Appendix 1 Supplemental files

https://dx.doi.org/10.21037/jtd-23-1758

Comparison of high-flow nasal cannula with conventional oxygen therapy for preventing postoperative hypoxemia in patients with lung resection surgery: a systematic review and meta-analysis

1 Search strategy

1.1 Table S1: Cochrane Library Search Strategy

Time limit: Initially until July 3, 2023.

Serial number	Search terms	Count
#1	('Humidication oxygen' OR 'humidified oxygen' OR 'HFO' OR 'high-flow' OR 'high flow' OR ' HFNC' OR 'HFNP' OR 'Nasal Cannula'):ti,ab, kw	16291
#2	('lung resection' OR 'pneumonectomy' OR 'lobectomy' OR 'wedge resection' OR 'video assisted thoracoscopic surgery' OR 'vats'):ti,ab,kw	7521
#3	#1 AND #2	65

Abbreviations: HFO, high flow oxygen; HFNC, high flow nasal cannula; HFNP, high-flow nasal prongs; vats, video assisted thoracoscopic surgery.

1.2 Table S2: Embase Search Strategy

Time limit: Initially until July 3, 2023.

Serial number	Search terms	Count
#1	'high flow nasal cannula therapy'/exp OR 'high flow nasal cannula therapy' OR 'humidication oxygen':ti,ab,kw OR 'humidified oxygen':ti,ab,kw OR HFO:ti,ab,kw OR 'high flow':ti,ab,kw OR HFNC:ti,ab,kw OR HFNP:ti,ab,kw OR 'nasal cannula':ti,ab,kw	24581
#2	'lung resection'/exp OR 'lung resection' OR (('lung'/exp OR lung) AND ('resection'/exp OR resection)) OR pneumonectomy:ti,ab,kw OR lobectomy:ti,ab,kw OR 'wedge resection':ti,ab,kw OR 'video assisted thoracoscopic surgery':ti,ab,kw	533109
#3	'crossover procedure':de OR 'double-blind procedure':de OR 'randomized controlled trial':de OR 'single-blind procedure':de OR (random* OR factorial* OR crossover* OR cross NEXT/1 over* OR placebo* OR doubl* NEAR/1 blind* OR singl* NEAR/1 blind* OR assign* OR allocat* OR volunteer*):de,ab,ti	3157687
#4	#1 And #2 And #3	231

Abbreviations: HFO, high flow oxygen; HFNC, high flow nasal cannula; HFNP, high-flow nasal prongs.

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1.3 Table S3: PubMed Search Strategy

Time limit: Initially until July 3, 2023.

Serial number	Search terms	Count
#1	(((((((Humidication oxygen[Title/Abstract]) OR (humidified oxygen[Title/Abstract])) OR (HFO[Title/Abstract])) OR (high-flow[Title/Abstract])) OR (high flow[Title/Abstract])) OR (HFNC[Title/Abstract])) OR (HFNP[Title/Abstract])) OR (Nasal Cannula[Title/Abstract])	14,330
#2	(((((lung resection[Title/Abstract]) OR (pneumonectomy[Title/Abstract])) OR (lobectomy[Title/Abstract])) OR (wedge resection[Title/Abstract])) OR (video assisted thoracoscopic surgery[Title/Abstract])) OR (vats[Title/Abstract])	43,310
#3	#1 AND #2	33

Abbreviations: HFO, high flow oxygen; HFNC, high flow nasal cannula; HFNP, high-flow nasal prongs; vats, video assisted thoracoscopic surgery.

1.4 Table S4: Web of Science Search Strategy

Time limit: Initially until July 3, 2023.

Serial number	Search terms	Count
#1	(((((((TS=(Humidication oxygen)) OR TS=(humidified oxygen)) OR TS=(HFO)) OR TS=(high-flow)) OR TS=(high flow)) OR TS=(HFNC)) OR TS=(HFNP)) OR TS=(Nasal Cannula)	492,342
#2	(((((TS=(lung resection)) OR TS=(pneumonectomy)) OR TS=(lobectomy)) OR TS=(wedge resection)) OR TS=(video assisted thoracoscopic surgery)) OR TS=(vats)	42,059
#3	#1 AND #2	294

Abbreviations: HFO, high flow oxygen; HFNC, high flow nasal cannula; HFNP, high-flow nasal prongs; vats, video assisted thoracoscopic surgery.

1.5 Table S5: Scopus Search Strategy

Time limit: Initially until January 2024.

Serial number	Search terms	Count
#1	TITLE-ABS-KEY ("humidication oxygen" OR "humidified oxygen" OR "HFO" OR "high-flow" OR "high flow" OR "HFNC" OR "HFNP" OR "nasal cannula")	46,424
#2	TITLE-ABS-KEY ("lung resection" OR "pneumonectomy" OR "lobectomy" OR "wedge resection" OR "video assisted thoracoscopic surgery" OR "vats")	110,344
#3	INDEXTERMS ("clinical trials" OR "clinical trials as a topic" OR "randomized controlled trial" OR "Randomized Controlled Trials as Topic" OR "controlled clinical trial" OR "Controlled Clinical Trials" OR "random allocation" OR "Double-Blind Method" OR "Single-Blind Method" OR "Cross-Over Studies" OR "Placebos" OR "multicenter study" OR "double blind procedure" OR "single blind procedure" OR "crossover procedure" OR "clinical trial")	2,160,954
#4	#1 AND #2	137
#5	#4 AND #3	19

Abbreviations: HFO, high flow oxygen; HFNC, high flow nasal cannula; HFNP, high-flow nasal prongs; vats, video assisted thoracoscopic surgery.

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2 Data Retrieval Details

2.1 Figure S1: Navicat Premium was used to manage the extracted data.

Navicat Premium is used for extracting and managing data from each article. Only a fraction of the data framework is displayed.

