

SUPPLEMENTAL DATA

Zhu and Li: Sugammadex vs neostigmine recovery

Sugammadex vs neostigmine in post- anesthesia recovery: A systematic review and meta- analysis

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Supplementary material 1

Search strategy

1.
Search: (((("sugammadex" [Title/Abstract]) OR ("sugammadex sodium" [Title/Abstract])) AND ("neostigmine" [Title/Abstract])) AND (((("train-of-four ratio" [Title/Abstract]) OR ("TOF" [Title/Abstract])) OR ("airway extubation" [Title/Abstract])) OR ("extubation" [Title/Abstract])) OR ("time to extubation" [Title/Abstract])) Filters: Randomized Controlled Trial

History and Search Details Download Delete

Search	Actions	Details	Query	Results	Time
#6	...	>	Search: (((("sugammadex" [Title/Abstract]) OR ("sugammadex sodium" [Title/Abstract])) AND ("neostigmine" [Title/Abstract])) AND (((("train-of-four ratio" [Title/Abstract]) OR ("TOF" [Title/Abstract])) OR ("airway extubation" [Title/Abstract])) OR ("extubation" [Title/Abstract])) OR ("time to extubation" [Title/Abstract])) Filters: Randomized Controlled Trial	56	03:22:00
#5	...	>	Search: (((("sugammadex" [Title/Abstract]) OR ("sugammadex sodium" [Title/Abstract])) AND ("neostigmine" [Title/Abstract])) AND (((("train-of-four ratio" [Title/Abstract]) OR ("TOF" [Title/Abstract])) OR ("airway extubation" [Title/Abstract])) OR ("extubation" [Title/Abstract])) OR ("time to extubation" [Title/Abstract]))	164	03:21:45
#4	...	>	Search: (((("train-of-four ratio" [Title/Abstract]) OR ("TOF" [Title/Abstract])) OR ("airway extubation" [Title/Abstract])) OR ("extubation" [Title/Abstract])) OR ("time to extubation" [Title/Abstract])	63,037	03:21:26
#3	...	>	Search: (((("sugammadex" [Title/Abstract]) OR ("sugammadex sodium" [Title/Abstract])) AND ("neostigmine" [Title/Abstract]))	437	03:19:35
#2	...	>	Search: "neostigmine" [Title/Abstract]	4,646	03:19:12
#1	...	>	Search: ("sugammadex" [Title/Abstract]) OR ("sugammadex sodium" [Title/Abstract])	1,595	03:17:55

Showing 1 to 6 of 6 entries

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P	I	C	O	S
general anesthesia	sugammadex	neostigmine	train-of-four ratio	RCT
	Sugammadex sodium		TOF	
			airway extubation	
			extubation	
			time to extubation	

2.
Search:(((("sugammadex" [Title Abstract]) OR ("sugammadex sodium" [Title/Abstract])) AND ("neostigmine" [Title/Abstract])) AND (((((((("postoperative pulmonary complications" [Title/Abstract]) OR ("PPC" [Title/Abstract])) OR ("pulmonary atelectasis" [Title/Abstract])) OR ("pulmonary atelectases"

[Title/Abstract])) OR ("pneumonia" [Title/Abstract])) OR ("pulmonary Inflammations" [Title/Abstract])) OR ("lung Inflammations"[Title/Abstract])) Filters: Randomized Controlled Trial

