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Smooth Extubation – Does Morphine Need a Comeback?

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ABSTRACT

Background: Extubation is a day-to-day procedure in anaesthetic practice with inherent complications; the incidence of described respiratory complications being higher than during intubation. If the procedure of extubation turns out to be choppy, the incidence is furthermore.

Methods: A complete search of the databases Cochrane, PubmedScopus with words: extubation, recovery, smooth, morphine was done

Results and Discussion: Extubation can be difficult in patients undergoing head and neck surgeries, patients with significant cardiorespiratory illness and those with a high body mass index. Extubation in a deeper plane is not uncommon and has its advantages and disadvantages. The frequent side effects which hinder smooth extubation in a routine case are cardiovascular stimulation, coughing, pain and inadequate narcosis. If we think in the reverse, in the absence of the above-said problems, extubation can be smooth. The process also differs with the type, duration and site of surgery. Polypharmacy with novel drugs like fentanyl, lignocaine and dexmedetomidine is likely to target the adverse issues separately and can still impede smooth extubation. The versatile natural opioid morphine has antitussive, narcotic, hypotensive and bradycardic effects. With a similar respiratory adverse effect profile as multiple doses of fentanyl, the cost-effective drug morphine can very well make a comeback to make extubation smooth. The comprehension of timed and synchronized administration of the reversal agent and withdrawal of the inhalational agent is earned with the rich experience of blending art and science.

Conclusion: We opine that morphine as a single drug may effectively do the job of the combination of drugs in achieving smooth extubation.

Key Words: Anaesthesia, General, Recovery, Extubation, Smooth, Opioids, Morphine

INTRODUCTION

General anaesthesia with endotracheal intubation is one of the commonest modes of anaesthetic techniques used globally by all anesthesiologists. The act of removing the tube at the end of surgery and anaesthesia is termed extubation. A lot of complications are associated with the process of extubation.¹ Even though a lot of literature is available on intubation and its side effects, not much is attainable on extubation. There are a few described complications associated with extubation like mechanical failure, cardiovascular stimulation, coughing, bucking, emergence agitation and pain to name a few.² These side effects can aggravate or worsen pre-existing systemic illnesses and make the recovery and extubation

complicated. Smooth extubation has not been defined so far. We have tried to define it as a technique wherein the patient has adequate narcosis to respond to oral commands, tolerate the tube without coughing, having much pain or a surge in sympathetic stimulation. This cannot be achieved in all cases as it depends upon many factors like the size and duration of surgery and the amount of analgesia received. Extubation of a patient after completely reversing him and keeping him in deeper planes of anaesthesia is known as deep extubation. Neurosurgery and ophthalmic surgeries may require this technique to avoid bucking which in turn may undesirably increase the intracerebral and intraocular pressures.³ One of the potential pitfalls associated with this technique is in dealing with an unconscious patient with an unprotected

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airway. It is more feasible in patients with an easy airway and who are at minimal risk of aspiration. Many don't practice this technique for fear of respiratory complications and the need for close monitoring post-procedure.⁴ Innumerable techniques and drugs have been described to make the process smooth. Drugs like lignocaine (intravenous and into the ETT cuff), dexmedetomidine, synthetic opioids like fentanyl and remifentanyl and a combination of them have been used to decrease the incidence of each of these complications.⁵ We have tried to analyze the pharmacology of the old drug morphine and its use in intraoperative analgesia (in a titrated manner) as well as in blunting the side effects which may hinder smooth extubation. Hence, we propose the need for the resurgence of the cost-effective drug morphine as a sole drug to answer the drawbacks of polypharmacy and to effectively achieve smooth extubation.

DESCRIPTION OF A ROUTINE TECHNIQUE OF EXTUBATION

The plan of smooth extubation is unfortunately done approximately 10 – 15 minutes before the end of the surgical procedure by most of us. The thought process of smooth extubation should begin right from the administration of the premedication drug and its appropriateness to the patient. The intraoperative events and the subtle modifications of pharmacology during the times will influence the process of extubation.⁶ Towards the end of the surgery, stopping the administration of inhalational agent plays a crucial role. The flows and the breathing system decide the steps which we may need to take. Factors that determine the time we need to stop administering the anaesthetic agent include the nature of the agent, type of surgery and level of analgesia (presence or absence of regional blocks). After the patient makes a few attempts to breathe and upon confirming at least 2 twitches on a train of four monitors, the reversal is administered and a thorough oropharyngeal suctioning is done. Elimination of the anaesthetic agent should be in synchronization with skeletal muscle recovery.^{5,6} The patient is usually positioned supine or but with a prone or a minimal head-up position in rare selected cases. Generally, 100% oxygen is administered, the cuff is deflated along with a positive pressure breath (preventing atelectasis). The plasters should be removed slowly to avoid any head and neck movements. The patients should obey oral commands, be able to sustain a spontaneous head lift for five seconds and breathe normally with adequate tidal volumes. These are a few of the classically described criteria for removing the tube. Removal of the tube is usually carried out at end-inspiration when the glottis is fully open to avoid trauma and laryngospasm⁷. The process will not be as easy as described in all the cases. The complications of extubation and their management are elaborated as follows.

