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Original Article

Intratracheal Administration of Lidocaine for Sedation of Patients under Mechanical Ventilation: A Double-Blind Randomized Clinical Trial

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Abstract

Background: Some patients with respiratory failure who are in need of mechanical ventilation require sedation to tolerate the inserted endotracheal tube (ETT) and other unpleasant stimuli. While a light sedation is satisfactory, deep sedation can interfere with the weaning process of patient from mechanical ventilator. Nevertheless, so far, the ideal regimen for sedatives and analgesics has not been found. We evaluate the effect of intratracheal administration of lidocaine for sedation of patients under mechanical ventilation.

Methods: In a double-blind randomized clinical trial, 50 patients aged 33–65 years who had no obvious brain injury, in need of mechanical ventilation were enrolled into this study. They were randomized into two groups; the treatment group received 2.5 mL of 2% lidocaine, and the control group received 2.5 mL of normal saline via ETT each two hours for 12 h under sterile conditions. The baseline sedation was maintained with morphine, midazolam, or both, which were titrated to patient comfort and to maintain an optimum sedation score throughout the entire study.

Results: During 12 h of the study, the mean±SD total morphine and midazolam requirements were 7.13±0.96 and 4.65±1.15 mg, respectively, in the treatment group, and 11.08±0.77 and 6.37±1.17 mg, respectively, in the control group. There was a significant ($P<0.05$) reduction in the requirements for both drugs during the study in the treatment group as compared to the control group.

Conclusion: Intratracheal administration of lidocaine significantly reduces sedative requirements in intubated patients during 12 h. In the short-term, no side effects or complications were observed.

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Keywords ● Intratracheal ● lidocaine ● ventilation ● mechanical ● sedatives

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Introduction

Endotracheal intubation is the standard technique for early airway management of patients requiring assisted ventilation. Most patients require anesthesia or

significant amounts of sedatives/analgesics to tolerate the inserted ETT for the first few days.[1,2] This need although unimportant during surgery is often a major drawback for patients requiring intensive care as sedatives often accumulate in the critically-ill patient and may increase the length of hospital stay, morbidity and mortality.[3] Excessive use of sedatives in the intensive care unit (ICU) may prolong the duration of mechanical ventilation, prolong the length of stay in the ICU and hospital and increase the need for tests to assess alternations in mental status.[4] On the other hand, deep sedation interferes with the weaning process. Tracheal intubation can be performed in awake patients by applying topical anesthesia to the airway in difficult intubation situations.[5,6] Topical lidocaine has been reported to reduce the incidence of ETT-induced coughing.[7,8] We were interested to determine if topical lidocaine delivered by a catheter via ETT to the tracheal mucosa could improve the patient's comfort, and thereby reduce the need for sedatives and analgesics in these patients.

Patients and Methods

After approval by the Ethics Committee of our University, informed written consents were taken from all the study patients or their relatives. Fifty patients aged between 32–65 years who required prolong ventilatory support in the ICU after upper abdomen or thoracic surgery, were enrolled into this double-blind clinical trial. We excluded those patients who required analgesia in the immediate postoperative period, those who suffered asthma and those with obvious brain injury.

Approximately six hours after operation, patients were randomized into two groups. Randomization was carried out by the pharmacy according to a computer-generated table. The treatment group received 2.5 mL of 2% lidocaine, and the control group received 2.5 mL of normal saline via ETT each two hours for 12 h under sterile conditions. Syringes containing 2.5 mL of either 2% lidocaine or normal saline were prepared by the hospital pharmacy. The authors and the nursing staff were blinded to the nature of the solutions.

Sedation was maintained with intermittent administration of either morphine, 0.04 mg/kg, or midazolam, 0.02 mg/kg, or both. The level of sedation was monitored hourly using a sedation scale (table 1) with six levels of cognitive neurologic function, similar to the Ramsay sedation scale.[9] Monitoring of sedation and adjustment of morphine and midazolam administration to maintain a target score of 3-4 (table 1) were carried out throughout the entire study. Episodes of coughing and gagging, desaturation (SaO_2<90%) and hypertension (increase in systolic blood pressure >20% above baseline) were recorded during the study. Patients who were awake enough were questioned about their discomfort caused by the presence of ETT or by pulmonary suctioning. Data was express as mean±SD. Independent-sample *Student's t* test was used to assess statistical significance between sedation requirements in two groups. The significance level was set at P<0.05.

Results

Table 2 shows the demographic data. There was no statistically significant difference between

Table 1: Sedation Score

Level 1	Patient restless, agitated or anxious compromising ventilation and oxygenation, showing signs of distress on physiotherapy, tracheal suction, oropharyngeal suction and handling in general
Level 2	Patient awake but needs sedation for physiotherapy and other nursing or invasive procedures
Level 3	Patient just asleep, responds to speech and touch, needs additional sedation to cover handling and physiotherapy or any other procedures
Level 4	Patient asleep, handles well and tolerate care, showing response to speech and touch by either squeezing the nurses hand or by blinking
Level 5	Patient asleep, has dull/sluggish response to any form of stimulation, for example tracheal suction
Level 6	Patient asleep showing no sign of response to stimulation of any kind

Table 2: Patients demographic data and their need to midazolam and morphine during the study.

