Practice Considerations for Intraoperative Administration of Dexmedetomidine as an Adjunctive to General Anesthesia in Colorectal Surgery to Improve Postoperative Recovery

Disclaimer

This document on the intraoperative administration of dexmedetomidine as an adjunctive to general anesthesia for adult patients undergoing nonemergent colorectal surgery is designed for anesthesia providers to make evidence-based decisions. While this document serves to synthesize peer-reviewed research, it cannot replace clinical judgment which necessitates accounting for the variability of individual situations and patient-centric care. This document is not intended to serve as a law, regulation, and/or policy that would replace or supersede labeling from the US Food and Drug Administration (FDA).
This document includes peer-reviewed journal articles published between January 1st, 2013, and May 1st, 2023. New peer-reviewed journal articles should be reviewed and incorporated into this document on an annual basis for any institution desiring to disseminate this document.

Purpose Statement

The purpose of this project is to disseminate evidence-based clinical practice considerations which are systematically developed and expert-validated to translate research linking intraoperative dexmedetomidine administration to reduced severity of adverse outcomes related to nonemergent colorectal surgery in adults. It is intended for use by anesthesia providers. This project is designed to provide education to anesthesia providers to enhance their practice and encourage consideration of administering dexmedetomidine as an adjunctive to general anesthesia.

Disclosures

The author declares that she has no relevant or material financial interests that relate to the research described in this paper. All expert panel participants received no financial or material incentive.

Methods

A complete detailing of the search methodology can be found in the attached Supplemental Material. A literature search was performed across Embase, CINAHL, and PubMed for relevant and recent literature. Once articles were identified their outcomes were synthesized into tables, which are in the Supplemental Material and guided the creation of this narrative document. Table 1 displays the outcomes each article contributed to this document. Following IRB approval from Northeastern University, a panel of experts was identified through a combination of purposive and snowball sampling to create a multidisciplinary panel which included nurse anesthetists, anesthesiologists, and pharmacists. Through a Modified Delphi technique, experts were anonymously asked to review the considerations and provide their input on the strength of recommendations based on criteria derived from the AGREE II method for evaluating practice guidelines.

Article, Year	Discharge Milestones	Pain	PONV	Inflammation
Chen et al., 2016	X	X	X	X
Chen et al., 2020				X
Chen et al., 2021		X	X	X
Cheung et al., 2014		X	X	
Ge et al., 2015		X	X	
He et al., 2022	X		X	
Lu et al., 2021	X	X	X	
Qi et al., 2022	X			X
Sun et al., 2021	X			X
Tang et al., 2022		X		X
Zhang et al., 2019				X

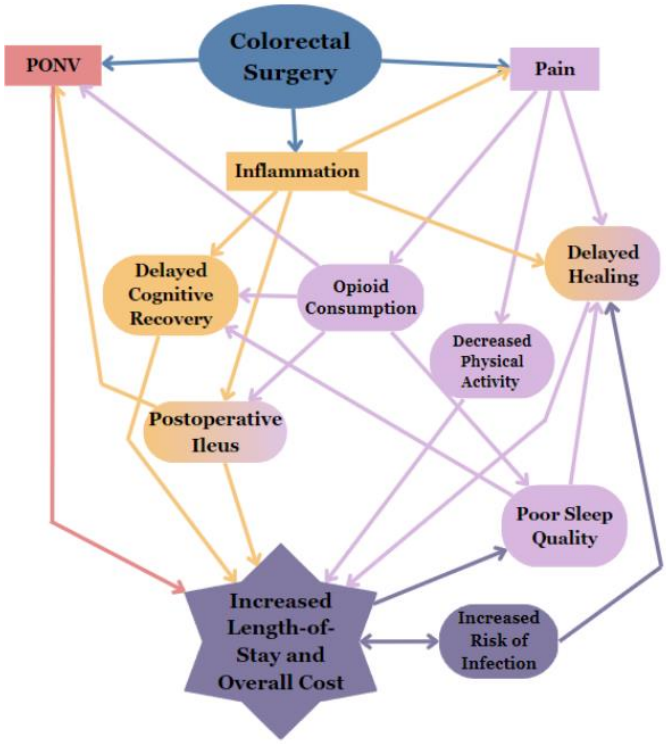
Table 1: Summary of relevant outcomes from each article used in these Practice Considerations

