ISSN: 1607-8322, e-ISSN: 2220-5799 **Anaesthesia, Pain & Intensive Care**
Vol 29(1); February 2025 DOI: 10.35975/apic.v29i1.2669

ORIGINAL RESEARCH **ANESTHESIOLOGY**

Intravenous dexmedetomidine versus intravenous lidocaine in attenuating airway reflexes during recovery of thyroidectomy patients

Ola Nasser Hussain Zaher [1], Mohsen Mohamed Kotb [2], Hadil Magdy AbdelHamid [3], Mai Mohsen Abdelaziz [4], Rania Hassan Abdel Hafiez [5]

Author affiliations:

1. Ola Nasser Hussain Zaher, Anesthesia, Intensive Care and Pain Management Department, Faculty of Medicine, Ain Shams University, Cairo, Egypt; Email: ola.nasser@med.asu.edu.eg
2. Mohsen Mohamed Kotb, Anesthesia, Intensive Care and Pain Management Department, Faculty of Medicine, Ain Shams University, Cairo, Egypt; Email: mkotb@hotmail.com
3. Hadil Magdy Abdelhamid, Anesthesia, Intensive Care and Pain Management Department, Faculty of Medicine, Ain Shams University, Cairo, Egypt; Email: hadilmagdy2012@hotmail.com
4. Mai Mohsen Abdelaziz, Anesthesia, Intensive Care and Pain Management Department, Faculty of Medicine, Ain Shams University, Cairo, Egypt; Email: maimohsen79@yahoo.com

. Rania Hassan Abdelhafiez, Anesthesia, Intensive Care and Pain Management Department, Faculty of Medicine, Ain Shams University, Cairo, Egypt; Email: raniahassan.a8@gmail.com

Correspondence: Ola Nasser Hussain Zaher; **Tel:** 01003067762; **E-mail:** ola.nasser@med.asu.edu.eg

ABSTRACT

Background: Cardiac and other airway reflexes are linked to intubation and extubation processes. These hemodynamic and respiratory responses during extubation have previously been attenuated with the use of intratracheal instillation and intravenous administration of lidocaine. In surgical intensive care units, dexmedetomidine, a strong α2 receptor agonist, considered to make extubation easier. However, its effect on reducing cardiopulmonary reflexes during extubation process under general anesthesia is currently being investigated.

Objective: To evaluate the capability of IV lidocaine or Dexmedetomidine to suppress the coughing reflex during extubation process following thyroid surgery.

Methods: This clinical trial was carried out in the operating rooms of Ain shams university hospitals. It included 140 participants, with 70 patients in each group. NCT05657028 is the clinicaltrials.gov registration number for this trial.

Results: Showed no statistically significant difference in hemodynamics in both groups regarding MAP and SpO_2. While intraoperative bradycardia has been recorded with the dexmedetomidine group in comparison with lidocaine group, also there was a decrease in the incidence of postoperative cough in dexmedetomidine group in comparison with lidocaine group and no statistically significant difference regarding the pain postoperatively.

Conclusion: Following thyroid surgery, dexmedetomidine was more effective in reducing the cough reflex during the tracheal extubation period. Both intravenous lidocaine and dexmedetomidine achieved acceptable analgesic effect. In terms of hemodynamics, intravenous infusions of dexmedetomidine caused bradycardia,

Keywords: Dexmedetomidine; Lidocaine; Thyroidectomy; cough reflex; Intravenous injection.

Citation: Zaher ONH, Kotb MM, AbdelHamid HM, Abdelaziz MM, AbdelHafiez RH. Intravenous dexmedetomidine versus intravenous lidocaine in attenuating airway reflexes during recovery of thyroidectomy patients. Anaesth. pain intensive care 2025;29(1):99-104. **DOI:** 10.35975/apic.v29i1.2669

Received: November 12, 2024; **Reviewed:** December 20, 2024; **Accepted:** December 29, 2024

 Open access attribution (CC BY-NC 4.0)

1. INTRODUCTION

The process of intubation and extubation are linked to various cardiac and respiratory reactions[1] Possible causes include uncleared secretions, anesthetic gas, and irritation by endotracheal tube.[2]