History and Search Details					Download Delete	
Search	Actions	Details	Query	Results	Time	
#6	...	>	Search: (((("sugammadex"[Title/Abstract]) OR ("sugammadex sodium"[Title/Abstract])) AND ("neostigmine"[Title/Abstract])) AND ((((((("postoperative pulmonary complications" [Title/Abstract]) OR ("PPC"[Title/Abstract]) OR ("pulmonary atelectasis"[Title/Abstract]) OR ("pulmonary atelectases" [Title/Abstract]) OR ("pneumonia"[Title/Abstract])) OR ("pulmonary Inflammations"[Title/Abstract])) OR ("lung Inflammations"[Title/Abstract])) Filters: Randomized Controlled Trial	5	03:52:32	
#5	...	>	Search: (((("sugammadex"[Title/Abstract]) OR ("sugammadex sodium"[Title/Abstract])) AND ("neostigmine"[Title/Abstract])) AND ((((((("postoperative pulmonary complications" [Title/Abstract]) OR ("PPC"[Title/Abstract]) OR ("pulmonary atelectasis"[Title/Abstract]) OR ("pulmonary atelectases" [Title/Abstract]) OR ("pneumonia"[Title/Abstract])) OR ("pulmonary Inflammations"[Title/Abstract])) OR ("lung Inflammations"[Title/Abstract]))	49	03:52:07	
#4	...	>	Search: ((((((("postoperative pulmonary complications" [Title/Abstract]) OR ("PPC"[Title/Abstract]) OR ("pulmonary atelectasis"[Title/Abstract]) OR ("pulmonary atelectases" [Title/Abstract]) OR ("pneumonia"[Title/Abstract])) OR ("pulmonary Inflammations"[Title/Abstract])) OR ("lung Inflammations"[Title/Abstract]))	169,526	03:51:48	
#3	...	>	Search: (((("sugammadex"[Title/Abstract]) OR ("sugammadex sodium"[Title/Abstract])) AND ("neostigmine"[Title/Abstract]))	437	03:43:42	
#2	...	>	Search: "neostigmine"[Title/Abstract]	4,646	03:43:26	
#1	...	>	Search: ("sugammadex"[Title/Abstract]) OR ("sugammadex sodium"[Title/Abstract])	1,595	03:42:46	
Showing 1 to 6 of 6 entries						

P	I	C	O	S
general anesthesia	sugammadex	neostigmine	postoperative pulmonary complications	RCT
	Sugammadex sodium		PPC	
			pulmonary atelectasis	
			pulmonary atelectases	
			pneumonia	
			pulmonary Inflammations	
			Lung Inflammations	

3.
Search: (((("sugammadex"[Title/Abstract]) OR ("sugammadex sodium" [Title/Abstract])) AND ("neostigmine" [Title/Abstract])) AND ((("postoperative nausea and vomiting" [Title/Abstract]) OR ("PONV" [Title/Abstract])) Filters: Randomized Controlled Trial

History and Search Details					Download	Delete
Search	Actions	Details	Query	Results	Time	
#6	...	>	Search: (((("sugammadex"[Title/Abstract]) OR ("sugammadex sodium"[Title/Abstract])) AND ("neostigmine"[Title/Abstract])) AND (("postoperative nausea and vomiting"[Title/Abstract]) OR ("PONV"[Title/Abstract])) Filters: Randomized Controlled Trial	8	04:09:19	
#5	...	>	Search: (((("sugammadex"[Title/Abstract]) OR ("sugammadex sodium"[Title/Abstract])) AND ("neostigmine"[Title/Abstract])) AND (("postoperative nausea and vomiting"[Title/Abstract]) OR ("PONV"[Title/Abstract]))	30	04:08:37	
#4	...	>	Search: ("postoperative nausea and vomiting"[Title/Abstract]) OR ("PONV"[Title/Abstract])	5,648	04:08:23	
#3	...	>	Search: (((("sugammadex"[Title/Abstract]) OR ("sugammadex sodium"[Title/Abstract])) AND ("neostigmine"[Title/Abstract]))	437	04:07:20	
#2	...	>	Search: "neostigmine"[Title/Abstract]	4,646	04:07:08	
#1	...	>	Search: ("sugammadex"[Title/Abstract]) OR ("sugammadex sodium"[Title/Abstract])	1,595	04:06:38	

Showing 1 to 6 of 6 entries

P	I	C	O	S
general anesthesia	sugammadex	neostigmine	postoperative nausea and vomiting	RCT
	Sugammadex sodium		PONV	

4.
 Search: (((("sugammadex" [Title/Abstract]) OR ("sugammadex sodium" [Title Abstract])) AND ("neostigmine" [Title/Abstract])) AND (("bradycardia" [Title/Abstract]) OR ("bradycardias" [Title Abstract])) Filters: Randomized Controlled Trial

