spontaneous	Manometer	Mitra [11] 2012	5-10y	i-gel LMA-ProSeal	Seal 30	
Elective surgery	Rectal 30 mg/kg paracetamol	No	Ventilated manually	Manometer	Van Zundert [<u>37</u>] 2012	18-80y	i-gel LMA-ProSeal	Seal 50	
Elective procedures	Midazolam 7.5 mg orally	No	Controlled	Audible leak	Chauhan [21] 2013	18-65y	i-gel LMA-ProSeal	Seal 40	
Elective surgeries	Midazolam 2 mg IV	Atracurium 0.5 mg/ kg I.V	Controlled	Manometer	Fukuhara [<u>31</u>] 2013	3months-15y	i-gel LMA-ProSeal	Seal 67	
Elective gynecological laparoscopic surgery	Midazolam 2 mg IV	Atracurium 0.5 mg/ kg I.V	Controlled	Audible leak	Das [<u>39</u>] 2014	20-30y	i-gel LMA-ProSeal	Seal 30	
Elective gynecological laparoscopic surgery	Midazolam 0.03 mg/kg IV	nium 0.6 mg/	Controlled	Manometer	Kini [<u>36]</u> 2014	18-60y	i-gel LMA-ProSeal	Seal 24	

Extra-ocular ophthalmic surgery	Midazolam 0.3 mg/kg orally	No	Controlled	Audible leak	Saran [<u>33]</u> 2014	1-12y	i-gel LMA-ProSeal	30 30
Elective surgeries	Alprazolam 0.25 mg orally	Vecuronium	Controlled	Manometer	Ekinci [<u>40</u>] 2015	18-65 y	i-gel LMA-ProSeal	40 40
Elective surgeries	Midazolam 0.3 mg/kg oral	Atracurium 0.5 mg/ kg IV	Controlled	Audible leak	Jadhav [<u>22]</u> 2015	18-60y	i-gel LMA-ProSeal	30 30
Elective superficial or peripheral surgery	No	No	Spontaneous	Audible leak	Kayhan [<u>15]</u> 2015	infants and neonates	i-gel LMA-ProSeal	25 25
Elective short surgical procedures	Midazolam 0.05 mg/kg IV	Vecuronium 0.1 mg/ kg IV	Controlled	Audible leak	Henlin [<u>24</u>] 2015	>18y	i-gel LMA-ProSeal	99 98
Elective surgeries	No	Atracurium 0.5 mg/ kg IV	Controlled	Audible leak	Mishra [26] 2015	18-65y	i-gel LMA-ProSeal	30 30
Elective surgical procedures	Alprazolam 0.25 mg oral	Rocuronium 0.6 mg/ kg IV	Controlled	Manometer	Mishra SK [23] 2015	Adult	i-gel LMA-ProSeal	30 30
Elective short surgical procedures	No	No	Controlled	Audible leak	Mukadder [25] 2015	18-60y	i-gel LMA-ProSeal	35 35
Minor (<1 hour in duration) elective surgery	No	No	Controlled	Audible leak	Peker [<u>34</u>] 2015	1-10y	i-gel LMA-ProSeal	15 15
Elective surgery	Alprazolam 0.25 mg oral	Vecuronium 0.02 mg/ kg IV	Controlled	Not reported	Taxak [27] 2015	16-60y	i-gel LMA-ProSeal	20 20
Elective short duration surgeries	Phenergan 0.5 mg/kg orally	Atracurium 0.5 mg/ kg IV	Controlled	Manometer	Nirupa [12] 2016	2-6y	i-gel LMA-ProSeal	50 50
y = years, LMA = Laryngeal Mask Airway, NMB = Neuromuscular blocker, OLP = Oropharyngeal leak pressure	irway, NMB = Neuromuscular	blocker, OLP = Orophar	yngeal leak pressur	2)	Liew [14] 2016	21-80y	i-gel LMA-ProSeal	50 LMA-ProSeal
					Das [28] 2017	20-60y	i-gel LMA-ProSeal	50 50
					Banerjee [<u>35</u>] 2018	3-8y	i-gel LMA-ProSeal	35 35
					Singh [29] 2018	18-60y	i-gel LMA-ProSeal	28 28
					Luthra [<u>30</u>] 2019	18-65y	i-gel LMA-ProSeal	20 20
					Oba [<u>16</u>] 2020	<12 months	i-gel LMA-ProSeal	60 60
					Kalra [41] 2021	18-60y	i-gel LMA-ProSeal	50 50
					Shiveshi [<u>3</u>] 2021	2-10y	i-gel LMA-ProSeal	35 35

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Table 2. Ris	k of bias assess	ment for evalua	tion the quality o	of each included	l trials.		
Study (author, year)	Random sequence generation	Allocation con cealment	Blinding of participant and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Other bias
Singh 2009	Unclear	Unclear	Low	Low	Low	Low	Unclear
Gasteiger 2010	Low	Low	Low	Low	Low	Low	Low
Sharma 2010	Low	Low	Low	Low	Low	Low	Low
Shin 2010	Low	Low	Low	Low	Low	Low	Low
Das 2012	Low	Low	Low	Unclear	Low	Low	Low
Gasteiger 2012	Low	Low	Low	Low	Low	Low	Low
Goyal 2012	Low	Low	Unclear	Unclear	Low	Low	Unclear
Mitra 2012	Low	Low	Unclear	Unclear	Low	Low	Unclear
Van 2012	Low	Low	Unclear	Unclear	Low	Low	Unclear
Chauhan 2013	Low	Low	Unclear	Unclear	Low	Low	Low
Fukuhara 2013	Low	Low	Unclear	Low	Low	Low	Low
Das 2014	Low	Low	Low	Low	Low	Low	Low
Kini 2014	Low	Low	Low	Low	Low	Low	Low
Saran 2014	Low	Low	Low	Unclear	Low	Low	Low
Ekinci 2015	Low	Low	Unclear	Unclear	Low	Low	Low
Jadhav 2015	Low	Low	Low	Low	Low	Low	Low
Kayhan 2015	Low	Low	Low	Low	Low	Low	Low
Henlin 2015	Low	Low	Low	High	Low	Low	Low
Mishra 2015	Low	Low	Unclear	Unclear	Low	Low	Low
Mishra SK 2015	Low	Low	Unclear	Unclear	Low	Low	Low
Mukadder 2015	Low	Low	Unclear	Unclear	Low	Low	Low
Peker 2015	Low	Low	Low	High	Low	Low	Low
Taxak 2015	Low	Low	Unclear	Unclear	Low	Low	Low
Nirupa 2016	Low	Low	Low	Low	Low	Low	Low
Liew 2016	Low	Low	Unclear	Unclear	Low	Low	Low
Das 2017	Low	Low	Low	Low	Low	Low	Low
Banerjee 2018	Low	Low	Unclear	Unclear	Low	Low	Low
Singh 2018	Low	Low	Low	Low	Low	Low	Low
Luthra 2019	Low	Low	Unclear	Unclear	Low	Low	Low
Obs 2020	Low	Low	Unclear	Unclear	Low	Low	Low
Shiveshi 2021	Low	Low	Low	Unclear	Low	Low	Low

Table 2. Risk of bias assessment for evaluation the quality of each included trials.

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determined with subgroup analysis (Table 3). According to age subgroup exploration, the pooled outcomes displayed that i-gel^{∞} offered a slightly greater OLP in the children subgroup, although an inadequate statistical difference was observed [MD = 1.34 (-0.37, 3.04), I^2 = 95%, P = 0.12]; a lower OLP was recorded in the adult subgroup [MD = -3.48 (-5.62, -1.33),