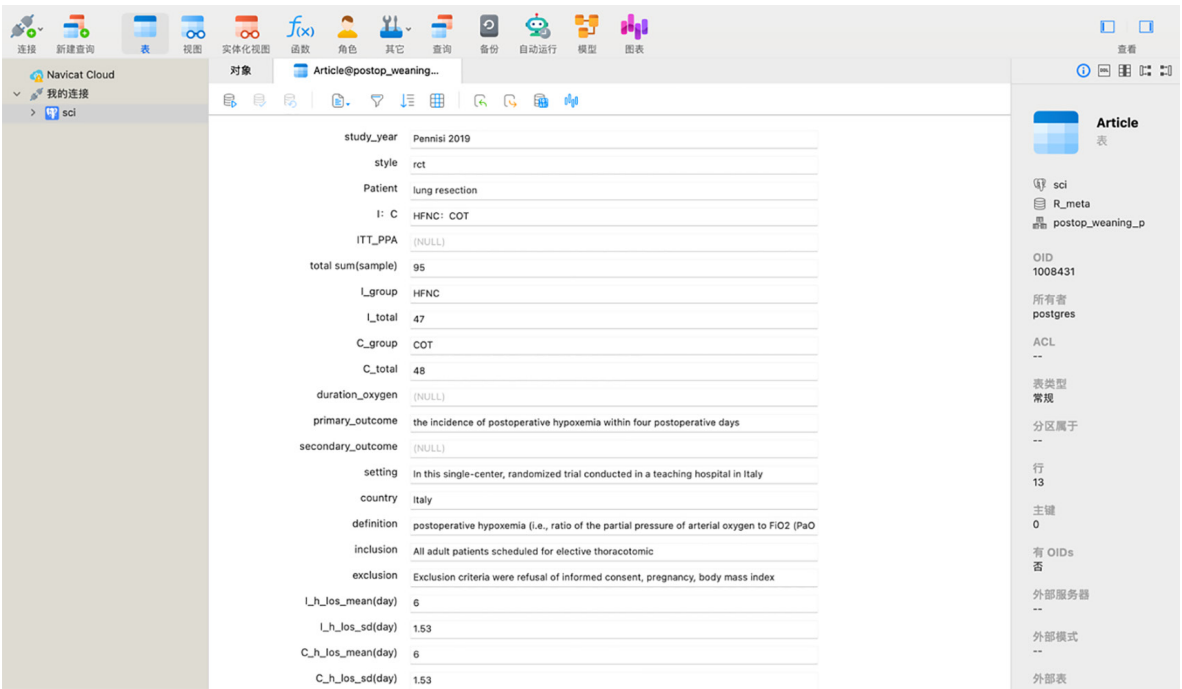

Figure S1 Navicat Premium was used to manage the extracted data from the included articles. Abbreviations: HFNC, high flow nasal cannula; COT, conventional oxygen therapy; RCT, Randomized Controlled Trial.

https://dx.doi.org/10.21037/jtd-23-1758

2.2 Table S6. Extracting PaO_2/FiO_2 from articles that fulfill the criteria.

Author	Group	Hours following extubation				
		1h	3-6h	12h	24h	72h
Yu 2017 (24)	HFNC	304.5±8	320.5±17.1	322.7±11.3	335.2±15.9	351.1±13.6
	COT	286.4±5.7	293.2±9.1	294.3±6.8	303.4±5.7	317.1±11.4
Pennisi 2019 (5)	HFNC	351.7±105.8	309.6±98.6	Null	282.1±78.3	312.6±68.1
	COT	305.3±62.3	303.9±75.4	Null	293.7±75.4	311.1±75.4
Zhu 2022 (25)	HFNC	289.2±82.0	Null	313.5±114.6	301.5±129.1	Null
	COT	281.9±76.7	Null	284±80.5	268.3±102.5	Null

The data of Yu (2017) and Pennisi (2019) were obtained from *Figures S2*,*S3*) using DigitizeIt software (Braunschweig, Germany, https://www.digitizeit.xyz/), and Zhu (2022)'s data was taken from the original article's table and transformed from median and quartiles to mean ± standard deviation. Abbreviations: HFNC, high flow nasal cannula; COT, conventional oxygen therapy. Null: There was no relevant data available at the corresponding time point in the original article.

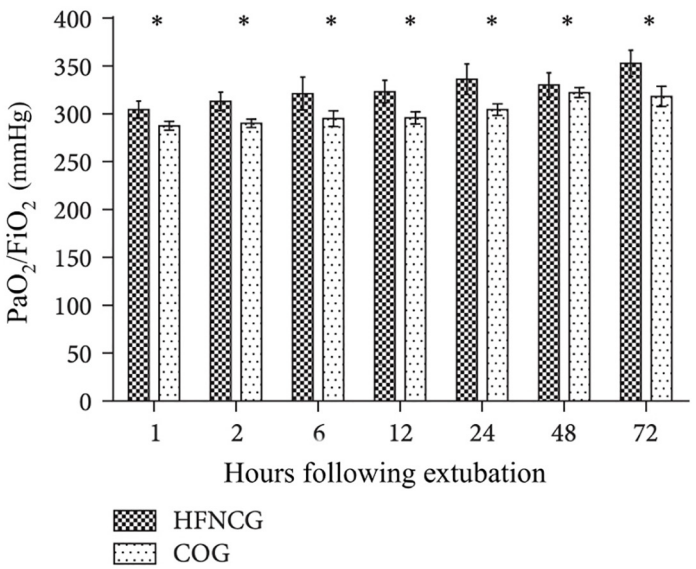

Figure S2 Collect data related to the postoperative PaO_2/FiO_2 from Yu (2017) (24).

Explanation:

1. The "*" symbol is a graphic element present in the original article and was not produced during the data extraction process.
2. The X-axis denotes the time point subsequent to the removal of tracheal intubation. On the Y-axis, the value of PaO_2/FiO_2 is depicted.

Abbreviations: HFNCG, high-flow nasal cannula group; COG, conventional oxygen group; PaO_2/FiO_2, the arterial pressure of oxygen/inspiratory fraction of oxygen.

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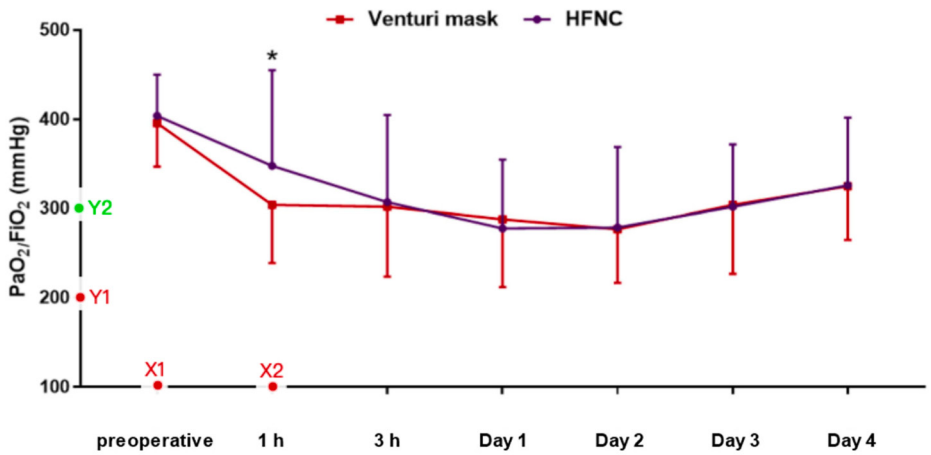

Figure S3 Collect data related to the postoperative PaO2/FiO2 from Pennisi (2019) (5).

Explanation:

1. The "*" symbol is a graphic element present in the original article and was not produced during the data extraction process.
2. The coordinate axes X1, X2, Y1, and Y2 are calibrated to convert graphical data in the article into numerical values using DigitizeIt software.

Abbreviations: HFNC, high-flow nasal cannula, PaO_2/FiO_2, the arterial pressure of oxygen/inspiratory fraction of oxygen.