History and Search Details					Download	Delete
Search	Actions	Details	Query	Results	Time	
#6	...	>	Search: (((("sugammadex"[Title/Abstract]) OR ("sugammadex sodium"[Title/Abstract])) AND ("neostigmine"[Title/Abstract])) AND (("bradycardia"[Title/Abstract]) OR ("bradycardias"[Title/Abstract])) Filters: Randomized Controlled Trial	3	04:35:30	
#5	...	>	Search: (((("sugammadex"[Title/Abstract]) OR ("sugammadex sodium"[Title/Abstract])) AND ("neostigmine"[Title/Abstract])) AND (("bradycardia"[Title/Abstract]) OR ("bradycardias"[Title/Abstract]))	25	04:35:16	
#4	...	>	Search: ("bradycardia"[Title/Abstract]) OR ("bradycardias"[Title/Abstract])	25,388	04:35:00	
#3	...	>	Search: (((("sugammadex"[Title/Abstract]) OR ("sugammadex sodium"[Title/Abstract])) AND ("neostigmine"[Title/Abstract]))	437	04:34:10	
#2	...	>	Search: "neostigmine"[Title/Abstract]	4,646	04:33:55	
#1	...	>	Search: ("sugammadex"[Title/Abstract]) OR ("sugammadex sodium"[Title/Abstract])	1,595	04:33:27	

Showing 1 to 6 of 6 entries

P	I	C	O	S
general anesthesia	sugammadex	neostigmine	bradycardia	RCT
	Sugammadex sodium		bradycardias	

5.

Search: (((("sugammadex" [Title/Abstract]) OR ("sugammadex sodium" [Title/Abstract])) OR ("neostigmine" [Title/Abstract])) AND (((("postoperative cognitive complications" [Title/Abstract]) OR ("postoperative cognitive dysfunction" [Title/Abstract])) OR ("POCD" [Title/Abstract])) OR ("delirium" [Title/Abstract])) OR ("postoperative delirium" [Title/Abstract]))

History and Search Details					Download Delete	
Search	Actions	Details	Query	Results	Time	
#4	...	>	Search: (((("sugammadex"[Title/Abstract]) OR ("sugammadex sodium"[Title/Abstract]) OR ("neostigmine"[Title/Abstract])) AND (((("postoperative cognitive complications" [Title/Abstract]) OR ("postoperative cognitive dysfunction" [Title/Abstract])) OR ("POCD"[Title/Abstract])) OR ("delirium" [Title/Abstract])) OR ("postoperative delirium"[Title/Abstract])) Filters: Randomized Controlled Trial	6	04:51:03	
#3	...	>	Search: (((("sugammadex"[Title/Abstract]) OR ("sugammadex sodium"[Title/Abstract]) OR ("neostigmine"[Title/Abstract])) AND (((("postoperative cognitive complications" [Title/Abstract]) OR ("postoperative cognitive dysfunction" [Title/Abstract])) OR ("POCD"[Title/Abstract])) OR ("delirium" [Title/Abstract])) OR ("postoperative delirium"[Title/Abstract]))	20	04:50:48	
#2	...	>	Search: (((("postoperative cognitive complications" [Title/Abstract]) OR ("postoperative cognitive dysfunction" [Title/Abstract])) OR ("POCD"[Title/Abstract])) OR ("delirium" [Title/Abstract])) OR ("postoperative delirium"[Title/Abstract]))	24,451	04:50:36	
#1	...	>	Search: ((("sugammadex"[Title/Abstract]) OR ("sugammadex sodium"[Title/Abstract])) OR ("neostigmine"[Title/Abstract]))	5,804	04:48:19	

Showing 1 to 4 of 4 entries

P	I	C	O	S
general anesthesia	sugammadex	neostigmine	postoperative cognitive complications	RCT
	Sugammadex sodium		postoperative cognitive dysfunction	Retrospective Cohort Study
			POCD	
			delirium	
			postoperative delirium	

