Obstructive Sleep Apnea and Adverse Perioperative Outcomes in Elective Spine Surgery

A Systematic Review and Meta-Analysis

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Sleep apnea **doubles** the risk of **breathing complications** after elective spine surgery.

BACKGROUND

- Most surgical patients with OSA are undiagnosed on the day of surgery. Roughly 80 percent reach the operating room without a diagnosis.
- Anesthetics, sedatives and opioids can increase upper airway collapsibility and reduce arousal responses to hypoxia.
- Spine surgery concentrates that risk: long prone operations, high opioid requirements and an older population with elevated BMI.
- OSA is screenable and treatable before surgery, yet no prior review has quantified its perioperative risk in this population.

METHODS

- Prospectively registered with PROSPERO (CRD420261346164) and reported per PRISMA 2020.
- MEDLINE, Embase, CENTRAL and Cochrane DSR searched via Ovid from inception to February 3 2026 with no language limits.
- Adults 18 years or older undergoing elective cervical or thoracolumbar spine surgery, with preoperative OSA and a non-OSA comparator.
- Dual independent screening and extraction, ROBINS-I for risk of bias and GRADE for certainty of evidence.
- Random-effects REML models. Risk ratios by Mantel-Haenszel for binary outcomes and mean difference by inverse variance for length of stay.

STUDY SELECTION

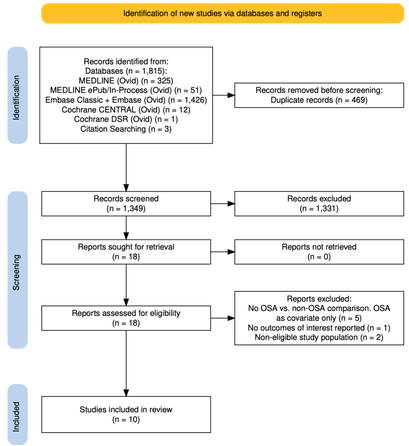


Figure 1. PRISMA 2020 flow diagram.

2.13
RR
Respiratory complications

1.90
RR
ICU admission

1.58
RR
Cardiac complications

1.55
RR
Composite infections

Cardiac complications in patients with OSA vs No OSA undergoing spine surgery

Study	OSA Events	OSA Total	No OSA Events	No OSA Total	RR	95%-CI	Weight
Tummala 2025	13	9400	18	9400	0.72	[0.35; 1.47]	10.3%
Mastrokostas 2025	36	12000	72	24000	1.00	[0.67; 1.49]	15.1%
Lin 2019	1128	107451	10699	1289050	1.26	[1.19; 1.34]	19.0%
Chung 2018	301	56372	2941	1052837	1.91	[1.70; 2.15]	18.7%
Stundner 2014	33	6163	211	78492	1.99	[1.38; 2.87]	15.6%
Katsnelson 2025	129	18734	194	74391	2.64	[2.11; 3.30]	17.7%
Nistal 2022	2	93	7	1098	3.37	[0.71; 16.01]	3.7%
Random effects model		**210213**		**2529268**	**1.58**	**[1.13; 2.21]**	**100.0%**
Prediction interval						**[0.56; 4.49]**	

Heterogeneity: I^2 = 92.4%, τ^2 = 0.1532, χ^2_6 = 78.86 (p < 0.0001)
Test for overall effect: z = 2.67 (p = 0.0077)

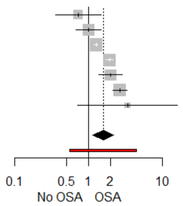


Figure 1A. Random-effects meta-analysis of cardiac complications in patients with versus without OSA undergoing elective spine surgery. Pooled as risk ratios using the Mantel-Haenszel method. Red bar shows the 95% prediction interval. RR = risk ratio. CI = confidence interval.