CARDIOVASCULAR RESPONSE

Cardiovascular complications after tracheal extubation are three times more common than those that occur during tracheal intubation. Hypertension and tachycardia associated with extubation are well-documented events. Tracheal extubation is known to produce a 10–30% increase in both the arterial pressure and heart rate which usually lasts for 5–15 min.⁸ Actually, the hemodynamic imbalance reflects sympathoadrenal response probably due to epi-pharyngeal and laryngopharyngeal stimulation. There is a distinct increase in plasma catecholamine levels and activation of both alpha- and beta-adrenergic receptors.⁹ This increase in blood pressure and heart rate is usually transient and similar to the one occurring during intubation. There is an increased chance of precipitation of adverse events like myocardial infarction, pulmonary oedema and stroke. This response can be obtunded by the administration of innumerable drugs. Among the beta-blockers, esmolol (1.5 mg/kg) and labetalol (0.25 mg/kg) attenuated the adverse hemodynamic response.¹⁰ Esmolol was more efficient than labetalol at extubation. The authors have deduced that labetalol blunts tachycardia better but esmolol blunts hypertension better.¹¹ This may look different in the context of the pharmacokinetics of both drugs. In another study¹² by Rehman *et al* 2015., the authors have concluded that metoprolol infusion was better than verapamil and placebo in controlling the hemodynamic response to extubation. This study was particularly done on hypertensive patients who underwent general anaesthesia. In these studies, there was no clear mention of smooth extubation though the time to extubate after administration of reversal were similar. In yet another study, the authors have noted in patients undergoing intracranial surgery, severe hypertension and/or tachycardia occurred in 92% of patients during extubation.¹³ Prophylactic esmolol infusion for the control of hemodynamic disturbances during extubation is feasible and safe. They deduced that the acceptable level for obtundation of sympathoadrenal response was evident at 100 micrograms/kg/min but they suggested that a rate of 200 micrograms/kg/min may be more effective. It has proved beyond doubt that with or without establishing complete analgesia, morphine attaches to the mu receptors in the central nervous system to attenuate the central sympathetic drive thereby causing hypotension and bradycardia. A few authors have demonstrated the action of morphine attenuating the surge of catecholamines after any insult.¹⁴ Morphine blunts the autonomic reflexes better than fentanyl in smaller doses. Even though fentanyl has got analgesic properties comparable with equipotent doses of morphine, the attenuation of the sympathetic surge and better narcosis put morphine ahead with regards to tube tolerance and hemodynamic stability. Intravenous lignocaine, magnesium and many other drugs have been described but they have not stood the test of time. Intravenous lignocaine has negligible analgesic activity

against the nociceptive component of pain, even though it has antitussive and cardiovascular surge attenuation.¹⁵ Gosai *et al* 2015., have compared dexmedetomidine and intravenous lignocaine and established that dexmedetomidine is better in suppressing adrenal response to extubation.¹⁶ Excessive sedation and bradycardia and the hassle of setting up an infusion in selected cases makes dexmedetomidine less preferable for routine use. Even bolus doses of dexmedetomidine have to be given slowly and carefully to avoid side effects. This necessity of additional dexterity at the end of surgery and the excess cost is not needed in routine cases. To summarize, the prudent intraoperative administration of morphine is bound to take care of both the sympathetic surge and pain and hence the drug demands a resurgence in common clinical use.