Limitations

This project has several limitations. First, it is not a meta-analysis, and the possibility remains that articles were unintentionally excluded from this review. Second, the primary articles used in the project took place throughout China raising concern for homogeneity in the sample population. Third, the relationships between dexmedetomidine and inflammation and postoperative nausea and vomiting are not entirely elucidated. Fourth, there is not a strong correlation between postoperative pain from colorectal surgery and dexmedetomidine, although this relationship is illustrated in other surgical populations. Further investigation of these relationships would bolster the understanding of dexmedetomidine's utility. Finally, at this time there is little research validating the optimum dose and timing of dexmedetomidine boluses. For the purpose of this project, dosing was based on the FDA approved doses, which were mirrored by the procedures used in the primary articles supporting this project.

Dexmedetomidine and Colorectal Surgery

Patients undergoing colorectal surgery (CRS) are predisposed to postoperative nausea and vomiting (PONV), inflammation and infection, and postoperative pain, placing them at risk for high rates of morbidity, mortality, and prolongation of hospitalization. These sequelae are interwoven and together have the potential to delay discharge from the hospital. The image to the right displays several postoperative effects of CRS and how they may influence one another.



Dexmedetomidine (Dex) is a potent alpha-2 agonist which acts on the central nervous system to directly block norepinephrine, a key neurotransmitter in the fight-or-flight response system, from binding to its receptors thus producing sedation, anxiolysis, hypnosis, and analgesia making it a useful medication during the perioperative period. In recent years, studies of Dex's versatility have become prevalent in literature and are being integrated into several Enhanced Recovery After Surgery (ERAS) Protocols as part of new guidelines for promoting better perioperative practices.

This document and the accompanying infographic highlight research within the past decade showing the potential utility of using Dex as an intraoperative adjunctive medication to mitigate several sequelae of CRS in adult patients. For further information, the Supplemental Material provides a more detailed explanation of the research used to synthesis this tool.

Dosing

Currently no research has directly focused on the relationship between intraoperative Dex doses and clinical outcomes in CRS. However, the studies reviewed for this tool used continuous infusion rates of 0.2 – 0.7 mcg/kg/hr, which fall into the FDA-approved range of 0.2-1.0 mcg/kg/hr (Hospira, Inc., 1999). Most studies additionally provided a loading dose prior to initiation of the continuous infusion (Chen et al., 2016; Chen et al., 2020; Chen et al., 2021; Cheung et al., 2014; He et al., 2022; Lu et al., 2021; Qi et al., 2022; Sun et al., 2021; Tang et al., 2022; Zhang et al, 2019). Loading doses are typically administered over at least 10-15 minutes to reduce severity of bradycardia and hypotension, which are the most common side effects of Dex. Loading doses were typically administered prior to induction of anesthesia, and continuous infusions were typically started after endotracheal intubation and stopped 30 minutes prior to the end of surgery, or at wound closure.

He et al. (2022) provided evidence that patients who received loading doses of Dex, in addition to a continuous infusion intraoperatively, did have decreased time to first flatus, and significantly higher concentrations of Dex in their system 8 hours postoperatively. Another study found a dose dependent relationship between Dex and PONV in patients undergoing elective thoracic surgery (Li et al., 2022). These articles suggest that administration of a bolus may play an important role in impacting postoperative outcomes.

Safety Considerations

While there are no absolute contraindications for Dex, it is necessary to be aware that it has two notable side effects: bradycardia and hypotension. Dex acts on α2-adrenergic receptors on pre- and postsynaptic membranes in the brainstem inhibiting the release of norepinephrine, decreasing sympathetic outflow and subsequent bradycardia and hypotension. This occurs in a dose-dependent manner and the risk of these events increases when a loading dose or bolus of Dex is given over a short period of time, hence the FDA recommendation to administer a loading dose of Dex over 10 minutes (Hospira, Inc., 1999). Although rare, Dex has been implicated in nearly 20 case reports of cardiac arrest since 1999 (Fritock et al., 2017). There is greater concern for adverse events in patients who have acute cardiac dysfunction, a