Additionally, bleeding after thyroidectomy is still a major concern and is frequently linked to serious side effects such cardiac arrest, reoperation, and cervical hematoma.[3] Deep extubation lowers cardiopulmonary stimulation and lowers the risk of coughing and tube strain.[4] These hemodynamic and respiratory responses during extubation have previously been attenuated with the use of intratracheal local anesthetic instillation, intravenous lidocaine, opioids like fentanyl, esmolol and labetalol, but with certain restrictions.[5] Additionally, the "no stimulation" extubation procedure guarantees that extubation only occurs when consciousness is restored, with spontaneous eye opening requiring no stimulation at all during emergence.[6]

Dexmedetomidine, strong α2 receptor agonist, considered to make extubation easier. However, its effect on reducing cardiopulmonary reflexes during extubation process under general anesthesia (GA) is currently being investigated.[7]

Aims of the study

We evaluated and compared the efficacy of intravenous lidocaine and dexmedetomidine to suppress the cough reflex during extubation process following thyroidectomy.

2. METHODOLOGY

This trial was accomplished in operating rooms of Ain Shams University Hospitals, and included 140 participants. The included subjects were ASA I or II, aged 18 to 65, and scheduled for elective thyroidectomy. Patients ASA class III or IV, refusing the procedure or study participation, patients with asthma, chronic cough, or symptoms of an upper respiratory infection prior to surgery, current smokers, those taking ACE inhibitors, those with sinus bradycardia (less than 60 beats per min), and those with a history of heart block or beta-blockers were excluded.

2.1. Study procedure

Participants were randomly allocated to one of the two groups: Group D (Dexmedetomidine group) and Group L (Lidocaine group).

All subjects underwent a standard preoperative evaluation. Prior to the operation, all individuals fasted for at least six hours. To induce GA, midazolam 0.05 mg/kg, propofol 2 mg/kg, fentanyl 2 μg/kg, and cisatracurium 0.15 mg/kg were administrated intravenously. After sufficient muscle relaxation, intubation was done using endotracheal tube of the appropriate size (size 7.5 for males and size 7 for females). Sevoflurane 2% was used to maintain GA, and cisatracurium 0.03 mg/kg was administered every 20 min for controlled ventilation. SpO_2, HR, and MAP were continuously monitored and recorded at the start of operation (time 0) and every 30 min thereafter.

2.2. Group D

Subjects of Group D had a loading dose 0.5 μg/kg of dexmedetomidine 10 min before induction, followed by infusion @ 0.4 μg/kg/hour until 30 min prior to the completion of the procedure.

2.3. Group L

Subjects of this group received a loading dose of 1.5 mg/kg lidocaine 2% 10 min before induction. This was followed by infusion of lidocaine @1.5 mg/kg/hour until 30 min prior to completion of the procedure. After the procedure, neostigmine 50 μg/kg (up to 5 mg) and atropine 10–20 μg/kg were used to reverse any remaining neuromuscular blockade. As soon as the surgery was finished, sevoflurane was stopped, fresh gas flow was increased, pharyngeal secretions or blood were carefully suctioned out. When the patient was fully conscious, breathing spontaneously, good muscle power, and spontaneous eye opening, extubation was carried out. Following extubation, the patients were moved to the PACU for monitoring.

Within five min of the extubation, the severity of the cough was assessed using the following criteria: 0 = no cough, 1 = a minor (single) cough, 2 = a moderate (≤ 5 s) cough, and 3 = a severe (> 5 s) cough.[2]

In this study, our primary outcome was to evaluate the capability of IV dexmedetomidine and lidocaine in attenuating coughing reflex following extubation process post thyroidectomy.

Secondary outcomes included comparing the values of the hemodynamic parameters e.g., SpO_2, HR, and MAP, at the beginning of the operation (time 0) and then every 30 min till the end of the procedure and after extubation, and satisfactory analgesic effect regarding sore throat after surgery using the visual analogue scale.

The study complied with the ethical guidelines set forth by the medical faculty's ethical committee at Ain Shams University. All of the patients who were part of the trial gave their written, informed consent.

2.4. Statistical analysis

Version 27.0 SPSS was used to collect, edit, code, and enter the data. Where applicable, the mean ± SD or

 Open access attribution (CC BY-NC 4.0)

Table 1: Comparison regarding demographic data

Demographic data		Group D (n = 70)	Group L (n = 70)	P-value
Age (yr)		44.34 ± 12.2	44.87 ± 12.2	0.798 [t]
Gender	Male	12 (17.1%)	18 (25.7%)	0.218 x2
	Female	58 (82.9%)	52 (74.3%)	
Type of thyroidectomy	Partial	16 (22.9%)	21 (30%)	0.34 x2
	Total	54 (77.1)	49 (70%)	

median (IQR) were used to express quantitative data. Frequencies and percentages were used to express the qualitative data. Two means were compared using the t-test of significance. The proportions of two qualitative factors were compared using the chi-square ($\chi 2$) test for significance. Mann Whitney-U test was used for two-group comparisons in non-parametric data.