Respiratory complications in patients with OSA vs No OSA undergoing spine surgery

Study	OSA Events	OSA Total	No OSA Events	No OSA Total	RR	95%-CI	Weight
Mastrokostas 2025	804	12000	1968	24000	0.82	[0.75; 0.88]	17.0%
Tummala 2025	278	9400	252	9400	1.10	[0.93; 1.31]	16.8%
Nistal 2022	20	93	116	1098	2.04	[1.33; 3.11]	15.4%
Katsnelson 2025	475	18734	538	74391	3.51	[3.10; 3.96]	16.9%
Chung 2018	4465	56372	23480	1052837	3.55	[3.44; 3.66]	17.0%
Stundner 2014	809	6163	2562	78492	4.02	[3.73; 4.33]	17.0%
Random effects model		**102762**		**1240218**	**2.13**	**[1.23; 3.68]**	**100.0%**
Prediction interval						**[0.32; 13.96]**	

Heterogeneity: I^2 = 99.6%, τ^2 = 0.4574, χ^2_5 = 1359.39 (p < 0.0001)
Test for overall effect: z = 2.71 (p = 0.0068)

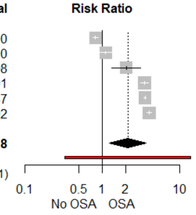


Figure 1B. Random-effects meta-analysis of respiratory complications in patients with versus without OSA undergoing elective spine surgery. Pooled as risk ratios using the Mantel-Haenszel method. Red bar shows the 95% prediction interval. RR = risk ratio. CI = confidence interval.

We also found that OSA was associated with more all-cause complications (RR 1.65), more composite adverse events (RR 1.50) and a longer hospital stay. Hospitalization costs were higher in all three studies that reported them.

RESULTS

We identified 10 retrospective cohort studies enrolling 2,739,991 patients undergoing elective spine surgery, of whom 210,382 had obstructive sleep apnea. Mean age was 57 ± 15 years and 50.5% were female.

OSA was ascertained by ICD codes in 6 studies, ICD codes with chart review in 2, polysomnography or documented clinical diagnosis in 1 and STOP-Bang in 1.

1,818 records were identified, 1,349 screened after duplicate removal, 18 full texts assessed and 10 studies included.

Outcome	Studies	Effect [95% CI]	P
Respiratory complications	6	RR 2.13 [1.23, 3.68]	0.007
ICU admission	2	RR 1.90 [1.79, 2.02]	<0.001
All-cause complications	5	RR 1.65 [1.45, 1.88]	<0.001
Cardiac complications	7	RR 1.58 [1.13, 2.21]	0.008
Composite infections	7	RR 1.55 [1.27, 1.89]	<0.001
Composite adverse events	9	RR 1.50 [1.27, 1.77]	<0.001
30-day ED visit	3	RR 1.77 [0.19, 16.59]	0.62
30-day readmission	3	RR 1.14 [0.90, 1.43]	0.28
In-hospital mortality	4	RR 1.10 [0.62, 1.95]	0.75
Non-home discharge	3	RR 1.07 [0.76, 1.49]	0.70
90-day readmission	3	RR 1.00 [0.93, 1.08]	0.96
Hospital length of stay	4	MD 0.31 d [0.19, 0.43]	<0.001

Risk of bias was low overall in all 10 studies by ROBINS-I. Certainty of evidence was very low for every outcome by GRADE. RR = risk ratio. MD = mean difference. CI = confidence interval. ED = emergency department.

SECONDARY OUTCOMES

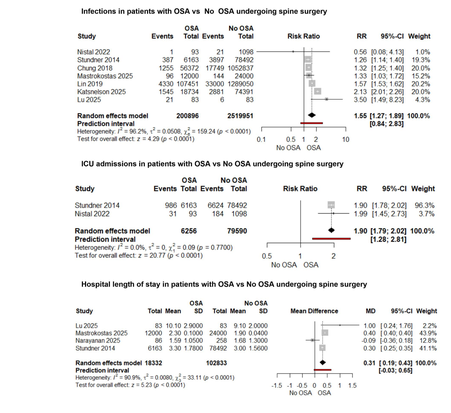


Figure 2. Composite infections, ICU admission and hospital length of stay in patients with versus without OSA. Infections included urinary, wound, sepsis, superficial, deep incisional and surgical site infection.

LIMITATIONS

- All included studies were observational and retrospective, precluding causal inference.
- OSA severity and CPAP adherence were rarely reported, which prevented severity-stratified analysis.

CONCLUSION

OSA is a potentially modifiable perioperative risk factor. Preoperative screening with STOP-Bang, CPAP optimization and enhanced postoperative respiratory monitoring may reduce risk.

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