2nd or 3rd degree heart block, meet NYHA Class III or IV criteria, have a baseline heart rate of less than 50-55 beats per minute, or are of advanced age (Page et al., 2016; Takata et al., 2014. Further, Dex is metabolized in the liver and excreted by the kidneys; while there is no official recommendation to alter dosing based off reduced hepatic or renal function, it is worth noting that impaired function of these organs should also be factored into the risk-benefit analysis (Weerink et al., 2017).
Treatment for Dex-related hypotension and/or bradycardia begins with stopping the Dex infusion. If further intervention is necessitated atropine, ephedrine, and appropriate volume administration may restore hemodynamic stability (Izumida & Imamura, 2022). Many of the articles mentioned in this project describe a linkage between bolus or loading dose administration and higher rates of bradycardia/hypotension. Efficacy and risk comparison of Dex with boluses would be beneficial to determine the necessity and risk of loading doses.
Providers are urged to use their clinical knowledge to weigh the risks and benefits of Dex, with particular attention paid to elderly patients, patients with baseline bradycardia, impaired renal or hepatic function, and history of cardiovascular dysfunction.

Pain and Opioids

The locus coeruleus in the pons contains one of the highest densities of α2-adrenergic receptors in the body. It plays a key role in the modulation of pain. Dex's primary mechanism of action is agonism of these receptors. Dex also provides pain modulation in the posterior horn of the spinal cord via activity on C- and Aα-fibers to inhibit the release of Substance P, a prominent neurotransmitter of pain.
The primary pain-related outcome investigated in the articles reviewed was pain score, measured as either Visual Acuity Scale, or a numeric pain scale (Cheung et al., 2016; Ge et al., 2015; Lu et al., 2021; Tang et al., 2022). All studies compared Dex to a saline control group. Nearly every study showed statistically significant lower pain scores in the group that received Dex, particularly in the first 24 hours postoperatively (Cheung et al., 2016; Ge et al., 2015; Lu et al., 2021; Tang et al., 2022). The Chen et al. (2016) study did not show a significant difference.
Dex has gained popularity in ERAS protocols for its potential utility in opioid-sparing and multimodal analgesia. It has been reported to improve postoperative pain scores while also reducing overall perioperative opioid consumption (Liu et al., 2018; Schnabel et al., 2013). A decrease in opioid consumption is particularly beneficial in the CRS as opioids decrease gut motility and place patients at increased risk of postoperative ileus. Opioids are further linked to postoperative cognitive dysfunction and sleep disruption. Dex has potential benefits in lowering rates of POCD, and produces sleep-mimetic brain waves (Duprey et al., 2021).
Of key importance, no study suggested that the group receiving Dex had higher pain scores, longer time to first analgesia, or increased analgesic requirements. Further research may be necessary in the CRS population to ascertain the effect of Dex on total opioid consumption, but current data suggests that Dex improves pain scores, and does not worsen opioid consumption.

Inflammation

Inflammation is closely tied to postoperative pain outcomes. Surgery produces an immune response, causing the release of pro-inflammatory cytokines such as interleukin-6 (IL-6), tumor-necrosis factor-α (TNF-α), and numerous prostaglandins (Luo et al., 2017; Wang et al., 2019). These mediators sensitize nociceptors, increasing sensitivity to pain. In addition to the typical inflammatory cascade, CRS produces pain through another unique mechanism; the Microbiota-Gut-Brain Axis (Brenner et al., 2021; Guo et al., 2019; Lin et al., 2020). The brain and the microbiota of the gut have a two-way communication network via the HPA axis, efferent nerves, the vagus nerve, and chemical mediators such as cytokines, neurotransmitters, and short-chain fatty acids (SCFA). SCFAs are also known to have a role in immune regulation. CRS disrupts the microbiota, leading to activation of nociceptors and increased perceptions of both visceral and somatic pain (Li et al., 2020).
Current studies which have investigated the relationship between Dex and CRS focus on several inflammatory markers including diamine oxidase and intestinal fatty-acid binding protein which are relatively specific to the gastrointestinal system, as well as more universal markers of inflammation such as TNF-α, D-lactate, and α7 Nicotinic Acetylcholine (Cronk et al., 2006; Honzawa et al., 2011; Lieberman et al., 1997). With the exception of the diamine oxidase marker in the Qi et al. study, every study reported reduced inflammatory markers with intraoperative Dex administration (Chen et al., 2016; Qi et al., 2022: Sun et al., 2021).