Church an Curk manua	i-	gel™	Tetel	LMA	ProSea	I TM	184-1-1-4	Mean Difference		Mean Difference
Study or Subgroup	Mean			Mean	SD		Weight	IV, Random, 95% CI		IV, Random, 95% Cl
Singh 2009	25.27		30	29.6	5.62	30	3.1%	-4.33 [-7.39, -1.27]		
Gasteiger 2010	23	7	75	30	7	76	3.3%	-7.00 [-9.23, -4.77]		
Sharma 2010	35.63		30	38.93	3.18	30	3.3%	-3.30 [-5.37, -1.23]		
Shin 2010	27	8	64	30	6	53	3.2%	-3.00 [-5.54, -0.46]		
Jeon 2012	27.12		30	22.75	1.46	30	3.6%	4.37 [3.57, 5.17]		
Van 2012	30	11	50	33		50	2.9%	-3.00 [-6.61, 0.61]		
Das 2012	27.1	1.69	30	22.73	1.44	30	3.6%	4.37 [3.58, 5.16]		
Gasteiger 2012	22	5	51	21	5	51	3.4%	1.00 [-0.94, 2.94]		
Goyal 2012	26	2.6	40	23	1.2	40	3.6%	3.00 [2.11, 3.89]		
Mitra 2012	27.12		30		1.46	30	3.6%	4.37 [3.57, 5.17]		
Chauhan 2013	26.73		40	29.55	3.53	40	3.5%	-2.82 [-4.16, -1.48]		
Fukuhara 2013	24	6	67	24	5	67	3.4%	0.00 [-1.87, 1.87]		
Kini 2014	23.58	4.9		21.83	5.92	24	3.1%	1.75 [-1.32, 4.82]		
Saran 2014	23.13		30		6.57	30	3.1%	-0.14 [-3.14, 2.86]		
Jadhav 2015	20.07		30		2.21	30	3.5%	-5.66 [-6.98, -4.34]		
Mishra SK 2015	24	4	30	29	4	30	3.3%	-5.00 [-7.02, -2.98]		
Henlin 2015	25.3	6.9	99	29.2	6.8	98	3.4%	-3.90 [-5.81, -1.99]		
Mukadder 2015	21	3.6	35	23.9	2.4	35	3.5%	-2.90 [-4.33, -1.47]		
Mishra 2015	22		30	28	4.19	30	3.4%	-6.00 [-7.89, -4.11]		
Taxak 2015	25.4		20	36	6.22	20		-10.60 [-13.67, -7.53]	2015	
Kayhan 2015	27.44		25	23.52	8.15	25	2.8%	3.92 [0.03, 7.81]	2015	
Peker 2015	20	3.2	15	22.1	3.8	15	3.2%	-2.10 [-4.61, 0.41]	2015	
Liew 2016	27.13	0.92	50	24.44	0.7	50	3.6%	2.69 [2.37, 3.01]	2016	-
Nirupa 2016	29.5	2.5	50	26.1	3.8	50	3.5%	3.40 [2.14, 4.66]	2016	
Das 2017	23.38	2.06	50	28.5	2.8	50	3.6%	-5.12 [-6.08, -4.16]	2017	
Singh 2018	26.71	3.45	28	32.64	4.14	28	3.4%	-5.93 [-7.93, -3.93]	2018	
Banerjee 2018	25	3.9	35	24.2	3	35	3.4%	0.80 [-0.83, 2.43]	2018	
Luthra 2019	27.05	4.4	20	30.55	4.02	20	3.2%	-3.50 [-6.11, -0.89]	2019	
Obs 2020	31.1	2	60	33.2	2	63	3.6%	-2.10 [-2.81, -1.39]	2020	
Shiveshi 2021	19.57	5.71	35	20.51	4.71	35	3.2%	-0.94 [-3.39, 1.51]	2021	
Total (95% CI)			1203			1195	100.0%	-1.53 [-2.89, -0.17]		◆
Heterogeneity: Tau² =	= 13.32; (Chi ^z =	1060.0	9, df = 2	9 (P < 0	.00001); I ^z = 979	6		
Test for overall effect:	Z = 2.21	l (P = 0).03)							Favours [experimental] Favours [control]

Fig 2. Forest plot for comparison of i-gelTM and LMA ProSealTM for OLP (cmH₂O). CI, confidence interval; I², I-square heterogeneity statistic; IV, inverse variance.

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	Subgroup	References	P- value	MD	95% CI	I-square; P- value
age	<18 years	[3, 9–12, 15, 16, 31–35]	0.12	1.34	(-0.37,3.04)	95%;<0.00001
	》18 years	[13, 14, 17–30, 36, 37]	0.001	-3.48	(-5.62,- 1.33)	98%;<0.00001
NMB	No	[9–12, 15, 16, 18, 22, 24, 30– 32, 34, 36–37]	0.74	-0.34	(-2.31,1.64)	97%;<0.0000
	Yes	[3, 13, 14, 17, 19–21, 23, 25– 29, 33, 35]	0.01	-2.74	(-4.92,- 0.57)	98%;<0.0000
Laparoscopic surgery	No	[3, 9–12, 14–18, 20–22, 24, 26–37]	0.06	-1.42	(-2.91,0.08)	97%;<0.0000
	Yes	[13, 19, 23, 25]	0.52	-1.66	(-6.74,3.42)	98%;<0.0000
OLP measurement method	Audible leak	[12, 14, 16, 17, 19, 23, 24, 28, 30, 31, 33–37]	0.11	-1.55	(-3.45,0.34)	97%;<0.0000
	Manometer	[3, 9–11, 13, 15, 18, 20–22, 25–27, 29, 32]	0.18	-1.53	(-3.8,0.73)	98%;<0.0000

 $Table \ 3. \ Subgroup \ meta-analysis \ for \ or ropharyngeal \ leak \ pressure \ with \ i-gel^{``} \ and \ LMA \ ProSeal^{``}.$

OLP, oropharyngeal leak pressure; LMA, Laryngeal Mask Airway; NMB, Neuromuscular blocker; MD, mean difference; CI, confidence interval.

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 $I^2 = 98\%$, P = 0.001] compared with LMA ProSeal[™]. Considering the potential use of NMB during anesthesia, the pooled results indicated that 15 trials [3, 13, 14, 17, 19–21, 23, 25–29, 33, 35] that applied NMB were covered, and the integrated outcome was lower for i-gel[™] than for LMA ProSeal[™] [MD = -2.74 (-4.92, -0.57), $I^2 = 98\%$, P = 0.001]. Without NMB, the integrated outcome showed no considerable variation between the two groups [MD = -0.34 (-2.31, 1.64), $I^2 = 97\%$, P = 0.74]. In case of the pooled analysis of the surgery type, no great difference was found between the two groups with neither laparoscopic nor non-laparoscopic surgery [MD = -1.66 (-6.74,3.42), $I^2 = 98\%$, and P = 0.52; MD = -1.42 (-2.91,0.08), $I^2 = 97\%$, P = 0.06, respectively]. Considering the different measurements of OLP (audible leak and manometric stability), the subgroup analysis showed no great difference between the two groups [MD = -1.55 (-3.45,0.34), $I^2 = 97\%$, P = 0.11; MD = -1.53 (-3.8,0.73), $I^2 = 98\%$, P = 0.18, respectively]. The funnel plot of OLP did not indicate obvious substantial asymmetry (Fig 3).

2. First-insertion success rate, insertion ease of SADs, the time spent on intubation, and gastric-tube first-insertion success rate

A total of 26 trials [3, 9–15, 17–20, 22–25, 27–28, 30–36, 40] showed that i-gel[™] provided a higher rate of first-insertion success [RR = 1.03 (1.0, 1.06), $I^2 = 32\%$, P = 0.03] than LMA Pro-Seal[™] (Fig 4). Exactly 21 trials [3, 9–12, 16, 17, 19, 21–23, 25, 28–31, 33, 34, 39–41] indicated that the insertion ease was substantially higher for i-gel[™] than for LMA ProSeal[™] [RR = 1.06 (1.01, 1.11), $I^2 = 47\%$, P = 0.01] (Fig 4). In addition, 23 trials [3, 12–16, 19, 21–25, 27–29, 31–34, 36, 37, 40] showed that SAD intubation time was notably shorter for i-gel[™] than for LMA ProSeal[™] [MD = -5.61 (-7.71, -3.51), $I^2 = 98\%$, and P<0.00001] (Fig 5). Twelve trials [3, 11, 14, 17, 19, 21, 23, 25, 27, 32, 33, 40] examined the rate of gastric-tube first-insertion success and observed no great difference between the two SADs [RR = 1.04 (0.99, 1.18), $I^2 = 66\%$, and P = 0.11] (Fig 5). With the removal of studies one by one, the heterogeneity of intubation time and the rate of gastric-tube first-insertion success revealed no marked decrease. The funnel plot of first- insertion success rate (Fig 3), insertion ease of SADs, and intubation time (Fig 6) did not indicate obvious substantial asymmetry.

3. Adverse events

The incidence of revealed adverse events were evaluated: blood staining on the SADs, sore throat, cough, and laryngospasm was shown in 15 [3, 9–11, 14–17, 19–21, 28, 29, 32, 39], 10 [3, 14, 19–22, 29, 30, 39, 40], 5 [3, 10, 16, 22, 39], 3 studies [15, 16, 22], respectively. Blood staining on the SADs after surgery (Fig 5) and sore throat (Fig 7) were greatly more universally occurring with LMA ProSeal^{**} than with i-gel^{**} [RR = 0.44 (0.28, 0.69), $I^2 = 25\%$, P = 0.0003; RR = 0.31 (0.18, 0.52), $I^2 = 0\%$, P<0.0001, respectively]. The two groups showed similar incidence of coughs and laryngospasm [RR = 1.17 (0.39, 3.46), $I^2 = 0\%$, P = 0.78; RR = 0.83 (0.15, 4.52), $I^2 = 0\%$, P = 0.83, respectively] (Fig 7). The funnel plot of blood staining did not show evident substantial asymmetry (Fig 8). The included studies reported none of the severe complications.