Supplementary material 2

Table 1. Sugammadex vs neostigmine: Trial characteristics and outcomes

Study	Age	ASA class (n1/n2, %)	Number	Surgery/ Population	Intervention group (n1)	Control group (n2)	Research types	Outcomes
Herring, W.J.2021	70(24-92) 68(35-89)	3: 74.5/74.5 4: 25.5/25.5	n1=212 n2=51	elective surgery	S1:2mg/kg S2:4mg/kg S3:16mg/kg	N:50ug/kg(m ax 5mg)+0.01m g/kg Gly(max 1mg)	RCT	⑩
Castro, D.S.2014	39.7±9.5 35.9±9.3	/	n1=44 n2=44	laparoscop ic bariatric surgery	S:2mg/kg	N:50ug/kg+0 .02mg/kg atropine	RCT	③⑧
Ding, X. 2023	31.5±9.3 30.6±8.6	2: 15.8/15.8 3: 84.2/84.2	n1=38 n2=38	laparoscop ic bariatric surgery	S:200mg	N:2mg+1mg atropine	RCT	⑧
Paech, M. J. 2018	33.7±9.4 33.3±9.3	>1: 39.6/34.2	n1=151 n2=153	laparoscop ic gynecolog ical surgery	S:2mg/kg (max 200mg)	N:40ug/kg(m ax 5mg)+0.4mg Gly	RCT	②⑥⑧
Tas Tuna, A. 2017	45.98±14.2 49.95±12.7	1: 20.0/25.0 2: 80.0/75.0	n1=40 n2=40	laparoscop ic cholecyste ctomy	S:2 mg/kg	N:40ug/kg(m ax2mg)+0.01 5mg/kg atropine	RCT	⑧
Yağın, Ö. 2017	40.3±13.3 40.8±11.2	1:72.0/77.1 2: 28.0/22.9	n1=50 n2=48	elective surgery	S:2mg/kg	N:50ug/kg+0 .02mg/kg atropine	RCT	⑧⑩
Alday, E. 2019	65.9±12 69.9±13	1: 6.0/0.0 2: 56.0/59.0 3: 34.0/39.0 4: 3.0/2.0	n1=62 n2=64	major abdominal surgery	S:4mg/kg	N:40ug/kg+0 .01mg/kg atropine	RCT	⑤⑦⑨
Ledowski, T. 2021	75-91 75-88	3-4	n1=85 n2=83	high-risk older patients	S:2mg/kg	N:50ug/kg(m ax5mg)+0.01 5/kg atropine	RCT	②⑤⑧⑨
Togioka,B. M. 2020	74.8±4.3 75.1±4.0	1: 0.0/2.0 2: 41.0/29.3 3: 52.0/67.7 4: 7.0/1.0	n1=100 n2=100	patients aged ≥70 yr having surgery ≥3 h	S: 2mg/kg	N:70ug/kg(m ax5 mg)+Gly(0.1 -0.2mg per 1mg neostigmine	RCT	⑤⑦⑧⑨ H

						administratio n)		
Yu,Y. 2022	56.7±10.3 57.2±9.8	2: 90.0/86.0 3: 10.0/14.0	n1=50 n2=50	lung cancer resection	S: 2mg/kg	N: 50ug/kg(max 5mg)+0.02m g/kg atropine	RCT	①②③⑤ ⑨ ^h
Batistaki, C. 2017	61.64±1.37 61.25±1.09	1: 16.6/22.0 2: 74.4/69.5 3: 9.0/8.5	n1=78 n2=82	elective surgery	S:2mg/kg	N:40ug/kg+0 .016mg/kg atropine	RCT	12
Deng, C. 2024	71(67-75) 71(67-76)	2: 33.9/50.0 3: 66.1/50.0	n1=59 n2=59	noncardia c surgery in older patients(≥ 65 yr)	N:40ug/kg	C:placebo (normal saline)	RCT	13
Liu, F. 2022	64.19±10.5 1 63.34±10.3 8	1: 5.6/5.4 2: 79.6/76.1 3: 14.8/18.5	n1=196 n2=205	colon carcinoma surgery	N:40ug/kg+ 0.02mg/kg atropine	C:placebo (normal saline)	RCT	13
Oh, C. S. 2016	76±7 75±9	/	n1=78 n2=96	hip fracture surgery	S:2mg/kg	N:50ug/kg+0 .01mg/kg Gly	RS	12
Pişkin, Ö. 2016	32.07±11.5 0 37.38±11.9 5	1: 40.5/40.0 2:59.5/60.0	n1=42 n2=45	elective surgery	S:2mg/kg	N:30ug/kg+0 .01mg/kg atropine	RCT	①
Rössler, J. 2024	unknown	/	n1=6881 n2=42587	noncardia c surgery	S:usual care practice (unknown)	N:usual care practice (unknown)	RS	12
Zhu,B. 2020	72.9±6.1 72.9±4.9	1-2: 57.7/50.0 3: 42.3/50.0	n1=78 n2=42	radical section of gastrointes tinal cancer	N:20ug/kg or 40ug/kg	C:placebo (normal saline)	RCT	13
Abola, R. E. 2020	54.4±13.5 53.1±13.0	2: 32.0/48.0 3: 67.0/52.0	n1=31 n2=31	gynecolog ical, or urologic surgery	S:2mg/kg or 4mg/kg	N:70ug/kg(m ax5mg)+0.01 mg/kg Gly	RCT	②⑥
Ajetunmobi ,O.2024	49.5(43.8-5 4.0) 51.0(42.8-5 5.3)	2: 1.7/5.0 3: 93.3/91.7 4: 5.0/3.3	n1=60 n2=60	elective bariatric surgery	S:2mg/kg	N: 2.5mg+0.4m g Gly	RCT	②③④⑤ ⑧
Han, J. 2021	54.1±10.7 51.3±11.5	1: 38.5/47.4 2: 48.7/47.4	n1=39 n2=38	laparoscop ic	S:2mg/kg or 4mg/kg	N:20ug/kg or 40ug/kg+0.4	RCT	③⑤⑥