Postoperative Cognitive Dysfunction (POCD)
POCD is a change from baseline cognition which occurs 7 or more days after surgery. It can persist for several weeks to months and sometimes results in a permanent change in cognition (Rundshagen, 2014). Particularly in older adults, the risk of POCD can be mitigated by intraoperative Dex administration. Both through serum markers and postoperative cognitive testing, categorically studies suggest that Dex decreases signs of cerebral inflammation and cognitive dysfunction both immediately after surgery, and days later (Chen et al., 2020; Chen et al,. 2021; Tang et al., 2022; Zhang et al., 2019).

Postoperative Delirium (POD)
POD is a new onset of attention deficit, agitation, confusion, and/or changes in mentation. It occurs in the short-term postoperative period, peaking 1-3 days after surgery, but is defined by lasting less than 7 days Alterations in sleep are thought to exacerbate delirium (Janjua et al., 2023). Dex is known to decrease rates of delirium in the pediatric population and new research indicates it may be beneficial in the adult population as well (Maagaard, 2023). Dex produces sleep-mimetic brain wave activity on EEG as opposed to opioids which are known to disrupt natural sleep patterns (Duprey et al., 2021; Wu et al., 2016). The chart to the right compares POD and POCD.

Postoperative Delirium	**Postoperative Cognitive Dysfunction**
Definition: attention deficit, agitation, confusion, changes in mentation	**Definition:** change from baseline cognitive function after surgery
Pathogenesis: not fully understood but thought to be related to pro-inflammatory nature of surgery, and use of general anesthesia	**Pathogenesis:** not fully understood but thought to be related to pro-inflammatory nature of surgery, and use of general anesthesia
Time Frame: Peak incidence 1-3 days after surgery	**Time Frame:** 7 days to months after surgery
Common Assessment Tool: Confusion Assessment Method (CAM)	**Common Assessment Tool:** Mini Mental Status Exam Montreal Cognitive Assessment
Risk Factors: Old age, depression, preoperative memory complaint, diabetes, sleep deprivation, alcohol misuse	**Risk Factors:** Old age, history of CVA, alcohol misuse, preoperative cognitive impairment, low educational level (Runshagen, 2014)

Chart 1: Comparison of POD and POCD

Gut Motility and Discharge Milestone
Postoperative ileus (POI) is a temporary impairment of bowel function after surgery, which can lead to distention, nausea, vomiting, and delayed passage of flatus and stool. While often self-limiting, it can potentially progress to bowel obstruction or perforation. Causes of POI include neurogenic (sympathetic stimulation inhibiting gut motility), inflammatory (related to mechanical manipulation of the bowels), pharmacologic (such as anesthesia and opioids), and immobility (Buchanan & Tuma. 2023). Dex has promise for improving postoperative bowel motility (Wu et al., 2022).
The articles reviewed for this document included measurement of gut motility through clinical outcomes such as time to first flatus (TTF), time to first stool (TTS), and total length of hospital stay (LOS). Patients had earlier return of flatus in all studies. The majority of studies showed a statistically significant return of defecation, with only one study showing a difference that was not statistically significant, but still favored Dex. LOS stay was categorically shortened with the Dex group as compared to saline. The Dex groups further showed lowered rates of postoperative gastrointestinal dysfunction, time to oral feed, time to resumption of borborygmus, and lower white-blood cell counts (Chen et al., 2016; He et al., 2022; Lu et al., 2021; Qi et al., 2022; Sun et al., 2021). Overall, Dex has the potential to decrease postoperative ileus and promote bowel motility, an important indicator of recovery from CRS.

Postoperative Nausea and Vomiting (PONV)
PONV is an unpleasant experience for patients and poses a potential risk to safe recovery, particularly in patients who cannot tolerate acute changes in parasympathetic activity, or acute rises in abdominal or thoracic cavity pressures. Research suggests Dex has the potential to decrease rates of PONV, particularly in patients with high Apfel scores (Jin et al, 2017). While the mechanism underlying this relationship is not well understood, it may be attributed to the decrease in opioids associated with Dex administration or decreased MAC of general anesthesia. Another theory suggests that nausea perception is partially influenced by sympathetic activity, which is disrupted through Dex's inhibition of norepinephrine resulting in decreased perception of nausea (Singh et al., 2016). The current body of evidence investigating a direct relationship between Dex and PONV remains inconclusive, but the relationship between Dex and decreased opioids and MAC has potential for decreasing PONV.