2.3 Table S7. Extracting $PaCO_2$ from articles that fulfill the criteria.

Author	Group	Hours following extubation				
		1h	3-6h	12h	24h	72h
Yu 2017 (24)	HFNC	43.5±3.8	45.7±4.9	46.4±5.8	45.0±3.5	47.2±2.0
	COT	45.2±4.3	44.2±3.6	45.8±2.5	43.8±3.5	46.9±3.3
Pennisi 2019 (5)	HFNC	40.1±4.4	39.4±4.0	Null	39.3±4.8	38.5±3.8
	COT	42.6±4.2	42.5±4.7	Null	41.2±4.6	37.9±3.7
Zhu 2022 (25)	HFNC	38.5±1.7	Null	38.7±1.7	37.8±2.5	Null
	COT	38.4±1.7	Null	38.7±1.7	38.6±1.8	Null

The data from Yu (2017) and Pennisi (2019) were obtained from *Figures S4*,*S5* using DigitizeIt software (Braunschweig, Germany, https://www.digitizeit.xyz/). Zhu (2022)'s data was taken from the original article's table and transformed from medians and quartiles to means ± standard deviations. Abbreviations: HFNC, high flow nasal cannula; COT, conventional oxygen therapy. Null: There was no relevant data available at the corresponding time point in the original article.

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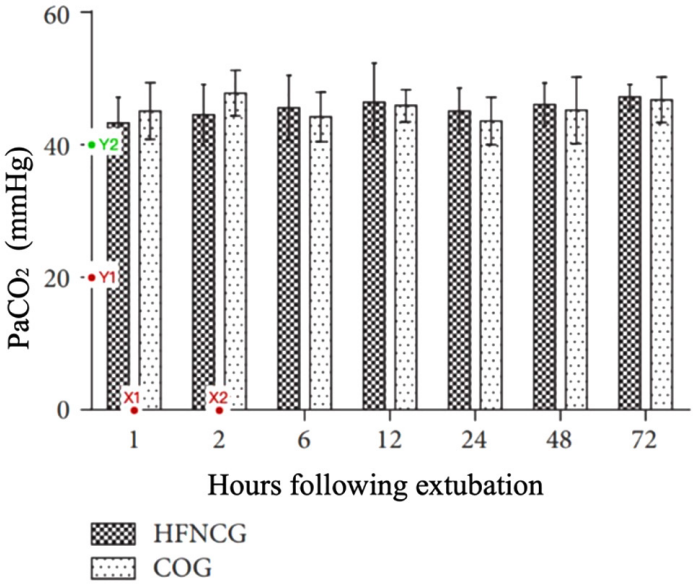

Figure S4 Collect data related to postoperative PaCO2 from Yu (2017) (24).

Explanation:

1.The coordinate axes X1, X2, Y1, and Y2 are calibrated to convert graphical data in the article into numerical values using DigitizeIt software.

2.The X-axis denotes the time point subsequent to the removal of the tracheal intubation. On the Y-axis, the value of $PaCO_2$ is depicted.

Abbreviations: HFNCG, high-flow nasal cannula group; COG, conventional oxygen group; $PaCO_2$, partial pressure of arterial carbon dioxide.

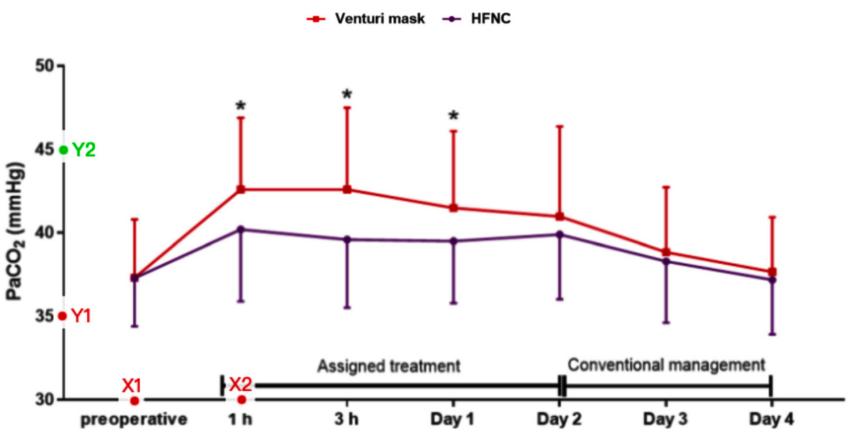

Figure S5 Collect data related to postoperative PaCO2 from Pennisi (2019) (5).

Explanation:

1.The "*" symbol is a graphic element present in the original article and was not produced during the data extraction process.

2. The coordinate axes X1, X2, Y1, and Y2 are calibrated to convert graphical data in the article into numerical values using DigitizeIt software.

Abbreviations: HFNC, high-flow nasal cannula; $PaCO_2$, partial pressure of arterial carbon dioxide.

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3 Assessing the certainty of evidence.

3.1 Table S8. Additional summaries of the findings were assessed from the article.

This table provides additional summaries of the findings from the research.

Certainty assessment							No of patients		Effect	Certainty
No of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	HFNC	COT	Absolute (95% CI)	
3-6 hours PaO_2/FiO_2 after intervention use										
2 (5,24)	Randomised trials	Serious[a]	Not serious[f]	Not serious[c]	Serious[d,e]	None	103	102	MD 23.87 mmHg higher (8.41 higher to 39.34 higher)	⊕⊕⊖⊖ Low
12 hours PaO_2/FiO_2 after intervention use										
2 (24,25)	Randomised trials	Serious[a]	Not serious[f,g]	Not serious[c]	Serious[d,e]	None	116	114	MD 28.41 mmHg higher (24.96 higher to 31.87 higher)	⊕⊕⊖⊖ Low
24 hours PaO_2/FiO_2 after intervention use										
3 (5,24,25)	Randomised trials	Serious[a]	Very serious[b,h]	Not serious[c]	Serious[d,e]	None	163	162	MD 19.03 mmHg higher (9.37 lower to47.42 higher)	⊕⊖⊖⊖ Very low
3-6 hours $PaCO_2$ after intervention use										
2 (5,24)	Randomised trials	Serious[a]	Very serious[b,j]	Not serious[c]	Not serious[d,i]	None	103	102	MD 0.79 mmHg lower (5.29 lower to 3.72 higher)	⊕⊖⊖⊖ Very low
12 hours $PaCO_2$ after intervention use										
2 (24,25)	Randomised trials	Serious[a]	Not serious[f,g]	Not serious[c]	Serious[d,e]	None	116	114	MD 0.07 mmHg higher (0.5 lower to 0.64 higher)	⊕⊕⊖⊖ Low
24 hours $PaCO_2$ after intervention use										
3 (5,24,25)	Randomised trials	Serious[a]	Very serious[b,j]	Not serious[c]	Not serious[d,i]	None	163	162	MD 0.82 mmHg lower (2.81 lower to 1.17 higher)	⊕⊖⊖⊖ Very low

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Abbreviations: CI, confidence interval; MD, mean difference; HFNC, high flow nasal cannula; COT, conventional oxygen therapy
Explanations:

a. The overall risk of bias of the included articles is ascertained by using the modified Cochrane Risk of Bias Evaluation Tool (Rob2).
b. The point estimates are significantly different, with an I-squared value of over 50%.
c. There were direct outcomes in terms of population, intervention, outcome assessment, and intervention modalities, with no indirect outcomes.
d. Imprecision varied slightly among the different evidence assessors, and we judged imprecision by assessing the width and narrowness of the 95% confidence interval between studies.
e. The width of the 95% confidence interval varied widely among studies.
f. The between-study confidence intervals had good overlap.
g. Good homogeneity and I squared = 0%.
h. There is significant heterogeneity and I squared = 87%.
i. The width of the 95% confidence interval was consistent among studies.
j. There is significant heterogeneity and I squared = 93%.