A 95% confidence interval and a 5% acceptable margin of error were established. Thus, the following P-value was deemed significant: $P < 0.05$ = significant difference; $P > 0.05$ = non-significant, and $P < 0.01$ = highly significant difference.

3. RESULTS

3.1. Demographics

The demographic data (in terms of age, sex, and type of operation) showed no statistically significant difference (Table 1).

3.2. Preoperative hemodynamics

The preoperative hemodynamic in terms of 'MAP', 'HR' and 'SpO2'showed no statistically significant difference (Table 2).

3.3. Intraoperative hemodynamics

The intraoperative hemodynamic in terms of 'MAP', 'HR' and 'SpO2' measured at 30 min after the start of the surgery, showed statistically significant difference between intraoperative heart rates in the two groups (Table 2). There was no difference in the measured MAP and SpO_2 values at this time.

3.4. Postoperative hemodynamics

The postoperative hemodynamic in terms of 'MAP', 'HR' and 'SpO2' showed no statistically significant differences between the two groups (Table 2).

Table 2: Comparison regarding preoperative hemodynamic data

Parameter	Recoding time	Group D (n = 70)	Group L (n = 70)	P-value [t]
MAP	Time Zero	81.94 ± 2.1	82.10 ± 2.2	0.669
	At 30 min	78.11 ± 2.2	78.27 ± 2.2	0.674
	In PACU	84.80 ± 2.2	85.10 ± 2.4	0.441
HR	Time Zero	79.14 ± 5.1	79.43 ± 5.1	0.742
	At 30 min	63.36 ± 5.6	81.63 ± 3.0	**< 0.0001***
	In PACU	74.43 ± 4.5	74.71 ± 4.9	0.719
SpO_2	Time Zero	97.26 ± 1.4	97.17 ± 1.5	0.726
	At 30 min	98.96 ± 0.8	99.03 ± 0.8	0.595
	In PACU	97.79 ± 1.2	97.70 ± 1.2	0.673

** Significant P-value*

Table 3: Comparative postoperative complications

Complication	Group D (n = 70)			Group L (n = 70)			P- value [z]
	range	Median	IQR	range	Median	IQR	
Cough score	0-3	1.5	1-2	1-3	2	2-2	0.0003
Pain score	2-6	2	2-2	2-6	2	2-2	0.6690

 Open access attribution (CC BY-NC 4.0)

3.5. Postoperative complications

The postoperative cough showed statistically significant difference, but the VAS pain scores were equivalent in both of the groups (Table 3).

4. DISCUSSION

Given that dexmedetomidine a known α2 receptor agonist used in perioperative sympatholysis, and preservation of respiratory function, this study evaluated the efficacy of intravenous lidocaine (Group L) and dexmedetomidine (Group D) in reducing coughing reflex and hemodynamic changes in patients undergoing thyroid surgery.[8] However, lidocaine has also been demonstrated to lessen post-operative sore throat and coughing during extubation. It can be injected intravenously, administered locally to the airway before intubation, or infused into the ETT cuff.[9]

Our primary endpoint showed that postoperative coughing was less in the dexmedetomidine group; where only 5 patients experienced severe cough, compared to the lidocaine group where 15 patients had severe cough. This can be correlated to dexmedetomidine's sympatholytic properties, analgesic and sedative properties of α2 agonistic effect. Moreover, dexmedetomidine also modulate the inflammatory process, responsible for airway hyperactivity by decreasing the levels of IL-6 and TNF–α and attenuating tracheal ring contraction caused by exogenous acetylcholine and the C-fiber mediated contraction.[10]

In agreement with our study, Xu et al.[11] found postoperative cough less in dexmedetomidine cohort in comparison with midazolam cohort after partial and total laryngectomy. Also, Aksu et al.[12] and Fan et al.,[13] who compared fentanyl with dexmedetomidine, found the prevalence of cough is lower with dexmedetomidine suggesting that dexmedetomidine was more effective in smooth emergence extubation. Moreover Guler et al. stated that postoperative coughing was markedly less in the dexmedetomidine arm compared to the placebo arm.[14]