Supplemental Material

Summary of Search Strategy

A literature review was performed across CINAHL, Embase, and PubMed using the following terms: "dexmedetomidine" OR "Precedex," AND "colorectal surgery" OR "colorectal" OR "abdominal surgery" OR "colectomy" OR "colorectal cancer." A second search was performed across these databases with the intent of finding evidence to support dexmedetomidine's efficacy amongst key topics discussed in this project: "post-operative nausea and vomiting" OR "PONV," "post-operative cognitive dysfunction" OR "POCD," "inflammation," and "opioid-sparing" OR "opioid-free" OR "analgesia" OR "pain" OR "flatus" OR "gut motility" OR "bowel function." These terms were searched with the previous terms to produce results relevant to each topic. Inclusion criteria consisted of articles published within the past twenty years, entire article written in the English language, and publication in a peer-reviewed journal. Across databases, the initial search yielded a total of 116 articles. Articles were then screened by title and abstract review for relevancy. Any redundant articles were removed. A total of 10 articles ultimately met all criteria and were used to synthesize these considerations.

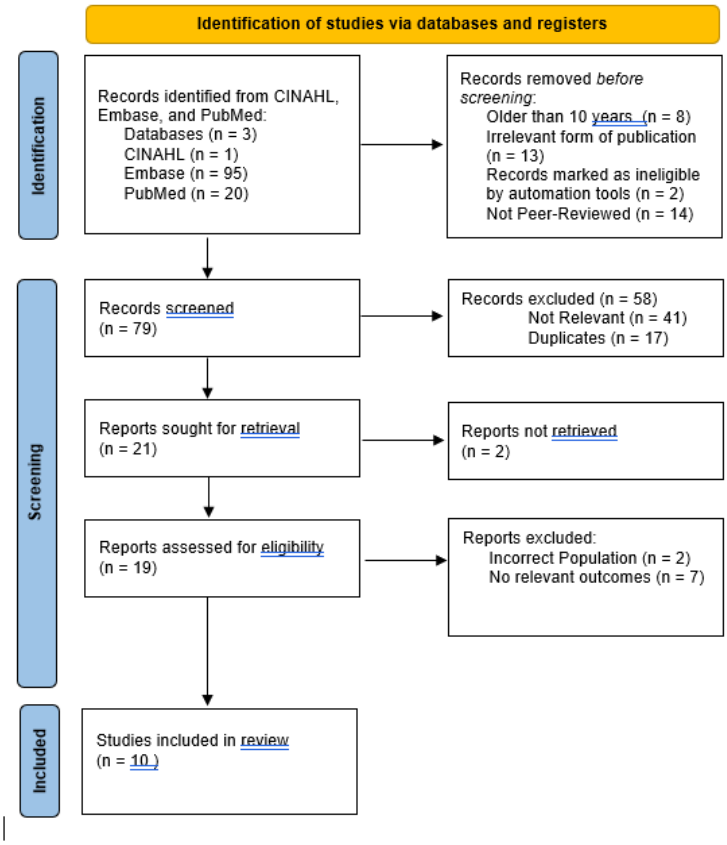


Chart 1: Flow of identification, screening, and inclusion of articles used in this Practice Considerations Document

Article, Year	Discharge Milestones	Pain	PONV	Inflammation
Chen et al., 2016	X	X	X	X
Chen et al., 2020				X
Chen et al., 2021		X	X	X
Cheung et al., 2014		X	X	
Ge et al., 2015		X	X	
He et al., 2022	X		X	
Lu et al., 2021	X	X	X	
Qi et al., 2022	X			X
Sun et al., 2021	X			X
Tang et al., 2022		X		X
Zhang et al., 2019				X

Table 1: Summary of relevant outcomes from each article used in these Practice Considerations

Summaries of Specific Data Findings Arranged by Outcomes Category and Individual Study

Interpreting Charts

The following are synthesized charts from the studies used in the design of these considerations. For results, dexmedetomidine results are presented first and followed by the control results. The background of cells corresponds to the statistical significance of the results, as delineated in the following chart:

Statistically Significant, favoring dexmedetomidine
Not Statistically Significant, but potentially clinically significant
Neither statistically nor clinically significant