Quality of the evidence (GRADE)
⊕⊖⊖⊖: very low quality of the evidence
⊕⊕⊖⊖: low quality of the evidence
⊕⊕⊕⊖: moderate quality of the evidence
⊕⊕⊕⊕: high quality of the evidence

4 Quality assessment of the included RCT studies.

4.1 Table S9. The result was assessed by the Modified Jadad Score.

Author/year	Randomization	Concealment of allocation	Double blinding	Withdrawals and dropouts	Total score
El-Nori 2023 (26)	2	1	0	1	4
Zhu 2022 (25)	2	1	0	1	4
Pennisi 2019 (5)	2	1	0	1	4
Yu 2017 (24)	2	1	0	1	4
Ansari 2016 (23)	2	2	0	1	5

The quality of the included trials was evaluated using the modified Jadad score. The score awards points for appropriate randomization, the presence of concealed allocation, the adequacy of double blinding, the appropriateness of the blinding technique, and the documentation of withdrawals and dropouts. The score ranges from 0 to 7, where a score of ≥4 denotes "high quality" based on the original validation studies. Each study was evaluated using a scoring scale to assess randomization (0-2 points), double blinding (0-2 points), concealment of allocation (0-2 points), and withdrawals and dropouts (0-1 point).

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4.2 Table S10. The risk of bias was assessed using Rob2.

Study (author, years)	Randomisation process	Deviations from the intended interventions	Missing outcome data	Measurement of the outcome	Selection of the reported result	Overall Rob
Ansari 2016 (23)	Low	Some concerns	Low	Some concerns	Low	Some concerns
Pennisi 2019 (5)	Low	Some concerns	Low	Some concerns	Low	Some concerns
Yu 2017 (24)	Low	Some concerns	Low	Some concerns	Some concerns	Some concerns
El-Nori 2023 (26)	Low	Some concerns	Low	Some concerns	Some concerns	Some concerns
Zhu 2022 (25)	Low	Some concerns	Low	Some concerns	Some concerns	Some concerns

https://dx.doi.org/10.21037/jtd-23-1758

4.3 Table S11. The details of the article (Ansari, 2016) were evaluated by the Rob2 tool.

Unique ID	Ansari 2016 (23)	**Study ID**	Ansari 2016 (23)	**Assessor**	Xingxing Zhang and Yun Yu
Ref or Label	10.1016/j.athoracsur.2015.07.025	**Aim**	Assignment to intervention (the 'intention-to-treat' effect)		
Experimental	HFNC	**Comparator**	COT	**Source**	Journal article(s)
Outcome	Hospital length of stay(primary outcome) and other patient centered outcomes				
Domain	**Signalling question**			**Response**	**Comments**
Bias arising from the randomization process	1.1 Was the allocation sequence random?			Y	A computational random number generator was used to generate a sequence of numbers across the two groups. A randomization table was then created where patients would be assigned the treatment allocated to their consecutively assigned study number. Allocation concealment was maintained by using opaque, sealed, sequentially numbered envelopes.
	1.2 Was the allocation sequence concealed until participants were enrolled and assigned to interventions?			Y	
	1.3 Did baseline differences between intervention groups suggest a problem with the randomization process?			N	The baseline characteristics of the two groups were similar.
	Risk of bias judgement			**Low**	
Bias due to deviations from intended interventions	2.1.Were participants aware of their assigned intervention during the trial?			PY	Patients were randomly allocated to either HFNO or standard oxygen therapy during surgery, and the anesthetist and surgeon were blinded to treatment group. Allocation concealment was maintained by using opaque, sealed, sequentially numbered envelopes. A clinical investigator not involved in the clinical care of the patient obtained the treatment allocation and prepared the appropriate therapy.
	2.2.Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?			PY	
	2.3. If Y/PY/NI to 2.1 or 2.2: Were there deviations from the intended intervention that arose because of the experimental context?			NI	There was no mention of this information in the article.
	2.4 If Y/PY to 2.3: Were these deviations likely to have affected the outcome?			NA	
	2.5. If Y/PY/NI to 2.4: Were these deviations from intended intervention balanced between groups?			NA	
	2.6 Was an appropriate analysis used to estimate the effect of assignment to intervention?			Y	The RCT was registered and ITT analysis was used.
	2.7 If N/PN/NI to 2.6: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomized?			NA	
	Risk of bias judgement			**Some concerns**	
Bias due to missing outcome data	3.1 Were data for this outcome available for all, or nearly all, participants randomized?			Y	In all, 68 patients were recruited to the study between June and December 2014; 9 were withdrawn before allocation to treatment group owing to conversion to pneumonectomy (2 patients), lung resection not performed (1 patient), study personnel (2 patients), or equipment not available (3 patients), and surgeon request (1 patient). Of the remaining 59 patients, 28 were randomly allocated to receive HFNO, and 31, to standard oxygen therapy.
	3.2 If N/PN/NI to 3.1: Is there evidence that result was not biased by missing outcome data?			NA	
	3.3 If N/PN to 3.2: Could missingness in the outcome depend on its true value?			NA	
	3.4 If Y/PY/NI to 3.3: Is it likely that missingness in the outcome depended on its true value?			NA	
	Risk of bias judgement			**Low**	
Bias in measurement of the outcome	4.1 Was the method of measuring the outcome inappropriate?			N	The study utilized a predetermined outcome.
	4.2 Could measurement or ascertainment of the outcome have differed between intervention groups?			N	Uniform standards are used to determine results.
	4.3 Were outcome assessors aware of the intervention received by study participants?			NI	There was no mention of this information in the article.
	4.4 If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?			NI	There was no mention of this information in the article.
	4.5 If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?			PN	
	Risk of bias judgement			**Some concerns**	
Bias in selection of the reported result	5.1 Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?			PY	The RCT was registered.
	5.2 ... multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?			PN	The study presented an exhaustive analysis of the anticipated outcomes.
	5.3 ... multiple eligible analyses of the data?			PN	The study presented an exhaustive analysis of the anticipated outcomes.
	Risk of bias judgement			**Low**	
Overall bias	**Risk of bias judgement**			**Some concerns**	

Abbreviations: HFNC, high flow nasal cannula; COT, conventional oxygen therapy; Y, yes; PY, probably yes; PN, probably no; N, no; Ni, no information; NA, not applicable.

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4.4 Table S12. The details of the article (Pennisi 2019) evaluated by Rob2 tool.