Discussion

The major finding of the current meta-analysis is that i-gel[™] provided a greatly lower OLP, incidence of blood staining on the SADs, sore throat, and a shorter intubation time than LMA ProSeal[™] among patients during general anesthesia. In addition, i-gel[™] offered a significantly higher first-insertion success rate and ease of insertion than LMA ProSeal[™]. No great differences were found in gastric-tube placement first-insertion rate, laryngospasm, and cough between i-gel[™] and LMA ProSeal[™].

(A) 0⊤^{SE(MD)} 0 0 0 0 0 0.5 0 0 8 0 00 8000 1 0 0000 1.5-0 0 0 0 0 MD 2. -10 -5 10 5 ò (B) 0T^{SE(log[RR])} C 0.05 8 0 n Ø 0 р 0 0 0.1 0 0 0 0.15-0 0.2+ 0.5 0.7 1.5 1 Fig 3. Funnel plots for comparison of i-gelTM and LMA ProSealTM for OLP (A) and insertion success rate at the first attempt (B).



(A)

	i-gel	ГM	LMA-ProS	eal [™]		Risk Ratio		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% Cl	Year	M-H, Fixed, 95% Cl
Singh 2009	30	30	28	30	3.1%	1.07 [0.96, 1.20]	2009	
Gasteiger 2010	75	75	73	76	7.9%	1.04 [0.99, 1.10]	2010	
Sharma 2010	28	30	24	30	2.6%	1.17 [0.95, 1.43]	2010	
Shin 2010	50	64	47	53	5.6%	0.88 [0.75, 1.04]	2010	
Jeon 2012	15	15	15	15	1.7%	1.00 [0.88, 1.13]	2012	
Goyal 2012	38	40	36	40	3.9%	1.06 [0.93, 1.20]	2012	
Mitra 2012	28	30	27	30	2.9%	1.04 [0.89, 1.21]	2012	
Das 2012	28	30	26	30	2.8%	1.08 [0.91, 1.28]	2012	
Gasteiger 2012	47	51	47	51	5.1%	1.00 [0.89, 1.12]	2012	
Fukuhara 2013	63	67	65	67	7.1%	0.97 [0.90, 1.04]	2013	
Kini 2014	19	24	18	24	2.0%	1.06 [0.77, 1.44]	2014	
Saran 2014	28	30	26	30	2.8%	1.08 [0.91, 1.28]	2014	
Mukadder 2015	33	35	26	35	2.8%	1.27 [1.03, 1.57]	2015	
Taxak 2015	17	20	16	20	1.7%	1.06 [0.80, 1.41]	2015	
Kayhan 2015	23	25	22	25	2.4%	1.05 [0.87, 1.26]	2015	
Peker 2015	14	15	14	15	1.5%	1.00 [0.83, 1.21]	2015	
Ekinci 2015	40	40	33	40	3.6%	1.21 [1.04, 1.40]	2015	
Jadhav 2015	29	30	24	30	2.6%	1.21 [1.00, 1.46]	2015	
Henlin 2015	87	99	85	98	9.3%	1.01 [0.91, 1.13]	2015	
Mishra SK 2015	27	30	30	30	3.3%	0.90 [0.79, 1.03]	2015	
Liew 2016	44	49	36	50	3.9%	1.25 [1.02, 1.52]	2016	
Nirupa 2016	50	50	46	50	5.1%	1.09 [0.99, 1.19]	2016	
Das 2017	45	50	44	50	4.8%	1.02 [0.89, 1.17]	2017	
Banerjee 2018	43	60	53	63	5.6%	0.85 [0.70, 1.03]	2018	
Luthra 2019	16	20	17	20	1.8%	0.94 [0.71, 1.25]	2019	
Shiveshi 2021	33	35	35	35	3.9%	0.94 [0.86, 1.04]	2021	
Total (95% CI)		1044		1037	100.0%	1.03 [1.00, 1.06]		◆
Total events	950		913					
Heterogeneity: Chi ² =	36.84, df	= 25 (P	= 0.06); l ² =	32%				0.5 0.7 1 1.5 2
Test for overall effect	Z = 2.22	(P = 0.0)	3)					Favours [experimental] Favours [control]
								Favours (experimental) Favours (control)

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	i-gel	M	LMA-ProS	eal		Risk Ratio		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% Cl	Year	M-H, Fixed, 95% Cl
Singh 2009	29	30	23	30	3.6%	1.26 [1.02, 1.55]	2009	
Sharma 2010	28	30	24	30	3.8%	1.17 [0.95, 1.43]	2010	+
Das 2012	29	30	24	30	3.8%	1.21 [1.00, 1.46]	2012	
Goyal 2012	38	40	36	40	5.7%	1.06 [0.93, 1.20]	2012	- -
Mitra 2012	28	30	27	30	4.3%	1.04 [0.89, 1.21]	2012	
Fukuhara 2013	52	67	57	67	9.0%	0.91 [0.77, 1.07]	2013	
Chauhan 2013	32	40	25	40	3.9%	1.28 [0.96, 1.70]	2013	+
Das 2014	27	30	25	30	3.9%	1.08 [0.88, 1.32]	2014	
Saran 2014	28	30	28	30	4.4%	1.00 [0.87, 1.14]	2014	
Ekinci 2015	34	40	29	40	4.6%	1.17 [0.93, 1.48]	2015	
Jadhav 2015	29	30	24	30	3.8%	1.21 [1.00, 1.46]	2015	
Mishra SK 2015	30	30	30	30	4.8%	1.00 [0.94, 1.07]	2015	+
Peker 2015	15	15	14	15	2.3%	1.07 [0.89, 1.28]	2015	
Mukadder 2015	32	35	21	35	3.3%	1.52 [1.14, 2.03]	2015	
Nirupa 2016	47	50	40	50	6.3%	1.18 [1.01, 1.37]	2016	
Das 2017	44	50	43	50	6.8%	1.02 [0.88, 1.19]	2017	
Singh 2018	28	28	28	28	4.5%	1.00 [0.93, 1.07]	2018	+
Luthra 2019	8	20	9	20	1.4%	0.89 [0.43, 1.83]	2019	
Obs 2020	43	60	53	63	8.2%	0.85 [0.70, 1.03]	2020	
Shiveshi 2021	28	35	32	35	5.1%	0.88 [0.72, 1.06]	2021	
Kalra 2021	39	50	41	50	6.5%	0.95 [0.78, 1.16]	2021	
Total (95% CI)		770		773	100.0%	1.06 [1.02, 1.10]		•
Total events	668		633					
Heterogeneity: Chi ² =		= 20 (P		47%			-	_ + _ + _ + _ + _ +
Test for overall effect				11 10				0.5 0.7 1 1.5 2
restion overall ellect	. 2 - 2.05	(i = 0.0						Favours [experimental] Favours [control]

Fig 4. Forest plot for comparison of i-gelTM and LMA ProSealTM for insertion success rate at the first attempt (A); and ease of insertion (B). CI, confidence interval; I², I-square heterogeneity statistic; IV, inverse variance.

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OLP refers to the airway leak or pressure airway sealing, and it is the most significant index for evaluating the security and effectiveness of airway tools [42]. Between the cuff of the mask and soft tissue around the neck was decided the power of the seal [7, 43], the OLP determines the feasibility of the extent of protecting airway and security of positive pressure ventilation. The current meta-analysis observed a greatly higher OLP with LMA ProSeal[™] than with i-gel[™]. The higher OLP in the LMA ProSeal[™] group caused by the inflatable cuff with a ventral and dorsal cuff could have led to better seal than i-gel[™] with a noninflatable cuff [30]. Growing