Parameters	Control (normal saline)	Treatment (lidocaine)	P value
n	24	23	NS
Male/Female	17/7	15/8	NS
Mean±SD age (yrs)	49±10	48±14	NS
Mean±SD duration of mechanical Ventilation (d)	4±0.5	4.5±0.2	NS
Mean±SD ICU stay (d)	6±0.5	6.3±0.4	NS
Mean±SD morphine need (mg/12 h)	11.08±0.77	7.13±.96	0.001
Mean±SD midazolam need (mg/12 h)	6.37±1.17	4.65±1.15	0.001

NS: Not Significant

age, duration of mechanical ventilation, male/female ratio, type of surgery and ICU stay between the study groups. They had no significant organ dysfunction except for respiratory failure. Two patients in the treatment group and one in the control group were excluded from subsequent analysis: one of thesm was extubated five hours from the start of the study; one required neuromuscular block six hours after the beginning of the study because of deterioration in oxygenation; and another was transferred to another hospital. The total amount of midazolam and morphine used for each patient was recorded for the 12 hour study period, in both groups (table 2). There was 30%–40% reduction in the requirements of both drugs in the treatment group as compared with the control group (fig 1).

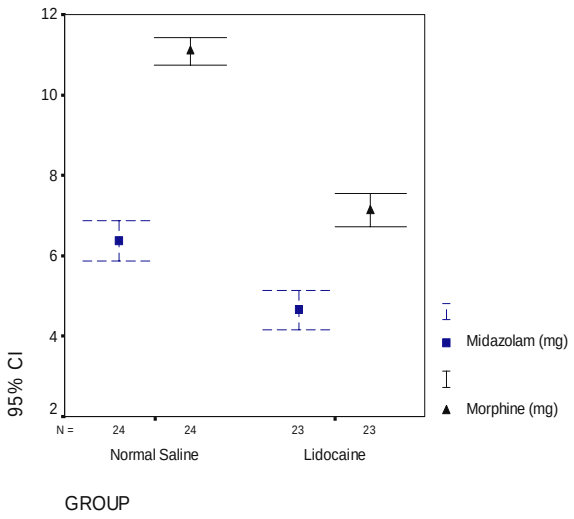

Fig 1: Midazolam and Morphine requirements in the two study groups

The patients appeared to be less discomfort by pulmonary suctioning in the treatment armthan in the control group. No episode of desaturation (SaO_2 <90%) or hypertensive crisis (increase in systolic arterial pressure >20% from baseline) were reported during the study in both groups.

Discussion

Sedatives are often given to patients who are in need of mechanical ventilation to alleviate their anxiety, to decrease excessive oxygen consumption and to facilitate nursing care. However, sedatives can prolong duration of mechanical ventilation.[10] Patients undergoing mechanical ventilation are subjected to numerous noxious stimuli attributable to diagnostic, therapeutic and physical nursing interventions. The presence of an ETT and frequent tracheal suctioning are very unpleasant. An optimal level of sedation is a fundamental requirement to facilitate delivery of ICU care. Although essential, sedation and analgesia in this group of patients produce many side effects including cardiovascular instability, delayed weaning from mechanical ventilation, impaired tolerance of enteral feeding, tolerance and withdrawal symptoms, and other complications of immobility.[3] Various strategies have been adopted to reduce the need for sedatives and analgesics, and hence their side effects, without compromising patient comfort. These include tracheotomy, non-invasive ventilation, regional nerve block to wounds whenever appropriate, and synchronization of mechanical ventilation. Tracheotomy is generally claimed to be tolerated better in patients undergoing ventilation.[11,12]

Non-invasive positive pressure ventilation in patients with respiratory failure has a better outcome compared with intubation and conventional intermittent positive pressure ventilation (IPPV).[13] However, at the present time, most patients in the ICU require an ETT to achieve adequate ventilation and provide access to the lower airway for removal of secretions.

In this study, we found that the need for midazolam and morphine was significantly decreased by 30%–40% in patients who received intratracheal instillation of lidocaine via ETT than those who received normal saline instillation.

During awake endotracheal intubation and bronchoscopy, a higher concentration (4% or 10%) of local anesthetic is used for airway anesthesia.[6] We could find very little information on topical airway anesthesia, on the drug of choice and its dose and frequency of administration.

We chose midazolam or morphine, or both, as the sedative/analgesic agents in our study. Midazolam potentiates the analgesic effects of morphine and the latter potentiates the sedative action of midazolam.