Unique ID	Pennisi 2019 (5)	**Study ID**	Pennisi 2019 (5)	**Assessor**	Xingxing Zhang and Yun Yu
Ref or Label	10.1186/s13054-019-2361-5	**Aim**	Assignment to intervention (the 'intention-to-treat' effect)		
Experimental	HFNC	**Comparator**	COT	**Source**	Journal article(s)
Outcome	Postoperative hypoxemia(primary outcome) and other patient centered outcomes				
Domain	**Signalling question**			**Response**	**Comments**
Bias arising from the randomization process	1.1 Was the allocation sequence random?			Y	A computer generated random allocation list was used to allocate enrolled patients to study arms.
	1.2 Was the allocation sequence concealed until participants were enrolled and assigned to interventions?			PY	
	1.3 Did baseline differences between intervention groups suggest a problem with the randomization process?			N	Demographics, most relevant clinical characteristics, main comorbidities, preoperative arterial blood gases and respiratory function, and surgical procedures are reported in Table 1 and were well balanced in the two study groups.
	Risk of bias judgement			**Low**	
Bias due to deviations from intended interventions	2.1.Were participants aware of their assigned intervention during the trial?			PY	This single center, open label, randomized controlled study was conducted in the post-anesthesia care unit, surgical intensive care unit, and thoracic surgical ward of a tertiary university hospital in Italy, between September 2015 and April 2018.
	2.2.Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?			PY	
	2.3. If Y/PY/NI to 2.1 or 2.2: Were there deviations from the intended intervention that arose because of the experimental context?			NI	There was no mention of this information in the article.
	2.4 If Y/PY to 2.3: Were these deviations likely to have affected the outcome?			NA	
	2.5. If Y/PY/NI to 2.4: Were these deviations from intended intervention balanced between groups?			NA	
	2.6 Was an appropriate analysis used to estimate the effect of assignment to intervention?			Y	The analysis was conducted on a “modified intention-to-treat” population that included all patients who underwent the allocated treatment for at least 6 h.
	2.7 If N/PN/NI to 2.6: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomized?			NA	
	Risk of bias judgement			**Some concerns**	
Bias due to missing outcome data	3.1 Were data for this outcome available for all, or nearly all, participants randomized?			PY	Between September 2015 and April 2018, of the 522 patients undergoing thoracic surgery for lung cancer, 99 patients were eligible for inclusion in the study and 96 underwent randomization.
	3.2 If N/PN/NI to 3.1: Is there evidence that result was not biased by missing outcome data?			NA	
	3.3 If N/PN to 3.2: Could missingness in the outcome depend on its true value?			NA	
	3.4 If Y/PY/NI to 3.3: Is it likely that missingness in the outcome depended on its true value?			NA	
	Risk of bias judgement			**Low**	
Bias in measurement of the outcome	4.1 Was the method of measuring the outcome inappropriate?			N	The study utilized a predetermined outcome.
	4.2 Could measurement or ascertainment of the outcome have differed between intervention groups?			N	Uniform standards are used to determine results.
	4.3 Were outcome assessors aware of the intervention received by study participants?			NI	There was no mention of this information in the article.
	4.4 If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?			NI	There was no mention of this information in the article.
	4.5 If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?			PN	
	Risk of bias judgement			**Some concerns**	
Bias in selection of the reported result	5.1 Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?			PY	The protocol was registered on clinical trials.gov(NCT02544477).
	5.2 ... multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?			N	The study presented an exhaustive analysis of the anticipated outcomes.
	5.3 ... multiple eligible analyses of the data?			N	The study presented an exhaustive analysis of the anticipated outcomes.
	Risk of bias judgement			**Low**	
Overall bias	**Risk of bias judgement**			**Some concerns**	

Abbreviations: HFNC, high flow nasal cannula; COT, conventional oxygen therapy; Y, yes; PY, probably yes; PN, probably no; N, no; Ni, no information; NA, not applicable.

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4.5 Table S13. The details of the article (Yu 2017) evaluated by Rob2 tool.

Unique ID	Yu 2017 (24)	**Study ID**	Yu 2017 (24)	**Assessor**	Xingxing Zhang and Yun Yu
Ref or Label	10.1155/2017/7894631	**Aim**	Assignment to intervention (the 'intention-to-treat' effect)		
Experimental	HFNC	**Comparator**	COT	**Source**	Journal article(s)
Outcome	The occurrence rate of hypoxemia (primary outcome) and other patient centered outcomes				
Domain	**Signalling question**			**Response**	**Comments**
Bias arising from the randomization process	1.1 Was the allocation sequence random?			Y	Patients were classified into two groups by random figure table following A Random number sequence was generated with STATA statistical software version 12.1.
	1.2 Was the allocation sequence concealed until participants were enrolled and assigned to interventions?			PY	
	1.3 Did baseline differences between intervention groups suggest a problem with the randomization process?			N	The baseline characteristics of the 110 eligible patients are shown in Table 1. There were no significant differences between patients in two groups in all aspects.
	Risk of bias judgement			**Low**	
Bias due to deviations from intended interventions	2.1.Were participants aware of their assigned intervention during the trial?			PY	The study was unblinded.
	2.2.Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?			PY	
	2.3. If Y/PY/NI to 2.1 or 2.2: Were there deviations from the intended intervention that arose because of the experimental context?			NI	There was no mention of this information in the article.
	2.4 If Y/PY to 2.3: Were these deviations likely to have affected the outcome?			NA	
	2.5. If Y/PY/NI to 2.4: Were these deviations from intended intervention balanced between groups?			NA	
	2.6 Was an appropriate analysis used to estimate the effect of assignment to intervention?			PY	All analyses were performed on an intention-to-treat basis and a two-sided P<0.05 was considered to be statistically significant.
	2.7 If N/PN/NI to 2.6: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomized?			NA	
	Risk of bias judgement			**Some concerns**	
Bias due to missing outcome data	3.1 Were data for this outcome available for all, or nearly all, participants randomized?			PY	Over the study period, a total of 141 patients were screened and 110 eligible patients were recruited for the study. A total of 56 patients were assigned to HFNCG and 58 patients to COG.
	3.2 If N/PN/NI to 3.1: Is there evidence that result was not biased by missing outcome data?			NA	
	3.3 If N/PN to 3.2: Could missingness in the outcome depend on its true value?			NA	
	3.4 If Y/PY/NI to 3.3: Is it likely that missingness in the outcome depended on its true value?			NA	
	Risk of bias judgement			**Low**	
Bias in measurement of the outcome	4.1 Was the method of measuring the outcome inappropriate?			N	The incidence of hypoxemia (defined as PaO_2/FiO_2 of 300 mmHg or less) was recorded in the first 72 h after extubation and the differences of PaO_2, PaO_2/FiO_2, SaO_2/FiO_2, and $PaCO_2$ between the two groups were compared. Secondly, the rates of PPC like suspected pneumonia.
	4.2 Could measurement or ascertainment of the outcome have differed between intervention groups?			N	Uniform standards are used to determine results.
	4.3 Were outcome assessors aware of the intervention received by study participants?			NI	
	4.4 If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?			NI	
	4.5 If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?			PN	
	Risk of bias judgement			**Some concerns**	
Bias in selection of the reported result	5.1 Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?			NI	There was no mention of this information in the article.
	5.2 ... multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?			N	The study presented an exhaustive analysis of the anticipated outcomes.
	5.3 ... multiple eligible analyses of the data?			N	The study presented an exhaustive analysis of the anticipated outcomes.
	Risk of bias judgement			**Some concerns**	
Overall bias	**Risk of bias judgement**			**Some concerns**	

Abbreviations: HFNC, high flow nasal cannula; COT, conventional oxygen therapy; Y, yes; PY, probably yes; PN, probably no; N, no; Ni, no information; NA, not applicable.