Study or Subgroup Mean SD Total Weight N. Random, 95% CI Year N. Random, 95% CI sharma 2010 18.67 42.6 30 14.23 5.56 30 4.8% -0.06 (+3.07, 1.95) 2010	iharma 2010 fa an 2012 easteiger 2012 itasteiger 2012 itaana 2013 itaran 2014 bas 2014 faini 2014 reker 2015 itaxak 2015 itainci 2015	13.67 44 26.4 28 11.2 13 17.2 14.9	4.26 12 0.83 11 1.814 4 7	30 50 15 51 40 67	14.23 48 24.64 30 15.13	5.56 16 1.44 15	30 50 15	4.8% 3.8%	-0.56 [-3.07, 1.95]	2010	IV, Random, 95% Cl
An 2012 44 12 50 48 16 50 3.8% -4.00 [9.54, 1.54] 2012	an 2012 eon 2012 isasteiger 2012 ihauhan 2013 ukuhara 2013 ukuhara 2013 asas 2014 asas 2014 aini 2014 eker 2015 iaxak 2015 ikinci 2015	44 26.4 28 11.2 13 17.2 14.9	12 0.83 11 1.814 4 7	50 15 51 40 67	48 24.64 30 15.13	16 1.44 15	50 15	3.8%			
leon 2012 26.4 0.83 15 24.64 1.44 15 5.1% 1.76 [0.92, 2.00] 2012 Gasteliger 2012 28 11 51 30 15 51 4.0% -2.00 [-7.11, 3.11] 2012 Gasteliger 2012 28 11 51 3.0 15 51 4.0% -2.00 [-7.11, 3.11] 2013 Ukuhara 2013 13 4 67 13 3 67 5.1% -3.09 [4.99, -2.87] 2013 Saran 2014 17.2 7 30 15.4 6 30 4.6% 18.01 [-1.50, 5.10] 2014 Gas 2014 14.9 2.6 30 20 3.1 30 5.0% -5.10 [-6.55, -3.65] 2014 Gas 2014 14.9 2.6 30 20 3.1 30 5.0% -5.00 [-6.61, -3.10 -2.9] 2015 Feker 2015 17.4 7 7 5.7 14.2 15 2.9% -8.30 [-1.024, -7.16] 2015	eon 2012 sasteiger 2012 ;hauhan 2013 ukuhara 2013 ukuhara 2013 saran 2014 Sini 2014 sini 2014 teker 2015 ;axak 2015 ;ikinci 2015	26.4 28 11.2 13 17.2 14.9	0.83 11 1.814 4 7	15 51 40 67	24.64 30 15.13	1.44 15	15		-4.00 [-9.54, 1.54]		
Gasteliger 2012 28 11 51 30 15 51 4.0% -2.00 [7.11, 3.11] 2012	Asateiger 2012 chauhan 2013 ukuhara 2013 iaran 2014 Das 2014 chair 2014 teker 2015 ikinci 2015	28 11.2 13 17.2 14.9	11 1.814 4 7	51 40 67	30 15.13	15		6 1 04		2012	
Chauhan 2013 11.2 1.814 40 15.13 2.91 40 5.1% -3.93 [4.99, -2.87] 2013 + Lukuhara 2013 13 4 67 13 3 67 5.1% -3.93 [4.99, -2.87] 2013 + Jakara 2014 17.2 7 30 15.4 6 30 4.6% 1.80 [-1.50, 5.10] 2014 + Jas 2014 14.9 2.6 30 2.0 3.1 30 5.0% -5.10 [-6.55, -3.65] 2014 + Gin 2014 21.98 5.42 24 30.6 8.51 2.4 4.3% -8.62 [+2.66, -4.58] 2014 + Veher 2015 17.4 7 15 2.5.7 14.2 15 2.9% -8.30 [+10.24, -7.16] 2015 + Feher 2015 13.1 2.24 20 2.18 2.7 20 5.0% -8.70 [+10.24, -7.16] 2015 + Feher 2015 7.4 41.1 9 10.96 61.5 98 1.5% -35.20 [-6.81, -3.19] 2015 + F	chauhan 2013 ukuhara 2013 aran 2014 Jas 2014 Gini 2014 eker 2015 axak 2015 ixinci 2015	11.2 13 17.2 14.9	1.814 4 7	40 67	15.13		64		1.76 [0.92, 2.60]	2012	+
Jukuhar 2013 13 4 67 13 3 67 51% 0.00[+1.20, 1.20] 2013 + Saran 2014 17.2 7 30 15.4 6 30 4.6% 1.80[+1.50, 5.10] 2013 + Saran 2014 14.9 2.6 30 20 3.1 30 5.0% -5.01[+6.55, -3.65] 2014 + Gni 2014 21.98 5.42 24 30.6 8.51 24 4.3% -8.62[+12.66, 4.68] 2014 + Gni 2014 21.98 5.42 22 30.6 8.51 24 4.3% -8.62[+12.66, 4.68] 2014 + Feker 2015 17.4 7 7 5.57 14.2 15 2.9% -8.30[+10.24, -7.16] 2015 + Fakex 2015 13.1 2.24 20 21.8 2.7 20 5.0% -8.20[+10.24, -7.16] 2015 + Ladina v2015 8 3 41 9.14 30 4.2% -11.47[+15.94, -7.00] 2015 + + - + -	ukuhara 2013 aran 2014 Jas 2014 Gini 2014 : 'eker 2015 axak 2015 Skinci 2015	13 17.2 14.9	4	67		0.04	51	4.0%	-2.00 [-7.11, 3.11]	2012	
Saran 2014 17.2 7 30 15.4 6 30 4.6% 1.80 [-1.50, 5.10] 2014	aran 2014 Das 2014 Gini 2014 Peker 2015 Gaxak 2015 Skinci 2015	17.2 14.9				2.91	40	5.1%	-3.93 [-4.99, -2.87]	2013	-
Das 2014 14.9 2.6 30 20 3.1 30 5.0% -5.10 [6.55, -3.65] 2014	Das 2014 Gini 2014 2 Veker 2015 Gaxak 2015 Skinci 2015	14.9			13	3	67	5.1%	0.00 [-1.20, 1.20]	2013	+
Gini 2014 21.98 5.42 24 30.6 8.51 24 4.3% -8.62 [12.66], 4.58] 2014 Peker 2015 17.4 7 15 25.7 14.2 15 2.9% -8.30 [-16.31], 0.29 [2015 Taxak 2015 13.1 2.24 20 21.8 2.7 20 5.0% -8.70 [-10.24], 7.16] 2015 Exinci 2015 8 3 40 13 5 40 5.0% -8.70 [-10.24], 7.16] 2015 Henlin 2015 74.4 41.1 99 109.6 61.5 98 1.5% -5.00 [-6.81, -3.19] 2015 Gayhan 2015 22.65 8.23 30 41 9.41 30 4.2% -11.47 [-15.94, -7.00] 2015 Gayhan 2015 12.6 2.19 25 24.2 6.05 25 4.8% -11.60 [-14.12, -9.08] 2015	(ini 2014 'eker 2015 'axak 2015 :kinci 2015			30	15.4	6	30	4.6%	1.80 [-1.50, 5.10]	2014	
Deter 2015 17.4 7 15 25.7 14.2 15 2.9% -8.30 16.31 0.29 2015 Taxak 2015 13.1 2.24 20 21.8 2.7 20 5.0% -8.70 10.24 7.16 2015	eker 2015 axak 2015 kinci 2015	21.98	2.6	30	20	3.1	30	5.0%	-5.10 [-6.55, -3.65]	2014	-
Faxak 2015 13.1 2.24 20 21.8 2.7 20 5.0% -8.70 [10.24], 7.16] 2015	axak 2015 kinci 2015		5.42	24	30.6	8.51	24	4.3%	-8.62 [-12.66, -4.58]	2014	
Exinci 2015 8 3 40 13 5 40 5.0% -5.00 [6.81, -3.19] 2015 Henlin 2015 74.4 41.1 99 109.6 61.5 98 1.5% -5.20 [4.83, -2.018] 2015 Jadhav 2015 29.65 8.23 30 41 9.41 30 4.2% -11.47 [1.59.4, 7.00] 2015 Gayhan 2015 12.6 2.19 25 24.2 6.05 25 4.8% -11.60 [1.412, -9.08] 2015 Mishra SK 2015 2 7 30 2.2 3 30 4.8% 0.00 [-2.73, .77] 2015 Miskra SK 2015 2 7 30 2.2 3 30 4.8% 0.00 [-2.73, .77] 2015	kinci 2015	17.4	7	15	25.7	14.2	15	2.9%	-8.30 [-16.31, -0.29]	2015	
Henlin 2015 74.4 41.1 99 109.6 61.5 98 1.5% -35.20[+9.82, -20.58] 2015		13.1	2.24	20	21.8	2.7	20	5.0%	-8.70 [-10.24, -7.16]	2015	
Jadhav 2015 29.53 8.23 30 41 9.41 30 4.2% -11.47 [15.94,-7.00] 2015 Gayhan 2015 12.6 2.19 25 24.2 6.05 25 4.8% -11.60 [14.12,-9.00] 2015 Wishra SK 2015 22 7 30 22 3 30 4.8% -11.60 [14.12,-9.00] 2015 Wukadder 2015 6.7 1.2 35 12.2 1.2 35 5.1% -5.50 [6.06,-4.94] 2015		8	3	40	13	5	40	5.0%	-5.00 [-6.81, -3.19]	2015	
Cayhan 2015 12.6 2.19 25 24.2 6.05 25 4.8% -11.60 14.12 -9.08 2015 Mishra SK 2015 22 7 30 22 3 30 4.8% 0.00 27.73 2015 Mixkadder 2015 6.7 1.2 35 12.2 1.2 35 51.% -50.6 6.06 4.94 2015 - Virupa 2016 10.2 1.9 50 12.4 2.7 50 5.1% -2.20 [3.12, -1.28] 2016 - Jas 2017 27.9 2.53 50 38.77 3.2 50 5.1% -10.87 [-1.20, -9.74] 2017 - Jos 2017 27.9 2.53 50 3.8.77 3.2 50 5.1% -10.87 [-1.20, -9.74] 2017 - Jos 2020 11.2 2.7 60 8.1 2.8 63 5.1% 3.10 [2.13, 4.07] 2020 - Shiveshi 2021 22.63 5.79	lenlin 2015	74.4	41.1	99	109.6	61.5	98	1.5%	-35.20 [-49.82, -20.58]	2015	←
Mishra SK 2015 22 7 30 22 3 30 4.8% 0.00 [-2.73, 2.73] 2015 Mukadder 2015 6.7 1.2 35 12.2 1.2 35 5.1% -5.20 [-6.06, -4.94] 2015 Mukadder 2015 1.2 35 12.4 2.7 50 5.1% -2.20 [-3.12, -1.28] 2016 - Jas 2017 27.9 2.53 50 38.77 3.2 50 5.1% -12.018, 97.41] 2016 - Jongh 2018 1.3 5.4 4.23 2.58 28 20.50	adhav 2015	29.53	8.23	30	41	9.41	30	4.2%	-11.47 [-15.94, -7.00]	2015	
Aukadder 2015 6.7 1.2 35 12.2 1.2 35 5.1% -5.50 [6.06, -4.94] 2015 - Mirupa 2016 10.2 1.9 50 12.4 2.7 50 5.1% -2.20 [-3.12, -1.28] 2016 - Jas 2017 27.9 2.53 50 38.77 3.2 50 5.1% -0.87 [+1.20, -9.74] 2017 - Singh 2018 13.5 4.41 28 23 2.58 28 5.0% -9.50 [+11.39, -7.61] 2018 - Jbs 2020 11.2 2.7 60 8.1 2.8 63 5.1% 3.10 [2.13, 4.07] 2020 - Shiweshi 2021 22.63 5.79 35 43.26 7.85 35 4.6% -20.63 [-23.86, -17.40] 2021 -	ayhan 2015	12.6	2.19	25	24.2	6.05	25	4.8%	-11.60 [-14.12, -9.08]	2015	
Virupa 2016 10.2 1.9 50 12.4 2.7 50 5.1% -2.20[3.12] -1.28] 2016	lishra SK 2015	22	7	30	22	3	30	4.8%	0.00 [-2.73, 2.73]	2015	
Das 2017 27.9 2.53 50 38.77 3.2 50 51.% -10.87 [12.00] 9.74] 2017 — Jingh 2018 13.5 4.41 28 23 2.58 28 5.0% -9.50 [-11.39] 7.61] 2018 — Dbs 2020 11.2 2.7 60 8.1 2.8 63 5.1% 3.10 [2.13, 4.07] 2020 — — Shiweshi 2021 22.63 5.79 35 43.26 7.85 35 4.6% -20.63 [-2.386, -17.40] 2021 — … <td>lukadder 2015</td> <td>6.7</td> <td>1.2</td> <td>35</td> <td>12.2</td> <td>1.2</td> <td>35</td> <td>5.1%</td> <td>-5.50 [-6.06, -4.94]</td> <td>2015</td> <td>-</td>	lukadder 2015	6.7	1.2	35	12.2	1.2	35	5.1%	-5.50 [-6.06, -4.94]	2015	-
Singh 2018 13.5 4.41 28 23 2.58 28 5.0% -9.50 [+11.39, -7.61] 2018	lirupa 2016	10.2	1.9	50	12.4	2.7	50	5.1%	-2.20 [-3.12, -1.28]	2016	+
Dbs 2020 11.2 2.7 60 8.1 2.8 63 5.1% 3.10 [2.13, 4.07] 2020 Shiveshi 2021 22.63 5.79 35 43.26 7.85 35 4.6% -20.63 [-23.86, -17.40] 2021	as 2017	27.9	2.53	50	38.77	3.2	50	5.1%	-10.87 [-12.00, -9.74]	2017	+
Shiveshi 2021 22.63 5.79 35 43.26 7.85 35 4.6% -20.63 [-23.86, -17.40] 2021	ingh 2018	13.5	4.41	28	23	2.58	28	5.0%	-9.50 [-11.39, -7.61]	2018	
	bs 2020	11.2	2.7	60	8.1	2.8	63	5.1%	3.10 [2.13, 4.07]	2020	-
′otal (95% Cl) 854 856 100.0% -5.61 [-7.71, -3.51] ◆	hiveshi 2021	22.63	5.79	35	43.26	7.85	35	4.6%	-20.63 [-23.86, -17.40]	2021	
	otal (95% CI)			854			856	100.0%	-5.61 [-7.71, -3.51]		•