The patients' levels of sedation and anxiety were assessed using a six-point scale similar to the Ramsay sedation scale. Monitoring the degree of sedation in the ICU is inexact. However, the Ramsay scale is the most widely-used scoring system in clinical studies in critically-ill patients. This scale evaluates the patient either in the awake or asleep state but does not convey information on the quality of sedation. Other authors have commented on the need for a new validated tool and scale to measure the efficacy of sedation in the ICU.[14]

We used 2% lidocaine (2.5 ml) to decrease the volume of placebo (normal saline) for prevention of excessive stimulation during instillation. Normal saline might not be a true control as patients cough and become restless for a few minutes in response to its instillation.

The total dose of lidocaine was 300 mg over 12 hours. The dose of lidocaine used for treatment of ventricular arrhythmias is significantly greater,[15] and we believe it is unlikely that toxicity would occur given the dose and duration of this study. Lidocaine is known to be absorbed rapidly from the tracheobronchial mucosa. We cannot exclude the effect of systemically absorbed lidocaine from our observations. However, studies investigating the effects of intravenous administration of lidocaine, as an antitussive and an agent to attenuate the cardiovascular response to intubation are inconclusive.[16,17] The short period of this study did not permit us to assess if tolerance to the local anesthetic occurred. Local anesthetics with a longer duration of action (e.g, bupivacaine) may be beneficial but there is a paucity of data on the mucosal use of such drugs. Moreover, high cardiovascular toxicity of this drug should be considered.

References

1 Bion JF. Sedation and analgesia in the intensive care unit. *Hospital Update* 1988; 14: 1272-86.
2 Paiement B, Boulanger M, Jones CW, Roy M. Intubation and other experiences in cardiac surgery: the consumer's views. *Can Anaesth Soc J* 1979; 26: 173-80.
3 Prielipp RC, Coursin DB, Wood KE, Murray MJ. Complications associated with sedative and neuromuscular blocking drugs in critically ill patients. *Crit Care Clin* 1995; 11: 983-1003.
4 Kollef MH, Levy NT, Ahrens TS, et al. The use of continuous i.v. sedation is associated with prolongation of mechanical ventilation. *Chest* 1998; 114: 541-8.
5 Reasoner DK, Warner DS, Todd MM, et al. A comparison of anesthetic techniques for awake intubation in neurosurgical patients. *J Neurosurg Anesthesiol* 1995; 7: 94-9.
6 Gal TG. Airway Management. In. Miller editor: Anesthesia.6th ed, Churchill Livingston, 2005. p. 1642.
7 Gonzalez RM, Bjerke RJ, Drobycki T, et al. Prevention of endotracheal tube-induced coughing during emergence from general anesthesia. *Anesth Analg* 1994; 79: 792-5.
8 Vorakitpokatorn P, Chintanapramote B, Raksamani A, Raksamani A. Intra-tracheal lidocaine for cough suppressi on during extubation. *Thai J Anesth* 1999; 25: 266-70.
9 Ramsay MA, Savage TM, Simpson BR, Goodwin R. Controlled sedation with alphaxalone-alphadolone. *BMJ* 1974; 2: 656-9.
10 Kress JP, Pohlman AS, O'Connor MF, Hall JB. Daily interruption of sedative infusions critically ill patients undergoing mechanical ventilation. *N Engl J Med* 2000, 342: 1471-7.
11 Rodriguez JL, Steinberg SM, Luchetti FA, et al. Early tracheostomy for primary airway management in the surgical critical care setting. *Surgery* 1990; 108: 655-9.
12 Nicolaou AJ, Tofte B, Leech RC, Beaumont AC. Early tracheostomy in ICU for patients with acute exacerbation of chronic obstructive pulmonary disease. *British Journal of Anesthesia* 1995; 74: A363.
13 Broachard L, Mancebo J, Wysocki M, et al. Noninvasive ventilation for acute exacerbation of chronic obstructive pulmonary disease. *N Engl J Med* 1995; 333: 817-22.
14 Hansen-Flaschen J, Cowen J, Polomano RC. Beyond the Ramsay scale: need for a validated measure of sedating drug efficacy in the intensive care unit. *Crit Care Med* 1994; 22: 732-3.
15 Hilleman DE, Mohiuddin SM, Mooss AN, et al. Comparative pharmaco-dynamics of intravenous lidocaine in patients with acute and chronic ventricular arrhythmias. *Ann Pharmacother* 1992; 26: 763-7.
16 Yukioka H, Hayashi M, Terai T, Fujimori M. Intravenous lidocaine as suppressant of coughing during tracheal intubation in elderly patients. *Anesth Analg* 1993; 77: 309-12.
17 Singh H, Vichitvejpaisal P, Gaines GY, White PF. Comparative effects of lidocaine, esmolol, and nitroglycerin in modifying the hemodynamic response to laryngoscopy and intubation. *J Clin Anesth* 1995; 7: 5-8.