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4.6 Table S14. The details of the article (El-Nori 2023) evaluated by Rob2 tool.

Unique ID	El-Nori 2023 (26)	**Study ID**	El-Nori 2023 (26)	**Assessor**	Xingxing Zhang and Yun Yu
Ref or Label	DOI: 10.4103/ejs.ejs_225_22	**Aim**	Assignment to intervention (the 'intention-to-treat' effect)		
Experimental	HFNC	**Comparator**	COT	**Source**	Journal article(s)
Outcome	Postoperative hypoxemia (primary outcome) and other patient centered outcomes				
Domain	**Signalling question**			**Response**	**Comments**
Bias arising from the randomization process	1.1 Was the allocation sequence random?			PY	A simple multicentric randomized controlled trial was performed. The two groups were equally allocated on a 1:1 ratio into the control and treatment arms. There were two groups: those that received the conventional oxygen and those that received the high-flow oxygen therapy. Convenience sampling was used. All our participants who met all of the inclusion criteria and exclusion criteria were enrolled.
	1.2 Was the allocation sequence concealed until participants were enrolled and assigned to interventions?			PY	
	1.3 Did baseline differences between intervention groups suggest a problem with the randomization process?			PN	Patients were randomly allocated to the two groups.
	Risk of bias judgement			**Low**	
Bias due to deviations from intended interventions	2.1.Were participants aware of their assigned intervention during the trial?			PY	The study was unblinded.
	2.2.Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?			PY	
	2.3. If Y/PY/NI to 2.1 or 2.2: Were there deviations from the intended intervention that arose because of the experimental context?			NI	There was no mention of this information in the article.
	2.4 If Y/PY to 2.3: Were these deviations likely to have affected the outcome?			NA	
	2.5. If Y/PY/NI to 2.4: Were these deviations from intended intervention balanced between groups?			NA	
	2.6 Was an appropriate analysis used to estimate the effect of assignment to intervention?			Y	The collected data were revised, coded, tabulated, and introduced to a PC using Statistical Package for the Social Sciences. Data were presented, and suitable analysis was done according to the type of data obtained for each parameter. Level of significance was set at P value <0.05.
	2.7 If N/PN/NI to 2.6: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomized?			NA	
	Risk of bias judgement			**Some concerns**	
Bias due to missing outcome data	3.1 Were data for this outcome available for all, or nearly all, participants randomized?			Y	This study was conducted on 180 patients who underwent lung resection (wedge resection, segmentectomy, lobectomy, or pneumonectomy) surgery between November 2019 and April 2022 at the Cardiothoracic department, Ain Shams University Hospitals.
	3.2 If N/PN/NI to 3.1: Is there evidence that result was not biased by missing outcome data?			NA	
	3.3 If N/PN to 3.2: Could missingness in the outcome depend on its true value?			NA	
	3.4 If Y/PY/NI to 3.3: Is it likely that missingness in the outcome depended on its true value?			NA	
	Risk of bias judgement			**Low**	
Bias in measurement of the outcome	4.1 Was the method of measuring the outcome inappropriate?			PN	The end points of the study were to investigate whether HFNC therapy is superior to conventional oxygen therapy for reducing hypoxemia and postoperative pulmonary complications in extubated patients after lung resection.
	4.2 Could measurement or ascertainment of the outcome have differed between intervention groups?			N	Uniform standards are used to determine results.
	4.3 Were outcome assessors aware of the intervention received by study participants?			NI	There was no mention of this information in the article.
	4.4 If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?			NI	There was no mention of this information in the article.
	4.5 If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?			PN	
	Risk of bias judgement			**Some concerns**	
Bias in selection of the reported result	5.1 Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?			NI	There was no mention of this information in the article.
	5.2 ... multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?			NI	There was no mention of this information in the article.
	5.3 ... multiple eligible analyses of the data?			N	The study presented an exhaustive analysis of the anticipated outcomes.
	Risk of bias judgement			**Some concerns**	
Overall bias	**Risk of bias judgement**			**Some concerns**	

Abbreviations: HFNC, high flow nasal cannula; COT, conventional oxygen therapy; Y, yes; PY, probably yes; PN, probably no; N, no; Ni, no information; NA, not applicable.

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4.7 Table S15. The details of the article (Zhu 2022) evaluated by Rob2 tool.

Unique ID	Zhu 2022 (25)	**Study ID**	Zhu 2022 (25)	**Assessor**	Xingxing Zhang and Yun Yu
Ref or Label	DOI: 10.3779/j.issn.1009-3419.2022.102.38	**Aim**	Assignment to intervention (the 'intention-to-treat' effect)		
Experimental	HFNC	**Comparator**	COT	**Source**	Journal article(s)
Outcome	Oxygen index(primary outcome) and other patient centered outcomes				
Domain	**Signalling question**			**Response**	**Comments**
Bias arising from the randomization process	1.1 Was the allocation sequence random?			Y	Table of random numbers and random assignment
	1.2 Was the allocation sequence concealed until participants were enrolled and assigned to interventions?			PY	
	1.3 Did baseline differences between intervention groups suggest a problem with the randomization process?			N	The article's results demonstrate an initial balance between the groups.
	Risk of bias judgement			**Low**	
Bias due to deviations from intended interventions	2.1.Were participants aware of their assigned intervention during the trial?			PY	The RCT was unblinded.
	2.2.Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?			PY	
	2.3. If Y/PY/NI to 2.1 or 2.2: Were there deviations from the intended intervention that arose because of the experimental context?			NI	There was no mention of this information in the article.
	2.4 If Y/PY to 2.3: Were these deviations likely to have affected the outcome?			NA	
	2.5. If Y/PY/NI to 2.4: Were these deviations from intended intervention balanced between groups?			NA	
	2.6 Was an appropriate analysis used to estimate the effect of assignment to intervention?			Y	The statistical analysis section describes the method used to analyze the data.
	2.7 If N/PN/NI to 2.6: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomized?			NA	
	Risk of bias judgement			**Some concerns**	
Bias due to missing outcome data	3.1 Were data for this outcome available for all, or nearly all, participants randomized?			Y	There are no patients who drop out.
	3.2 If N/PN/NI to 3.1: Is there evidence that result was not biased by missing outcome data?			NA	
	3.3 If N/PN to 3.2: Could missingness in the outcome depend on its true value?			NA	
	3.4 If Y/PY/NI to 3.3: Is it likely that missingness in the outcome depended on its true value?			NA	
	Risk of bias judgement			**Low**	
Bias in measurement of the outcome	4.1 Was the method of measuring the outcome inappropriate?			N	The study utilized a predetermined outcome.
	4.2 Could measurement or ascertainment of the outcome have differed between intervention groups?			N	Uniform standards are used to determine results.
	4.3 Were outcome assessors aware of the intervention received by study participants?			NI	There was no mention of this information in the article.
	4.4 If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?			NI	There was no mention of this information in the article.
	4.5 If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?			PN	
	Risk of bias judgement			**Some concerns**	
Bias in selection of the reported result	5.1 Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?			NI	There was no mention of this information in the article.
	5.2 ... multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?			N	The study presented an exhaustive analysis of the anticipated outcomes.
	5.3 ... multiple eligible analyses of the data?			N	The study presented an exhaustive analysis of the anticipated outcomes.
	Risk of bias judgement			**Some concerns**	
Overall bias	**Risk of bias judgement**			**Some concerns**	

Abbreviations: HFNC, high flow nasal cannula; COT, conventional oxygen therapy; Y, yes; PY, probably yes; PN, probably no; N, no; Ni, no information; NA, not applicable.