(B)

(C)

	i-gel ^T	M	LMA-ProSe	al TM		Risk Ratio		Risk Ratio
Study or Subgroup	Events	Total	Events		Weight	M-H, Random, 95% CI	Year	M-H, Random, 95% Cl
Singh 2009	30	30	26	30	6.5%	1.15 [0.99, 1.34]	2009	
Sharma 2010	30	30	30	30	12.1%	1.00 [0.94, 1.07]	2010	
Gasteiger 2012	50	51	47	51	10.3%	1.06 [0.97, 1.16]	2012	+
Mitra 2012	28	30	29	30	8.4%	0.97 [0.86, 1.08]	2012	
Chauhan 2013	38	40	29	40	4.5%	1.31 [1.07, 1.61]	2013	· · · · ·
Saran 2014	27	30	27	30	5.7%	1.00 [0.84, 1.18]	2014	
Taxak 2015	20	20	20	20	9.9%	1.00 [0.91, 1.10]	2015	
Ekinci 2015	37	40	29	40	4.3%	1.28 [1.03, 1.57]	2015	·
Mishra SK 2015	30	30	30	30	12.1%	1.00 [0.94, 1.07]	2015	
Mukadder 2015	32	35	27	35	4.4%	1.19 [0.96, 1.46]	2015	
Liew 2016	44	47	47	50	9.3%	1.00 [0.90, 1.10]	2016	
Shiveshi 2021	35	35	35	35	12.7%	1.00 [0.95, 1.06]	2021	+
Total (95% CI)		418		421	100.0%	1.04 [0.99, 1.10]		•
Total events	401		376					
Heterogeneity: Tau ² =	0.00; Chi	² = 32.	17, df = 11 (P	= 0.000	07); I ² = 60	6%		
Test for overall effect:	Z=1.60 ((P = 0.1)	1)					0.5 0.7 1 1.5 2
								Favours [experimental] Favours [control]

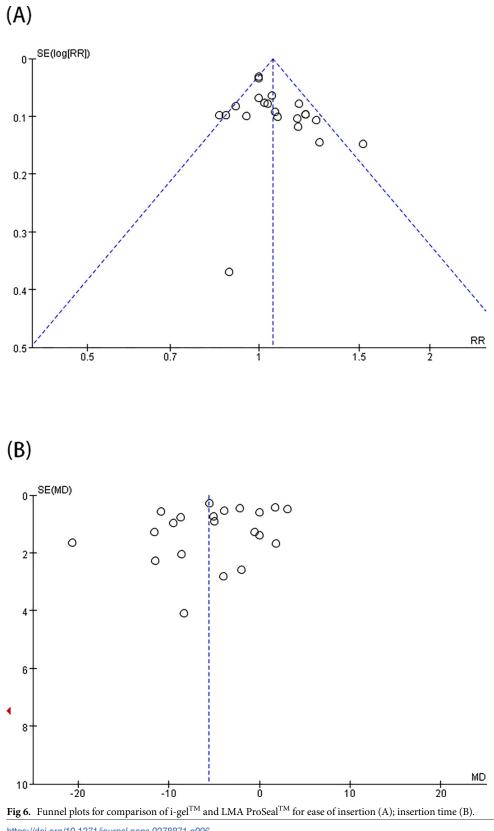
TM THE REAL TM B

	I-gel	ГM	LMA-ProSe	al TM		Risk Ratio		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% Cl	Year	M-H, Fixed, 95% Cl
Singh 2009	1	30	6	30	10.0%	0.17 [0.02, 1.30]	2009	
Sharma 2010	3	30	8	30	13.4%	0.38 [0.11, 1.28]	2010	
Shin 2010	0	64	3	53	6.4%	0.12 [0.01, 2.25]	2010	· · · · · · · · · · · · · · · · · · ·
Das 2012	1	30	4	30	6.7%	0.25 [0.03, 2.11]	2012	
Gasteiger 2012	1	51	0	51	0.8%	3.00 [0.13, 71.96]	2012	
Goyal 2012	2	40	4	40	6.7%	0.50 [0.10, 2.58]	2012	
Mitra 2012	1	30	3	30	5.0%	0.33 [0.04, 3.03]		
Chauhan 2013	0	40	8	40	14.2%	0.06 [0.00, 0.99]		
Das 2014	2	30	3	30	5.0%	0.67 [0.12, 3.71]	2014	
Kayhan 2015	0	25	2	25	4.2%	0.20 [0.01, 3.97]		
Liew 2016	0	49	9	50	15.7%	0.05 [0.00, 0.90]	2016	• • • • • • • • • • • • • • • • • • •
Das 2017	3	50	2	50	3.3%	1.50 [0.26, 8.60]	2017	
Singh 2018	2	28	0	28	0.8%	5.00 [0.25, 99.67]	2018	
Obs 2020	7	60	3	60	5.0%	2.33 [0.63, 8.60]	2020	
Shiveshi 2021	0	35	1	35	2.5%	0.33 [0.01, 7.91]	2021	
Total (95% CI)		592		582	100.0%	0.44 [0.28, 0.69]		◆
Total events	23		56					
Heterogeneity: Chi ² =	18.74, df	= 14 (F	² = 0.18); I ² =	25%				
Test for overall effect:	Z = 3.60	(P = 0.0)	003)					0.01 0.1 1 10 100
								Favours [experimental] Favours [control]