Conversely, Kim et al. showed no differences between the remifentanil and dexmedetomidine in attenuation of cough reflex after craniotomy surgery. [15]

Regarding the preoperative and post-operative hemodynamics, our clinical trial showed no statistically significant difference between both arms. Additionally, intraoperative hemodynamics in terms of MAP and SpO_2 showed no statistical significance. However, there was significant difference regarding heart rate, where 8 patients of the dexmedetomidine group had bradycardia (HR < 60 beats/min), two of them received atropine (0.04 mg/kg). Dexmedetomidine reduces the production of norepinephrine, which in return lower catecholamine release from nerve endings and central sympatholytic effect, leading to decreases in HR and blood pressure.

In line with our research, Hu et al. reported that 35 patients had bradycardia (HR 60 beats/min), and one patient's HR in the dexmedetomidine group was 40 beats/min, compared to the lidocaine and control groups in patients having thyroid surgery.[2] Additionally, Kim et al. discovered that the MAP and heart rate were considerably greater in the remifentanil group than in the dexmedetomidine group when they compared the two medications in patients having craniotomies.[15]

Additionally, Elmasry et al. discovered that the "no stimulation" method and dexmedetomidine groups experienced considerably fewer variations in vital data during emergence extubation than the Standard awake extubation group.[5] This could be explained as airway-related events during removal of the endotracheal tube using the "no stimulation" technique, was more efficient than standard awake extubation in inhibiting catecholamine release. Additionally, dexmedetomidine, reduces sympathetic outflow and noradrenergic activity, which counteracts hemodynamic fluctuation that occurs during extubation.

In our investigation, there were no statistically significant differences between the groups regarding the postoperative pain or analgesic intake. This can be explained by the analgesic qualities of both dexmedetomidine and lidocaine. Moreover, in both myelinated A and unmyelinated C nerve fibers, lidocaine reduces spike activity, amplitude, and conduction time. Our results came in harmony with Hu et al. that found both lidocaine and dexmedetomidine achieved satisfactory analgesic effect post thyroidectomy.[2] Also, Kim et al. showed no difference between remifentanil and dexmedetomidine in postoperative pain score after craniotomy.

Conversely, Xu et al. stated that the pain scores postoperatively were markedly lower in dexmedetomidine group compared to the midazolam group at departure from PACU.[11]

5. LIMITATIONS

First, ASA 3 and 4 patients were excluded, so the findings of this study cannot be applied to ASA 1 and 2 patients. Further, the incidence of post-operative bleeding was not recorded.

Finally, this clinical trial was a single-center clinical trial, hence larger sample, multicenter studies are still required to support the findings, and draw universally applicable conclusions.

 Open access attribution (CC BY-NC 4.0)

6. CONCLUSION

Following thyroid surgery, both intravenous infusions of lidocaine and dexmedetomidine achieved acceptable analgesic effect. In terms of hemodynamics, intravenous infusions of dexmedetomidine caused bradycardia, although it was more effective in reducing the cough reflex during the tracheal extubation period.

7. Data availability

The numerical data generated during this research is available with the authors.

8. Ethical considerations

Ain Shams University Hospitals ethical committee approved the trial. Written permission was obtained from all participating patients.

9. Study Registration

The study was registered with clinicaltrials.gov under registration number NCT05657028

10. Conflict of interest

The study utilized the hospital resources only, and no external or industry funding was involved.

11. Authors' contribution

ONHZ: Conducted the study

MMK: Drafting and editing the manuscript

HNAH: Literature search

MMAZ: Statistical analysis; Revision of the manuscript

RHAH: Literature search

12. REFERENCES

1. Minogue SC, Ralph J, Lampa MJ. Laryngotracheal topicalization with lidocaine before intubation decreases the incidence of coughing on emergence from general anesthesia. Anesth Analg. 2004;99(4):1253-7. [PubMed] DOI: 10.1213/01.ANE.0000132779.27085.52

2. Hu S, Li Y, Wang S, Xu S, Ju X, Ma L. Effects of intravenous infusion of lidocaine and dexmedetomidine on inhibiting cough during the tracheal extubation period after thyroid surgery. BMC Anesthesiol. 2019;19:66. [PubMed] DOI: 10.1186/s12871-019-0739-1