		3: 12.8/5.3		cholecystectomy		mg Gly		
Mohamad Zaini, R. H. 2016	2-12years old	/	n1=40 n2=40	paediatric population	S:2mg/kg	N:50ug/kg+0.02mg/kg atropine	RCT	①②⑧
Brueckman n, B. 2015	56.4±12.8 57.0±12.7	1: 1.0/0.0 2: 80.0/82.0 3: 19.0/18.0	n1=74 n2=77	Adult patients undergoing abdominal surgery	S:2mg/kg or 4mg/kg	N:usual care practice	RCT	⑦⑧⑨⑩ 12
Carron, M. 2013	40.4±12.0 46.0±9.0	1-3	n1=20 n2=20	Morbidly obese(MO) patients	S: 4mg/kg	N:70ug/kg(max 5mg)+0.01 mg/kg atropine(max 1 mg)	RCT	①②③
Farag, E. 2021	54±15 59±12	2: 9.0/3.0 3: 91.0/97.0	n1=35 n2=33	cerebral neurointerventional procedures	S: 4mg/kg	N:70ug/kg(max 5 mg)	RCT	①②
Gaszynski, T. 2012	38.1±10.3 38.9±9.6	/	n1=35 n2=35	morbidly obese patients	S: 2mg/kg	N:50ug/kg+0.02mg/kg atropine	RCT	①
Hakimoğlu, S. 2016	33.87±13.85 33.60±12.92	1: 40.0/53.3 2: 60.0/46.7	n1=30 n2=30	arthroscopic surgery	S: 4mg/kg	N:50ug/kg+0.015mg/kg atropine	RCT	②
Illman, H. L. 2011	43.1±15.1 38.9±16.4	1: 62.5/65.2 2: 29.2/34.8 3: 8.3/0.0	n1=24 n2=23	elective surgery	S: 2mg/kg	N:50ug/kg+0.01mg/kg Gly	RCT	①
Korkmaz, M. O. 2019	6.63±2.14 6.58±2.44	/	n1=35 n2=35	adenotonsillectomy surgery	S: 2mg/kg	N:20ug/kg+0.01mg/kg atropine	RCT	②⑧
Koyuncu, O. 2015	25(18-77) 29(18-73)	1: 18.0/22.0 2: 42.0/42.0 3: 38.0/36.0 4: 2.0/0.0	n1=50 n2=50	extremity surgery	S:2mg/kg	N:70ug/kg+0.028mg/kg atropine	RCT	②⑩
Li, L. 2021	3.2±0.8 3.1±1.1	2-3	n1=30 n2=30	cardiac surgery in children	S:4mg/kg	N:30ug/kg+0.015mg/kg atropine	RCT	①②⑤⑧ ⑨
Lu, L. 2024	46.3±13.8 46±11.0	1-3	n1=31 n2=32	Patients with interstitial	S:2mg/kg	N:40ug/kg+0.02mg/kg atropine	RCT	⑦⑧