Fig 5. Forest plot for comparison of i-gelTM and LMA $ProSeal^{TM}$ for insertion time (A); gastric tube placement first insertion success rate (B); blood staining on the SADs (C). CI, confidence interval; I^2 , I-square heterogeneity statistic; IV, inverse variance.

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OLP provides specific merits in fat patients, restrictive and obstructive lung diseases, lithotomy position, and pneumo-peritoneum patients [44].



https://doi.org/10.1371/journal.pone.0278871.g006

(A)

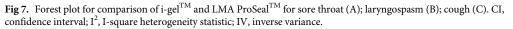
	i-gel ^T	M	LMA-ProSe	al TM		Risk Ratio		Risk Ratio
Study or Subgroup	Events	Total	Events		Weight	M-H, Fixed, 95% Cl	Year	M-H, Fixed, 95% Cl
Sharma 2010	0	30	3	30	5.5%	0.14 [0.01, 2.65]	2010	· · · · · · · · · · · · · · · · · · ·
Shin 2010	5	64	5	53	8.6%	0.83 [0.25, 2.71]	2010	
Chauhan 2013	0	40	7	40	11.8%	0.07 [0.00, 1.13]	2013	· · · · · · · · · · · · · · · · · · ·
Das 2014	0	30	1	30	2.4%	0.33 [0.01, 7.87]	2014	
Ekinci 2015	3	40	7	40	11.0%	0.43 [0.12, 1.54]	2015	
Jadhav 2015	1	30	5	30	7.9%	0.20 [0.02, 1.61]	2015	
Liew 2016	2	50	15	50	23.6%	0.13 [0.03, 0.55]	2016	_
Singh 2018	2	28	0	28	0.8%	5.00 [0.25, 99.67]	2018	
Luthra 2019	8	20	16	20	25.2%	0.50 [0.28, 0.89]	2019	
Shiveshi 2021	3	35	2	35	3.2%	1.50 [0.27, 8.43]	2021	
Total (95% CI)		367		356	100.0%	0.40 [0.27, 0.61]		◆
Total events	24		61					
Heterogeneity: Chi ² =	11.73, df	= 9 (P =	= 0.23); I ² = 2	23%				0.01 0.1 1 10 100
Test for overall effect:	Z = 4.32 ((P < 0.0	001)					Favours [experimental] Favours [control]
								ravous texperimental ravous (control)

(B)

	i-gel TM		LMA-ProSeal TM		Risk Ratio			Risk Ratio		
Study or Subgroup	Events	Total	Events		Weight	M-H, Fixed, 95% Cl	Year	M-H, Fixed, 95% Cl		
Jadhav 2015	0	30	2	30	62.7%	0.20 [0.01, 4.00]	2015			
Kayhan 2015	1	25	1	25	25.1%	1.00 [0.07, 15.12]	2015			
Obs 2020	1	60	0	63	12.2%	3.15 [0.13, 75.79]	2020			
Total (95% CI)		115		118	100.0%	0.76 [0.17, 3.31]				
Total events	2		3							
Heterogeneity: Chi ² =	1.57, df=	2 (P =	0.46); I ² = 0%							
Test for overall effect: Z = 0.36 (P = 0.72)								0.01 0.1 1 10 100 Favours [experimental] Favours [control]		

(C)

	_ i-gel TM		LMA-ProSeal TM		Risk Ratio			Risk Ratio		
Study or Subgroup	Events	Total	Events		Weight	M-H, Fixed, 95% Cl	Year	M-H, Fixed, 95% Cl		
Goyal 2012	2	40	1	40	14.4%	2.00 [0.19, 21.18]	2012			
Das 2014	1	30	2	30	28.8%	0.50 [0.05, 5.22]	2014			
Jadhav 2015	3	30	0	30	7.2%	7.00 [0.38, 129.93]	2015			
Obs 2020	2	60	2	63	28.1%	1.05 [0.15, 7.22]	2020	+		
Shiveshi 2021	0	35	1	35	21.6%	0.33 [0.01, 7.91]	2021			
Total (95% CI)		195		198	100.0%	1.30 [0.49, 3.44]		-		
Total events	8		6							
Heterogeneity: Chi ² =	= 2.80, df =	4 (P =	0.59); I ² = 0%							
Test for overall effect	: Z = 0.53	(P = 0.6	60)		0.01 0.1 1 10 100 Favours [experimental] Favours [control]					

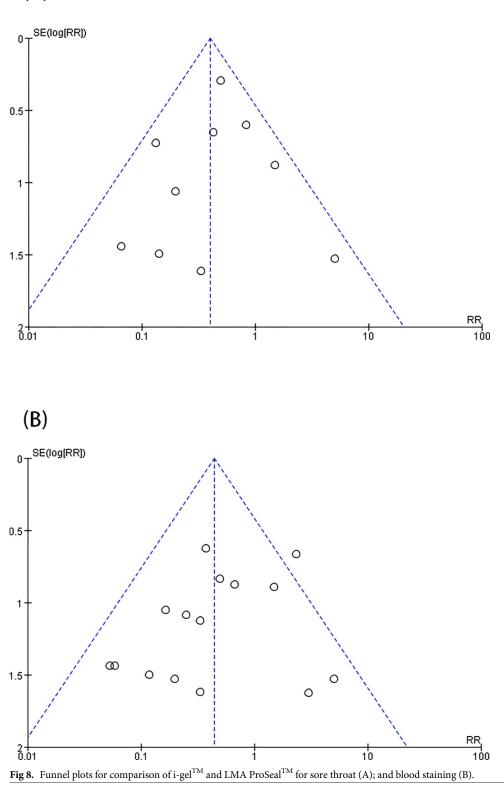


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Patient age, the use of NMB, intra-abdominal pressure during operation, evaluation approach of OLP, and LMA size selection standards may influence OLP [45]. Distinct data heterogeneity in the united OLP outcome was observed in our findings. A great heterogeneity ($I^2 = 97\%$) cannot be reduced although different subgroup analyses were adopted, probably due to the application of various sizes of SADs in these trials. The research by Mitra [11] used a 2.5 device. In Shiveshi's research [3], despite the use of 2 and 2.5 devices, the device adopted showed the evident size of 2 in more than 70% of kids. In addition, diversities in induction, maintenance, anesthesia depth, measurement standards, and the number of patients researched might also have contributed to the distinct data heterogeneity.

SADs with an inflatable mask show promise in causing tissue distortion, venous compression, and nerve injury, which translate into the growing incidence of related postoperative morbidity [5]. The incrimination of trauma on insertion, various insertions, and pressure brought by cuff against the pharyngeal mucosa cuff volumes and pressure has been made for postoperative complications [46, 47]. In the present study, i-gel[™] provided a higher first-insertion success rate, higher ease of insertion, and shorter intubation time than LMA ProSeal[™],

(A)



https://doi.org/10.1371/journal.pone.0278871.g008

possibly because of a convenient disposable device, relieve of interpolation by stiff bite block, and the natural oropharyngeal curvature of i-gel[™] compared with LMA ProSeal[™]. In addition, we observed that the application of the i-gel[™] is related to a lower incidence of pharyngolaryngeal morbidity (blood staining of the SADs and sore throat) compared with the LMA ProSeal[™].

By comparing with a previous review [48], our study presented different findings. First, the included studies in the previous review were published from 2009 to 2014, which is a long time ago. However, nearly 50% of the studies [3, 12, 14–16, 22–30, 34, 35, 40, 41] in our present meta-analysis were published after 2014 and reported conflicting results. Second, this work added several new outcomes compared with the past reviews. The first research showed that i-gel[™] can offer a higher first-insertion success rate and insertion ease, similar gastric-tube-placement first-insertion rate, laryngospasm, and cough by comparing with LMA ProSeal[™] in adults. Third, previous meta-analyses [49] comparing the two devices reported higher a OLP in i-gel[™] than LMA ProSeal[™] for pediatric patients, forming a contrast against our findings, which indicated that i-gel[™] offers a similar OLP compared with LMA ProSeal[™] in children. This disparity may be due to the differences in the included studies. Finally, LMA ProSeal[™] did not show a higher OLP compared with i-gel[™] under conditions of NMB and laparoscopic surgery.