3. Elbers L, Squizzato A, Gerdes V. Thyroid Disorders and Hemostasis. Semin Thromb Hemost. 2018;44(7):676-82. [PubMed]

   DOI: 10.1055/s-0038-1666825

4. Luthra A, Prabhakar H, Rath GP. Alleviating stress response to tracheal extubation in neurosurgical patients: a comparative study of two infusion doses of dexmedetomidine. J Neurosci Rural Pract. 2017;8(Suppl 1):S49. [PubMed] DOI: 10.4103/jnrp.jnrp_91_17

5. Elmasry NIF, Ismael MM, Hamroush AS, Hegazy AGM. The effects of dexmedetomidine on airway-related complications during emergence from general anesthesia in nasal and paranasal surgeries. Egypt J Hosp Med. 2019;76(7):4600-7. DOI: 10.21608/ejhm.2019.45169

6. Tsui BC, Wagner A, Cave D, Elliott C, El-Hakim H, Malherbe S. The incidence of laryngospasm with a "no touch" extubation technique after tonsillectomy and adenoidectomy. Anesth Analg. 2004;98(2):327-9. [PubMed] DOI: 10.1213/01.ANE.0000097185.70171.89

7. Rani P, Kumar VH, Ravishankar M, Sivashanmugam T, Sripriya R, Trilogasundary M. Rapid and reliable smooth extubation–Comparison of fentanyl with dexmedetomidine: A randomized, double-blind clinical trial. Anesth Essays Res. 2016;10(3):597-601. [PubMed] DOI: 10.4103/0259-1162.186605

8. Kaur M, Singh PM. Current role of dexmedetomidine in clinical anesthesia and intensive care. Anesth Essays Res. 2011;5(2):128-33. [PubMed] DOI: 10.4103/0259-1162.94750

9. Clivio S, Putzu A, Tramèr MR. Intravenous lidocaine for the prevention of cough: systematic review and meta-analysis of randomized controlled trials. Anesth Analg. 2019;129(5):1249-55. [PubMed]

   DOI: 10.1213/ANE.0000000000003699

10. Shen F, Zhang Q, Xu Y, Wang X, Xia J, Chen C, et al. Effect of intranasal dexmedetomidine or midazolam for premedication on the occurrence of respiratory adverse events in children undergoing tonsillectomy and adenoidectomy: a randomized clinical trial. JAMA Netw Open. 2022;5(8):e2225473. [PubMed] DOI: 10.1001/jamanetworkopen.2022.25473

11. Xu R, Zhu Y, Lu Y, Li W, Jia J. Dexmedetomidine versus midazolam on cough and recovery quality after partial and total laryngectomy–a randomized controlled trial. BMC Anesthesiol. 2020;20:249. [PubMed]

    DOI: 10.1186/s12871-020-01168-7

 Open access attribution (CC BY-NC 4.0)

12. Aksu R, Akin A, Biçer C, Esmaoğlu A, Tosun Z, Boyaci A. Comparison of the effects of dexmedetomidine versus fentanyl on airway reflexes and hemodynamic responses to tracheal extubation during rhinoplasty: A double-blind, randomized, controlled study. Curr Ther Res Clin Exp. 2020;70(3):209-20. [PubMed]

DOI: 10.1016/j.curtheres.2009.06.003

13. Fan X, Cai H, Pan B, Xie Y. Comparison of dexmedetomidine and remifentanil on reducing coughing during emergence from anesthesia with tracheal intubation: A meta-analysis. Front Pharmacol. 2022;13:993239. [PubMed] DOI: 10.3389/fphar.2022.993239

14. Guler G, Akin A, Tosun Z, Eskitascoglu E, Mizrak A, Boyaci A. Single dose dexmedetomidine attenuates airway and circulatory reflexes during extubation. Acta Anaesthesiol Scand. 2005;49:1088-91. [PubMed] DOI: 10.1111/j.1399-6576.2005.00780.x

15. Kim H, Min KT, Lee JR, Ha SH, Lee WK, Seo JH, et al. Comparison of dexmedetomidine and remifentanil on airway reflex and hemodynamic changes during recovery after craniotomy. Yonsei Med J. 2016;57(4):980. [PubMed] DOI: 10.3349/ymj.2016.57.4.980

 Open access attribution (CC BY-NC 4.0)