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4.8 Differential analysis of modified Jadad and Rob2 assessment results.

We utilized the widely employed RCT assessment tools (modified Jadad and Rob2) to assess RCT articles.

The modified Jadad assessment comprises four key domains: randomization (0-2 points), allocation concealment (0-2 points), blinding (0-2 points), and handling of withdrawals and dropouts (0-1 point). It is designed to be straightforward and easy to use. The article's assessment is determined by ratings across multiple domains, with quality categorized into two levels: a score of 1-3 denotes low quality, while a score of 4-7 signifies high quality.

With its wealth of content and comprehensive coverage, Rob2 in the Cochrane Library provides an extensive array of bias risk information, enhancing the integration and evaluation of evidence in RCTs. The Rob2 evaluation, which is more rigorous, covers five domains and three risk levels (low, moderate, high). An overall low-risk assessment is only given if all three levels within the five domains are classified as low risk. When there is a degree of risk present in a particular domain, the collective outcome is classified as high risk. The remaining cases all pertain to some concerns.

The variation in assessment outcomes is attributed to the third-level standard of Rob2 and the second-level standard of Jadad. Compared to the modified Jadad tool, the Rob2 tool enforces stricter criteria and presents greater complexity. It is advisable for readers to consult and opt to employ it.

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5 Forest plot

5.1 Figure S6: Forest Plot of postoperative hypoxemia after sensitivity analysis

Figure S6 Forest Plot of postoperative hypoxemia after sensitivity analysis.
The result of a sensitivity analysis conducted after age (≥ 65 years old) was removed as a high-risk factor.
Abbreviations: HFNC, high-flow nasal cannula; COT, conventional oxygen therapy; CI, confidence interval.

5.2 Figure S7: Forest Plot of Reintubation Rate

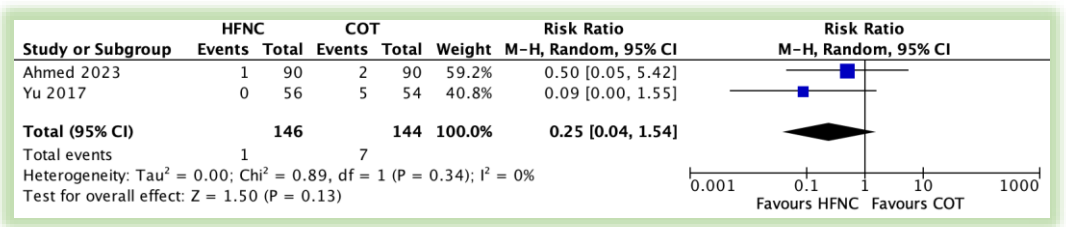

Figure S7 Forest Plot of Reintubation Rate.
Abbreviations: HFNC, high-flow nasal cannula; COT, conventional oxygen therapy; CI, confidence interval.

5.3 Figure S8: Forest Plot of Escalation in Oxygen Therapy

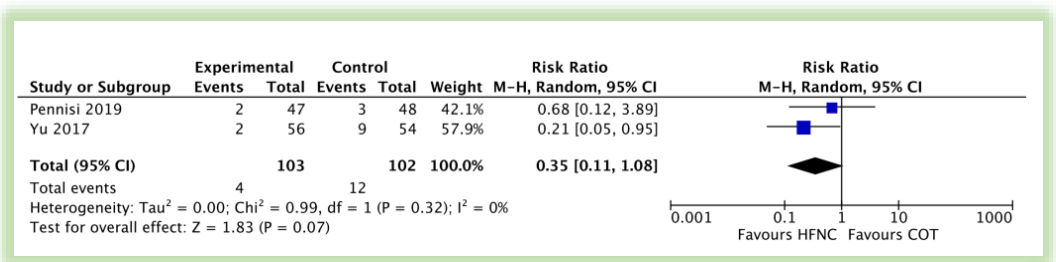

Figure S8 Forest Plot of Escalation in Oxygen Therapy.
Abbreviations: HFNC, high-flow nasal cannula; COT, conventional oxygen therapy; CI, confidence interval.

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5.4 Figure S9: Forest Plot of differences in $PaCO_2$ after extubation

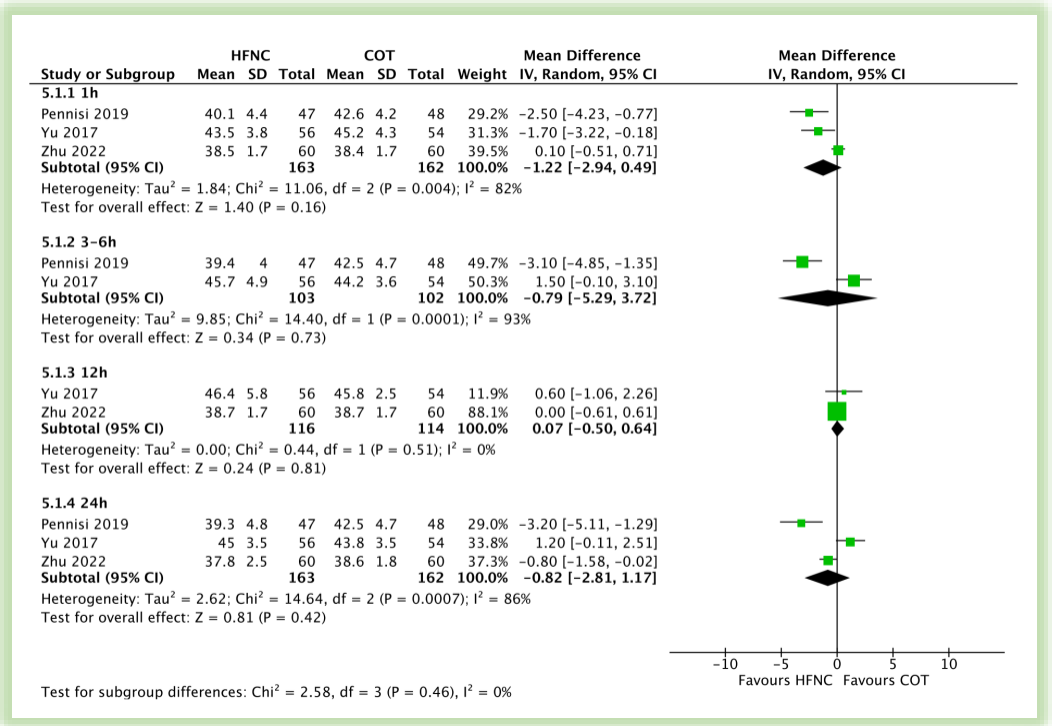

Figure S9 Forest Plot of differences in PaCO2 after extubation.
Abbreviations: HFNC, high-flow nasal cannula; COT, conventional oxygen therapy; CI, confidence interval.