Several limitations were observed in the current work. First, diversities in induction, maintenance, anesthesia depth, and the number of patients researched might have contributed to the distinct data heterogeneity. In spite of subgroups and sensitivity explorations were performed to control several factors, all possible confounding factors cannot be accounted for. Second, while comprehensively searching the published articles, the bias of potential publication might have been present because of the unsuccess to include in-progress or unpublished studies. Third, the mean difference of OLP from the pooled estimates is 1.53, with the absolute value of OLP from the included studies were all more than 20cmH₂O. An OLP value of more than 20cmH₂O is generally accepted as an adequate seal. In clinical practice, the difference in OLP values may not be meaningful, when both devices could achieve a enough seal to provide adequate ventilation. In the end, poor quality was found in several included studies. Two studies [24, 34] conducted a single-blinded rather than a double-blinded trial, and several research did not illustrate the details of binding in the result evaluation. Hence, extra high-quality research and follow-up studies such as trial sequential analysis are necessary to certify our outcomes.

To conclude, our outcomes showed that both i-gel[™] and LMA ProSeal[™] may offer a good seal to provide adequate ventilation. In addition, i-gel[™] offers certain advantages over LMA ProSeal[™] (higher insertion success rate at the first attempt, insertion ease, and rapid intubation time) with limited adverse events (blood staining, and sore throat) in anesthetized patients.

Author Contributions

Data curation: Yuan Tan. Formal analysis: Yuan Tan. Methodology: Yuan Tan. Supervision: Rurong Wang. Writing – original draft: Jingyao Jiang. Writing – review & editing: Yuan Tan, Rurong Wang.

References

- 1. Ramesh S, Jayanthi R, Archana SR. Paediatric airway management: What is new? Indian J Anaesth. 2012 Sep; 56(5):448–53. https://doi.org/10.4103/0019-5049.103959 PMID: 23293383
- Mushtaq R, Zahoor S A, Naqash I, et al. Cardiovascular responses to tracheal extubation in normotensive patients; A comparison with LMA removal. JK Practioner. 2003; 10:22–4.
- Shiveshi P, Anandaswamy TC. Comparison of Proseal LMA with i-gel in children under controlled ventilation: a prospective randomised clinical study. Braz J Anesthesiol.2021Apr 3:S0104–0014(21)00118-4. https://doi.org/10.1016/j.bjane.2021.02.042 PMID: 33823205
- 4. Hendinezhad M A, Babaei A, Baradari A G, et al. Comparison of Supraglottic airway devices for airway management during surgery in children: A review of literature. 2019; 7:89–98.
- Levitan RM, Kinkle WC. Initial anatomic investigations of the I-gel[™] airway: a novel supraglottic airway without inflatable cuff. Anaesthesia. 2005 Oct; 60(10):1022–6. https://doi.org/10.1111/j.1365-2044. 2005.04258.x PMID: 16179048
- Brain AI, Verghese C, Strube PJ. The LMA 'ProSeal'—a laryngeal mask with an oesophageal vent. Br J Anaesth. 2000 May; 84(5):650–4. https://doi.org/10.1093/bja/84.5.650 PMID: 10844848
- Keller C, Brimacombe JR, Keller K, et al. Comparison of four methods for assessing airway sealing pressure with the laryngeal mask airway in adult patients.[J]. Anesthesia&Analgesia,1998, 87(6):1379– 82. https://doi.org/10.1093/bja/82.2.286 PMID: 10365012
- Lopez-Gil M, Brimacombe J, Keller C. A comparison of four methods for assessing oropharyngeal leak pressure with the laryngeal mask airway (LMA) in paediatric patients.[J]. Pediatric Anesthesia, 2001, 11(3):319–21. https://doi.org/10.1046/j.1460-9592.2001.00649.x PMID: 11359590
- Das B, Mitra S, Jamil SN, et al. Comparison of three supraglottic devices in anesthetised paralyzed children undergoing elective surgery[J]. 6,3(2012-09-21), 2012, 6(3):224–228. <u>https://doi.org/10.4103/1658-354X.101212</u> PMID: 23162394
- Goyal R, Shukla RN, Kumar G. Comparison of size 2 i-gel supraglottic airway with LMA-ProSeal and LMA-Classic in spontaneously breathing children undergoing elective surgery.[J]. Pediatric Anesthesia, 2012, 22(4):355–359. https://doi.org/10.1111/j.1460-9592.2011.03757.x PMID: 22151106
- 11. Mitra S, Das B, Jamil SN. Comparison of Size 2.5 i-ge[™] with Proseal LMA[™] in Anaesthetised, Paralyzed Children Undergoing Elective Surgery[J]. North American Journal of Medical Sciences, 2012, 4 (10):453–7. https://doi.org/10.4103/1947-2714.101983 PMID: 23112965
- 12. Nirupa R, Gombar S, Ahuja V, et al. A randomised trial to compare i-gel and ProSeal[™] laryngeal mask airway for airway management in paediatric patients[J]. Indian Journal of Anaesthesia, 2016, 60 (10):726–731. https://doi.org/10.4103/0019-5049.191670 PMID: 27761035
- Jeon W J, Cho S Y, Baek S J, et al. Comparison of the Proseal LMA and intersurgical I-gel during gynecological laparoscopy[J]. Korean J Anesthesiol, 2012, 63(6):510–514. <u>https://doi.org/10.4097/kjae.</u> 2012.63.6.510 PMID: 23277811
- Liew G H, Yu E D, Shah S S, et al. Comparison of the clinical performance of i-gel™, LMA Supreme and LMA ProSeal™ in elective surgery[J]. Singapore medical journal, 2016, 57(8):432–437. <u>https://doi.org/ 10.11622/smedj.2016133</u> PMID: 27549212
- Kayhan GE, Begec Z, Sanli M, et al. Performance of size 1 I-gel compared with size 1 ProSeal laryngeal mask in anesthetized infants and neonates. Scientific World Journal. 2015; 2015:426186. <u>https://doi.org/10.1155/2015/426186 PMID: 25793219</u>
- Oba S, Türk HŞ, Kılınç L, et al. Comparing I-gel to Proseal Laryngeal Mask Airways in Infants: A Prospective Randomised Clinical Study. Turk J Anaesthesiol Reanim. 2020 Aug; 48(4):308–313. <u>https://</u> doi.org/10.5152/TJAR.2019.47936 PMID: 32864646
- Singh I, Gupta M, Tandon M. Comparison of Clinical Performance of I-gel with LMA-Proseal in Elective Surgeries. Indian J Anaesth. 2009 Jun; 53(3):302–5. PMID: 20640137
- Gasteiger L, Brimacombe J, Perkhofer D, Kaufmann M, Keller C. Comparison of guided insertion of the LMA ProSeal vs the i-gel. Anaesthesia. 2010 Sep; 65(9):913–6. https://doi.org/10.1111/j.1365-2044. 2010.06422.x PMID: 20645948
- Sharma B, Sehgal R, Sahai C, et al. PLMA vs. I-gel: A Comparative Evaluation of Respiratory Mechanics in Laparoscopic Cholecystectomy. J Anaesthesiol Clin Pharmacol. 2010 Oct; 26(4):451–7. PMID: 21547168
- Shin WJ, Cheong YS, Yang HS, et al. The supraglottic airway I-gel in comparison with ProSeal laryngeal mask airway and classic laryngeal mask airway in anaesthetized patients. Eur J Anaesthesiol. 2010 Jul; 27(7):598–601. https://doi.org/10.1097/EJA.0b013e3283340a81 PMID: 19915475