Table 2: Pain

Article, Year	Study Type	Comparison	N size	Time to first analgesic (hours)	Total Analgesic (micrograms)	Total Pain Score	Total morphine consumption	Intraoperative remifentanil (ug)
Chen et al., 2016	RCT	Dex. Vs. Saline	60 patients	13.46 ± 1.81 vs 10.44 ± 1.78 p = 0.0102	103.43 ± 4.39 vs 121.57 ± 8.71, p = 0.335			
Chen et al., 2021	RCT	Dex vs Saline	80 Patients					343.7 ± 78.3 vs. 475.6 ± 79.2, p = 0.002
Cheung et al., 2014	RCT	Dex. Vs. saline	96 patients			Hours 1-48, area under the curve: 113.8 (SD 68.4) vs 136.7 (SD 70.3), p = 0.048	Median (IQR) 31 (16.5–42.25) vs 31 (17.75 – 49.5)	
Ge et al., 2015	RCT	Dex vs saline	80 patients			VAS score measured during first 24 hours postoperatively: significantly lower in Dex group with P<0.05	Morphine consumption significantly lower after first 4 hours postoperatively in Dex group, with P <0.05	
Lu et al., 2021	RCT	Dex vs saline	675 patients			Reported statistically significant favoring Dex on POD 1 and 4 only		
Tang et al., 2022	RCT	Dex vs. saline	100 patients			VAS, time 6,12,24, 48 h statistically lower for Dex at every interval		

Table 2 Key: **AUC**: Area under the curve; **VAS**: Visual Analog Scale. Dexmedetomidine results are always listed first, followed by control.

Table 3: Gastrointestinal Mobility

Article, Year	Study Type	Comparison	N size	TTF	TTS	LOS (days)	Other
Chen et al., 2016	RCT	Dex. Vs. Saline	60 patients	44.41 (hrs) ± 4.51 hours vs 61.03 ± 5.16 hours, *P* = 0.02	60.67 (hrs) ± 4.94 hours vs 82.50 ± 6.88 hours, *P* = 0.014	8.15 ± 0.37 days vs 9.70 ± 0.63 days, *P* = 0.045	
He et al., 2022	Retro-spective Cohort	Dex with or without loading dose	539 patients	Loading dose: 3.08 (days) ±1.21, vs no loading: 3.56 ± 1.53, P<0.01	4.85 (days) ± 2.68 vs 4.89 ± 2.38 P0.82	17.45 ± 4.81 vs 17.61 ± 5.83, P 0.73	POGD: 27% vs 40.4%, P = 0.002
Lu et al., 2021	RCT	Dex vs Saline	675 patients	Median, IQR, hours: 65 (48-78) vs 78 (62-93), P<0.001	85 (68-115) vs 98 (74-121), P<.001	Median, IQR, days: 13 (10-17) vs 15 (11-18) P = 0.005	First oral feeding: Dex 76 (52-112) vs 90 (72-115) P<0.001
Qi et al, 2022	RCT	Dex vs midazolam	42 patients		6.24 (h) ± 2.10 vs 7.38 ± 2.00, P = 0.077	18.86 (d) ± 8.12 vs 24.74 ± 8.91, P = 0.031	Borborygmus resumption time: 70.8 (h) ± 23.28 vs 90.24 ± 32.88, P = 0.034
Sun et al., 2021	RCT	Dex vs Saline	56 patients	4 (2) 5 (d) (SD 2), P=0.023	5 (2), vs 6 (3) P=0.293	10 d (2) vs 13 (4), P=0.035	WBC POD1: 7.9 ± 6.1 vs 10.8 ± 5.2, P = 0.34, WBC POD5 6.5 ± 2.7 Vs 8.6 ± 3.4, P = 0.035

Table 3 Key: TTF: Time to Flatus; **TTS**: Time to Stool; **LOS**: Length of Stay; **POGD**: Postoperative Gastrointestinal Dysfunction; **BRT**: Borborygmus Resumption Time; **WBC**: White Blood Cell Count
Dexmedetomidine results are always listed first, followed by control.