					lung diseases; transbronchial cryobiopsy				
Mraovic, B. 2021		70.4±4.7 71.2±4.8	2: 42.0/24.0 3: 58.0/48.0	n1=19 n2=21	posterior lumbar spine surgery in geriatric patients	S:2mg/kg	N:50ug/kg(max5mg)+0.01mg/kg Gly (max1mg)	RCT	①②④⑤
Niu, 2020	L.	47±10 46±11	1: 82.4/64.7 2: 17.6/35.3	n1=34 n2=34	nasopharyngeal surgery in overweight patients	S:2mg/kg	N:40ug/kg+0.015mg/kg atropine	RCT	①⑦
Putz, 2016	L.	49.9±9.8 51.7±10.9	1-2	n1=50 n2=50	Laparoscopic hysterectomy	S:2-4mg/kg	N: 50ug/kg+Gly	RCT	③④⑤⑧
Sacan, 2007	O.	60±10 60±14	1-3	n1=20 n2=20	elective surgery	S:4mg/kg	N:70ug/kg+0.014mg/kg Gly	RCT	①②⑧
Voss, 2022	T.	7.8±4.4 8.5±4.3	1-3	n1=242 n2=34	in pediatric participants	S:2mg/kg or 4mg/kg	N:50ug/kg	RCT	⑩
Wu, 2014	X.	42.3±11.7 42.1±11.4	1: 68.5/69.0 2: 28.9/31.0 3: 2.6/0.0	n1=149 n2=142	Chinese and Caucasian subjects	S:2mg/kg	N:50ug/kg+0.01-0.02mg/kg atropine	RCT	⑧

Figure S1: Evaluation of recovery quality, focusing on hospital stay duration and overall recovery scores between sugammadex and neostigmine groups.

Figure S2a: Forest plot of subgroup analysis by age comparing time to TOF $\geq 90\%$ between Sugammadex and neostigmine.

Figure S2b: Forest plot of subgroup analysis by ASA physical status comparing time to TOF $\geq 90\%$ between Sugammadex and neostigmine.

Figure S2c: Forest plot of subgroup analysis by body mass index (BMI) comparing time to TOF $\geq 90\%$ between Sugammadex and neostigmine.

Figure S3a: Forest plot of subgroup analysis by age comparing time to extubation between Sugammadex and neostigmine.

Figure S3b: Forest plot of subgroup analysis by ASA physical status comparing time to extubation between Sugammadex and neostigmine.

Figure S3c: Forest plot of subgroup analysis by body mass index (BMI) comparing time to extubation between Sugammadex and neostigmine.

Notes: ①time to TOF>0.9 or /and time to TOF=0.9; ②time to extubation; ③PACU stay; ④OR discharge time; ⑤hospital stay; ⑥Recovery scores; ⑦incidence of RNB; ⑧incidence of PONV; ⑨incidence of PPCs; ⑩incidence of bradycardia; ⑪ 30-day hospital readmission rate; ⑫ incidence of POD; ⑬ incidence of POCD; Gly: glycopyrrolate; RS: Retrospective study.