- Chauhan G, Nayar P, Seth A, et al. Comparison of clinical performance of the I-gel with LMA ProSeal. J Anaesthesiol Clin Pharmacol. 2013 Jan; 29(1):56–60. <u>https://doi.org/10.4103/0970-9185.105798</u> PMID: 23493414
- Jadhav PA, Dalvi NP, Tendolkar BA. I-gel versus laryngeal mask airway-Proseal: Comparison of two supraglottic airway devices in short surgical procedures. J Anaesthesiol Clin Pharmacol. 2015 Apr-Jun; 31(2):221–5. https://doi.org/10.4103/0970-9185.155153 PMID: 25948905
- 23. Mishra SK, Sivaraman B, Balachander H, et al. Effect of pneumoperitoneum and Trendelenberg position on oropharyngeal sealing pressure of I-gel™ m and ProSeal LMA™ in laparoscopic gynecological surgery: A randomized controlled trial. Anesth Essays Res. 2015 Sep-Dec; 9(3):353–8. https://doi.org/10.4103/0259-1162.159771 PMID: 26712973
- Henlin T, Sotak M, Kovaricek P, et al. Comparison of five 2nd-generation supraglottic airway devices for airway management performed by novice military operators. Biomed Res Int. 2015; 2015:201898. https://doi.org/10.1155/2015/201898 PMID: 26495289
- Mukadder S, Zekine B, Erdogan KG, et al. Comparison of the proseal, supreme, and i-gel SAD in gynecological laparoscopic surgeries. Scientific World Journal. 2015; 2015:634320. <u>https://doi.org/10.1155/</u> 2015/634320 PMID: 25802890
- 26. Mishra SK, Nawaz M, Satyapraksh MV, et al. Influence of Head and Neck Position on Oropharyngeal Leak Pressure and Cuff Position with the ProSeal Laryngeal Mask Airway and the I-gel: A Randomized Clinical Trial. Anesthesiol Res Pract. 2015; 2015:705869. <u>https://doi.org/10.1155/2015/705869</u> PMID: 25648620
- 27. Taxak S, Gopinath A, Saini S, et al. A prospective study to evaluate and compare laryngeal mask airway ProSeal and i-gel airway in the prone position. Saudi J Anaesth. 2015 Oct-Dec; 9(4):446–50. <u>https://doi.org/10.4103/1658-354X.159473 PMID: 26543466</u>
- Das B, Varshney R, Mitra S. A randomised controlled trial comparing ProSeal laryngeal mask airway, igel and Laryngeal Tube Suction-D under general anaesthesia for elective surgical patients requiring controlled ventilation. Indian J Anaesth. 2017 Dec; 61(12):972–977. <u>https://doi.org/10.4103/ija.IJA</u> 339 17 PMID: 29307902
- 29. Singh A, Bhalotra AR, Anand R. A comparative evaluation of ProSeal laryngeal mask airway, I-gel and Supreme laryngeal mask airway in adult patients undergoing elective surgery: A randomised trial. Indian J Anaesth. 2018 Nov; 62(11):858–864. https://doi.org/10.4103/ija.IJA_153_18 PMID: 30532321
- Luthra A, Chauhan R, Jain A, et al. Comparison of Two Supraglottic Airway Devices: I-gel Airway and ProSeal Laryngeal Mask Airway Following Digital Insertion in Nonparalyzed Anesthetized Patients. Anesth Essays Res. 2019 Oct-Dec; 13(4):669–675. https://doi.org/10.4103/aer.AER_132_19 PMID: 32009713
- Fukuhara A, Okutani R, Oda Y. A randomized comparison of the i-gel[™] and the ProSeal laryngeal mask airway in pediatric patients: performance and fiberoptic findings. J Anesth. 2013 Feb; 27(1):1–6. https://doi.org/10.1007/s00540-012-1477-4 PMID: 22965330
- 32. Gasteiger L, Brimacombe J, Oswald E, et al. LMA ProSeal^(TM) vs. i-gel^(TM) in ventilated children: a randomised, crossover study using the size 2 mask. Acta Anaesthesiol Scand. 2012 Nov; 56(10):1321–4. https://doi.org/10.1111/j.1399-6576.2012.02765.x PMID: 22946775
- 33. Saran S, Mishra SK, Badhe AS, et al. Comparison of i-gel supraglottic airway and LMA-ProSeal[™] in pediatric patients under controlled ventilation. J Anaesthesiol Clin Pharmacol. 2014 Apr; 30(2):195–8. https://doi.org/10.4103/0970-9185.130013 PMID: 24803756
- Peker G, Takmaz SA, Baltacı B, et al. Comparison of Four Different Supraglottic Airway Devices in Terms of Efficacy, Intra-ocular Pressure and Haemodynamic Parameters in Children Undergoing Ophthalmic Surgery. Turk J Anaesthesiol Reanim. 2015 Oct; 43(5):304–12. https://doi.org/10.5152/TJAR. 2015.49091 PMID: 27366519
- 35. Banerjee G, Jain D, Bala I, et al. Comparison of the ProSeal laryngeal mask airway with the l-gel[™] in the different head-and-neck positions in anaesthetised paralysed children: A randomised controlled trial. Indian J Anaesth. 2018 Feb; 62(2):103–108. https://doi.org/10.4103/ija.IJA_594_17 PMID: 29491514
- 36. Kini G, Devanna GM, Mukkapati KR, et al. Comparison of I-gel with proseal LMA in adult patients undergoing elective surgical procedures under general anesthesia without paralysis: A prospective randomized study. J Anaesthesiol Clin Pharmacol. 2014 Apr; 30(2):183–7. https://doi.org/10.4103/0970-9185. 130008 PMID: 24803754
- Van Zundert TC, Brimacombe JR. Similar oropharyngeal leak pressures during anaesthesia with i-gel, LMA-ProSeal and LMA-Supreme Laryngeal Masks. Acta Anaesthesiol Belg. 2012; 63(1):35–41. PMID: 22783708

- Liberati A, Altman DG, Tetzlaff J, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. PLoS Med 2009; 6:e1000100. https://doi.org/10.1371/journal.pmed.1000100 PMID: 19621070
- 39. Das A, Majumdar S, Mukherjee A, et al. i-gel[™] in Ambulatory Surgery: A Comparison with LMA-Pro-Seal[™] in Paralyzed Anaesthetized Patients. J Clin Diagn Res. 2014 Mar; 8(3):80–4. <u>https://doi.org/10.7860/JCDR/2014/7890.4113 PMID: 24783088</u>
- 40. Ekinci O, Abitagaoglu S, Turan G, et al. The comparison of ProSeal and I-gel™ laryngeal mask airways in anesthetized adult patients under controlled ventilation. Saudi Med J. 2015 Apr; 36(4):432–6. <u>https://</u> doi.org/10.15537/smj.2015.4.10050 PMID: 25828279
- Kalra N, Gupta A, Sood R, et al. Comparison of Proseal Laryngeal Mask Airway with the I-gel[™] Supraglottic Airway During the Bailey Manoeuvre in Adult Patients Undergoing Elective Surgery. Turk J Anaesthesiol Reanim. 2021 Apr; 49(2):107–113. https://doi.org/10.5152/TJAR.2020.29569 PMID: 33997838
- 42. Beleña J M, Núñez M, Anta D, et al. Comparison of Laryngeal Mask Airway Supreme and Laryngeal Mask Airway Proseal with respect to oropharyngeal leak pressure during laparoscopic cholecystectomy: a randomised controlled trial[J]. European Journal of Anaesthesiology (EJA), 2013, 30(3): 119–123. https://doi.org/10.1097/EJA.0b013e32835aba6a PMID: 23318811
- 43. Seet E, Rajeev S, Firoz T, et al. Safety and efficacy of laryngeal mask airway Supreme versus laryngeal mask airway ProSeal: a randomized controlled trial[J]. European Journal of Anaesthesiology (EJA), 2010, 27(7): 602–607. https://doi.org/10.1097/eja.0b013e32833679e3 PMID: 20540172
- LOPEZ-GIL M, Brimacombe J. The ProSeal laryngeal mask airway in children[J]. Pediatric Anesthesia, 2005, 15(3): 229–234. https://doi.org/10.1111/j.1460-9592.2005.01427.x PMID: 15725321
- Shimbori H, Ono K, Miwa T, et al. Comparison of the LMA-ProSeal and LMA-Classic in children[J]. British journal of anaesthesia, 2004, 93(4): 528–531. https://doi.org/10.1093/bja/aeh238 PMID: 15298876
- 46. Burgard G, Möllhoff T, Prien T. The effect of laryngeal mask cuff pressure on postoperative sore throat incidence. J Clin Anesth. 1996 May; 8(3):198–201. https://doi.org/10.1016/0952-8180(95)00229-4 PMID: 8703453
- **47.** Brimacombe J, Holyoake L, Keller C, et al. Pharyngolaryngeal, neck, and jaw discomfort after anesthesia with the face mask and laryngeal mask airway at high and low cuff volumes in males and females. Anesthesiology. 2000 Jul; 93(1):26–31. https://doi.org/10.1097/00000542-200007000-00009 PMID: 10861142
- Shin HW, Yoo HN, Bae GE, et al. Comparison of oropharyngeal leak pressure and clinical performance of LMA ProSeal and i-gel® in adults: Meta-analysis and systematic review. J Int Med Res. 2016 Jun; 44 (3):405–18. https://doi.org/10.1177/0300060515607386 PMID: 27009026
- 49. Maitra S, Baidya DK, Bhattacharjee S, et al. Evaluation of i-gel([™]) airway in children: a meta-analysis. Paediatr Anaesth. 2014 Oct; 24(10):1072–9. https://doi.org/10.1111/pan.12483 PMID: 25041224