Table 4: Serum Inflammatory Markers

Article, Year	Study Type	Comparison	N size	DAO	I-FABP	TNF- α	D-Lactate	α7nAChR
Chen et al., 2016	RCT	Dex. Vs. Saline	60 patients	2.49 ± 0.41 ng/mL vs 4.48 ± 0.94 ng/mL, *P* = 0.028	1.32 ± 0.09 ng/mL vs 2.17 ± 0.12 ng/mL for I-FABP, *P* = 0.04			
Qi et al., 2022	RCT	Dex vs. midazolam	42 patients	**Hour 0:** 72.91 ± 14.54 vs 67.15 ± 17.70 P = 0.209 Hour 24: 63.06 ± 15.08 vs 63.06 ± 15.08 P = 0.72		Hour 0: 124.61 ± 36.98 vs 105.52 ± 28.14, P 0.067 Hour 24: 99.03 ± 30.49 vs 116.24 ± 22.67 , P< 0.044	Hour 0: 40.35 ± 8.00 Vs 40.22 ± 8.23 , P = 0.960 Hour 24: 34.00 ± 5.68 vs 39.13 ± 7.39 , P 0.016	Hour 0: 0.25 (0.45) Vs 0.52 (0.76), P = 0.308 Hour 24: 0.62 (0.77) vs 0.22 (0.68) , P = 0.015
Sun et al., 2021	RCT	Dex vs. saline	56 patients	PO2h: 155.12 ± 29.0 vs 171.7 ± 46.4, P = 0.252 POD1: 155.6 ± 45.8 vs., 225.2 ± 37.1 P< 0.001	PO2h: 9.1 ± 3.1 vs 13.6 ± 4.8, P<0.001 POD1: 15.8 ± 5.9 vs 22.4 ± 9.8 , P<0.001			

Table 5 Key: DAO: Diamine Oxidase; **I-FABP:** Intestinal Fatty-Acid Binding Protein; **POH**: Postoperative Hour; **α7nAChR:** α7 Nicotinic Acetylcholine Receptor
Dexmedetomidine results are always listed first, followed by control.

Table 5: Postoperative Cognitive Dysfunction

Article, Year	Study Type	Comparison	N-size	MMSE hrs 2, 6, 12, 24	MMSE POD 1	MMSE POD 3	MoCA	Cerebral Oxygen Metabolism	S100B	NSE	POCD POD1	POCD D3
Chen et al., 2020	RCT	Dex. Vs Saline	88 patients		27.3 ± 0.8 vs 21.1 ± 0.5, P < 0.05	28.8 ± 0.9 vs. 22.5 ± 0.8, P < 0.05						
Chen et al., 2021	RCT	Dex vs. Saline	80 patients	Favoring Dex at Hour 2: p = 0.032 Hour 6 p = 0.008 Hour 12 P = 0.029	Favoring Dex POD1 p = 0.018							
Tang et al., 2022	RCT	Dex vs saline	100 patients				Statistically higher in Dex group at 6, 12, 24, and 48 hours	Statistically significant (ANOVA results) across all times, lower in Dex group	Statistically significantly lower at 6, 12, 24, 28	Statistically significantly lower at 6, 12, 24, 28		
Zhang et al., 2019	RCT	Dex vs saline	140 patients		26.76±1.67 vs 24.15±1.98, P< 0.001	28.11±2.01 vs 26.09±1.78, P<0.001			POD1: Stat sig, favor dex POD3: stat sig favor dex		8.75% vs 21.67%, P=0.031	0 vs 13.33%, P<0.001

Table 5 Key: MMSE: Mini-Mental Status Exam; **MoCA**: Montreal Cognitive Assessment; **COM**: Cerebral Oxygen Metabolism; **NSE**: Neuron Specific Enolase; **POCD**: Postoperative Cognitive Dysfunction
Dexmedetomidine results are always listed first, followed by control.

Table 6: PONV

Article, Year	Study Type	Comparison	N size	PONV	Nausea	Vomiting
Chen et al., 2016	RCT	Dex. Vs. Saline	60 patients	60 vs 60, p = 0.991		
Chen et al., 2021	RCT	Dex vs Saline	80 patients	1 vs 6, p = 0.008		
Cheung et al., 2014	RCT	Dex vs. saline	96 patients		57% vs 55%	17% vs 31%
Ge et al., 2015	RCT	Dex vs saline	80 patients		26.32% vs 43.24%, p = 0.15	15.79% vs 27.03%, p = 0.27
He et al., 2022	Retrospective	Dex loading dose vs. no loading dose	539 patients		25.3% vs 33.8%, P = 0.034	13.9% vs. 23.18%, P=0.007
Lu et al., 2021	RCT	Dex vs. saline	675 patients	Subjectively reported by patients: P<0.05 favoring Dex as superior on POD 1 and 3		

Table 6 Key: PONV: Postoperative Nausea and Vomiting. Dexmedetomidine results are always listed first, followed by control.

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