5.5 Figure S10: Forest Plot of length of hospital stay

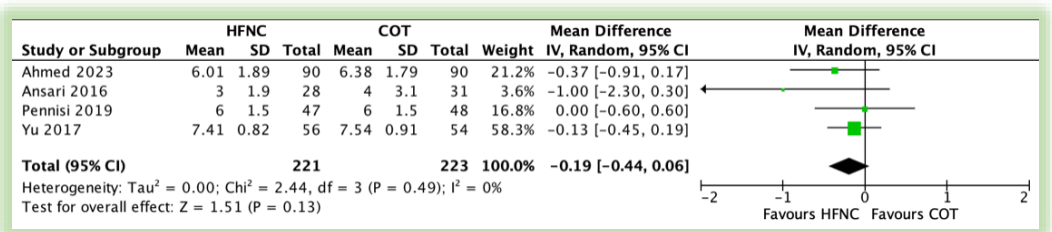

Figure S10 Forest Plot of Length of Hospital Stay
Abbreviations: HFNC, high-flow nasal cannula; COT, conventional oxygen therapy; CI, confidence interval.

https://dx.doi.org/10.21037/jtd-23-1758

5.6 Figure S11: Forest Plot of length of ICU stay

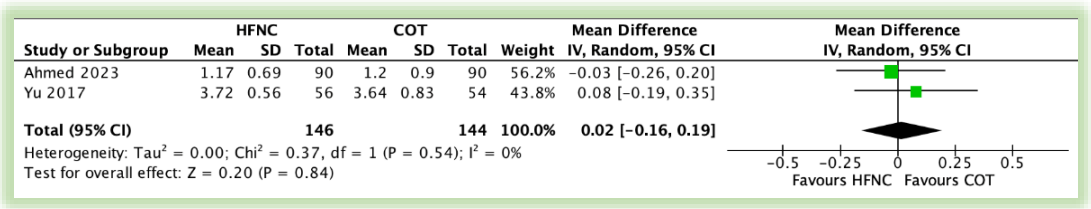

Figure S11 Forest Plot of Length of ICU Stay
Abbreviations: HFNC, high-flow nasal cannula; COT, conventional oxygen therapy; CI, confidence interval.

6 Trial sequential analysis

6.1 Figure S12: Trial sequential analysis plot

Trial sequential analysis for comparing the incidence of postoperative hypoxemia between two groups. The required information size for a conclusive result was 1372. We set RRR:((50/193)-(63/192))/(63/192)=-21%.

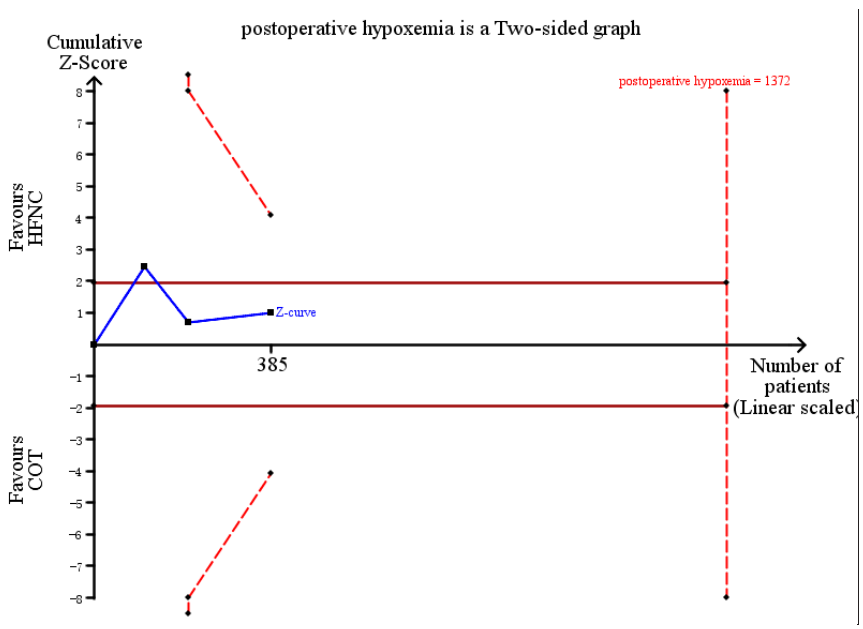

Figure S12 Trial sequential analysis for the comparison of the incidence of postoperative hypoxemia.
Abbreviations: HFNC, high-flow nasal cannula; COT, conventional oxygen therapy.

https://dx.doi.org/10.21037/jtd-23-1758

6.2 Figure S13: Parameters of Trial Sequential Analysis

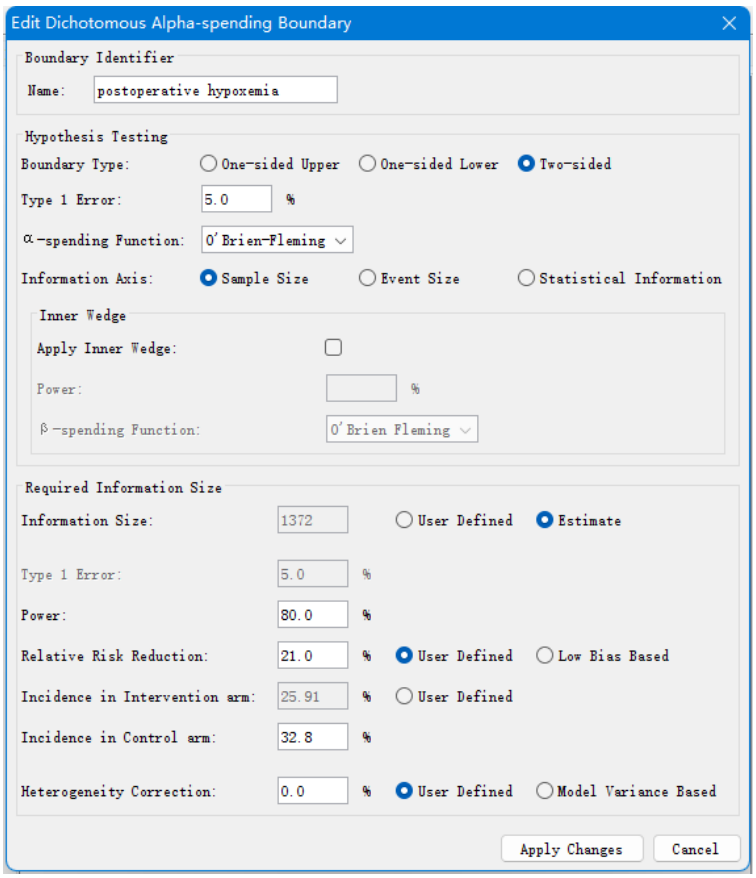

Figure S13 Parameters of Trial Sequential Analysis

Parameters of TSA for comparison in the incidence of postoperative hypoxemia.

https://dx.doi.org/10.21037/jtd-23-1758