Supplementary material 3

Table 2. Study quality of RCT studies

Study	Selecti on bias	Performa nce bias	Detection bias	Attrition bias	Reporting bias	Other bias	Scores	Bias risk
Herring, W.J.2021	Low	Low	Low	Unclear	Unclear	Unclear	4.5	Low
Castro, D.S.2014	Low	Low	Unclear	Unclear	High	High	3	High
Ding, X. 2023	Low	Low	Unclear	Low	Unclear	Unclear	4.5	Low
Paech, M. J. 2018	Low	Low	Low	Low	Low	Low	6	Low
Tas Tuna, A. 2017	Low	Unclear	Unclear	Low	High	High	3	High
Yağan, Ö. 2017	Low	Unclear	Low	Unclear	High	High	3	High
Alday, E. 2019	Low	Low	Low	Low	Unclear	Unclear	5	Low
Ledowski, T. 2021	Low	Low	Low	Low	Low	Low	6	Low
Togioka, B.M. 2020	Low	Low	Low	Low	Low	Low	6	Low
Yu,Y. 2022	Low	Low	Low	Unclear	Unclear	Unclear	4.5	Low
Batistaki, C. 2017	Low	Unclear	Low	Unclear	High	High	3	High
Deng, C. 2024	Low	Low	Low	Low	Low	Unclear	5.5	Low
Liu, F. 2022	Low	Low	Unclear	Low	Unclear	Unclear	4.5	Low
Pişkin, Ö. 2016	Low	Unclear	Unclear	Low	High	High	3	High
Zhu,B. 2020	Low	Low	Low	Low	Unclear	Unclear	5	Low
Abola, R. E. 2020	Low	Low	Low	Low	Unclear	Unclear	5	Low
Ajetunmobi, O. 2024	Low	Low	Low	Low	Low	Unclear	5.5	Low
Han, J. 2021	Low	Low	Unclear	Low	Unclear	Unclear	4.5	Low
Mohamad Zaini, R. H. 2016	Low	Low	Low	Low	Low	Unclear	5.5	Low
Brueckmann, B. 2015	Low	Low	Low	Low	Low	Low	6	Low
Carron, M. 2013	Low	Low	Unclear	Low	Unclear	Unclear	4.5	Low
Farag, E. 2021	Low	Low	Low	Low	Low	Unclear	5.5	Low
Gaszynski, T. 2012	Low	Low	Low	Low	Low	Low	6	Low
Hakimoğlu, S. 2016	Low	Low	Low	Unclear	Unclear	Unclear	4.5	Low
Illman, H. L. 2011	Low	Low	Low	Low	Low	Unclear	5.5	Low
Korkmaz, M. O.	Low	Low	Unclear	Unclear	High	High	3	Low

2019								
Koyuncu, O. 2015	Low	Low	Low	Low	Low	Low	6	Low
Li, L. 2021	Low	Low	Unclear	Low	Unclear	Unclear	4.5	Low
Lu, L. 2024	Low	Unclear	Unclear	Low	High	High	3	High
Mraovic, B. 2021	Low	Unclear	Low	Unclear	High	High	3	High
Niu, L. 2020	Low	Unclear	Unclear	Unclear	Unclear	High	3	High
Putz, L. 2016	Low	Low	Low	Low	Low	Low	6	Low
Sacan, O. 2007	Low	Low	Low	Low	Low	Unclear	5.5	Low
Voss, T. 2022	Low	Unclear	Unclear	Unclear	Unclear	High	3	High
Wu, X. 2014	Low	Low	Low	Unclear	Unclear	Unclear	4.5	Low

Notes: The quality assessment based on the Cochrane quality evaluation manual. Scoring criteria: Low=1; Unclear=0.5; High=0. Literature with a score of at least 4.5 is considered to be of high quality with a low risk of bias.

Table 3. Study quality of cohort studies based on the Newcastle-Ottawa Scale

Study	Adequate definition of cases	Representativeness of the cases	Selection of controls	Definition of controls	Comparability	Ascertainment of exposure	Same method of ascertainment for cases and controls	Non-Response rate	Scores
Rössler, J. 2024	★	★	★	★	★★★	★	★	★	9
Oh, C. S. 2016	☆	☆	★	★	★	★	★	☆	5

Notes: ★=1; ☆= 0.

Supplementary material 4

Abbreviations

RNB: Residual neuromuscular blockade
TOF: Train-of-four ratio
PONV: Postoperative nausea and vomiting
PPCs: Postoperative pulmonary complications
NMBAs: Neuromuscular blocking agents
ASA: American Society of Anesthesiologists
MMSE: Mini-Mental State Examination
MoCA: Montreal Cognitive Assessment
NOS: Newcastle-Ottawa scale
RCTs: Randomized controlled trials
POD: Postoperative delirium
POCD: Postoperative cognitive dysfunction
bCAM: Brief Confusion Assessment Method
CAM: Confusion Assessment Method
PACU: Post-anesthesia care unit
CAP: Cholinergic anti-inflammatory pathway