COUGH SUPPRESSANT

Cough is a forced expulsive manoeuvre, usually against a closed glottis and which is associated with a characteristic sound.¹⁷ If the patient cannot achieve full inspiration but expels forcefully with the endotracheal tube in situ, it's termed as bucking even though clear-cut differences are lacking in the literature. Tube tolerance before extubation and the absence of bucking is one of the desirable qualities of smooth extubation. Coughing and bucking occur in 40 % of patients during emergence.¹⁸ In addition to discomfort, coughing has important pathological consequences: increased intrathoracic pressure with a resultant decreased venous return to the heart, increased intra-abdominal pressures and a decreased functional residual capacity. These changes may not augur well in a patient with significant cardiorespiratory disease. Lidocaine, remifentanyl, dexmedetomidine and fentanyl are some of the drugs used to decrease the incidence of cough. Codeine and morphine are better antitussives than the newer drugs like fentanyl and remifentanyl.¹⁹ Extubation times and hemodynamic stability are also vital in selecting an antitussive. Prolonged extubation times may hamper the case turnover of the operating room. An unrushed yet fast and smooth recovery is needed for a safer transfer of patients. Remifentanyl and dexmedetomidine are prone to cause excessive bradycardia and hypotension which may not be suitable in patients with hemodynamic instability. The antitussive action of dexmedetomidine is less than morphine and thus cannot be considered as an alternative in this regard. Intracuff inflation with lignocaine-sodium bicarbonate combination has been studied as an effective antitussive measure. The mechanism of action seems to be the seepage of the local anaesthetic into the tracheal mucosa to numb the same.²⁰ The procedure of inflating the cuff with lignocaine is not routinely practised and the fear of an anaesthetized tracheal mucosa at the time of extubation is not preferred by many anesthesiologists. Instead of using dexmedetomidine

for sedation with negligible antitussive action, a narcotic analgesic like morphine with notable antitussive action seems to be a more suitable alternative. The use of morphine has effectively decreased cough²¹ even in patients with chronic obstructive lung disease which is not shared by other opioids. This clinical effect can be effectively used in the setting of extubation to avoid polypharmacy.

EMERGENCE AGITATION

Emergence agitation is an undesirable immediate postanesthetic condition that occurs during recovery from general anaesthesia. It is typified by confusion, disorientation and violent behaviour. Even though it is common in pediatric patients, the incidence in adults is said to be between 4.7% and 21.3%.²² Emergence agitation can lead to serious sequelae like self-extubation, bleeding and removal of catheters. There is a risk that patients could fall off their beds. During this process, there is an increased risk for the medical staff to be injured. Even though many risk factors can increase the incidence of emergence agitation age, smoking, sevoflurane administration, pain and presence of endotracheal tubes or urinary catheters are some of the significant ones.²³ The incidence of agitation is high in patients undergoing nasal surgeries when they have the endotracheal tube in situ. The administration of dexmedetomidine is associated with decreased incidence of this complication but the postoperative pain is not well controlled. Hence, the addition of fentanyl to dexmedetomidine becomes imperative. Tube tolerance can be achieved by adequate narcosis and analgesia. These two factors can be conveniently handled by a shot of parenteral morphine. PBK Chan(2002) found that 1 mg/kg of intravenous propofol just before extubation decreased the incidence of agitation but it seems impractical in many settings.²⁴ Extubation in a deep plane with an inhalational agent is suggested for certain cases but this is at the risk of having an unconscious patient with an unprotected airway. Yes, it may decrease the incidence of emergence agitation but at what cost? The knowledge of recovery time from agents is necessary to know when to switch off the dial. After receiving isoflurane a mean time of 108-minute of the institution of the agent in general anaesthesia, the time to eye-opening after discontinuing the inhalational agent was 18.5 minutes (range 11–30, median 18 minutes).²⁵ But in the case of desflurane, the meantime from discontinuation to eye-opening was 5.2 minutes (SD=1.6, range 3-10).²⁶ This time was not related to the duration of anaesthesia (60-256 minutes), total fentanyl needed, nor the body mass index. This duration may vary with the use of low flow systems. The reversal agent neostigmine may take a mean time of 6.9 minutes to significantly reverse the neuromuscular blockade in non-obese routine cases.²⁷ Hence, we need to synchronize the discontinuation of the inhalational agent and administration of the

reversal agent. This comes with a blend of experience and knowledge.

There are innumerable other drugs like nefopam, tramadol, clonidine etc which can decrease the incidence. All these techniques will end up using multiple agents. The need for such polypharmacy and its side effects is in question? Rapid awakening and pain have been associated with increased incidence of risks of emergence agitation. The combined effect of dexmedetomidine and fentanyl can be conveniently addressed by single narcotic morphine because pain and inadequate sedation are the prime reasons for emergence agitation. These effects are addressed by morphine as a single drug. The uncertainty remains: Can the drug combination with newer ones be replaced by a single old drug?

AIRWAY OBSTRUCTION

Airway obstruction is a life-threatening complication that hampers smooth extubation. Laryngospasm, laryngeal oedema and vocal cord paralysis are some of the causes of upper airway obstruction occurring immediately after the following extubation. These are different topics that need to be discussed separately. It is also important to remember a few mechanical causes of airway obstruction with foreign bodies (throat packs, dentures and blood clots). All these conditions require immediate attention and action to relieve the obstruction²⁸. The incidence of such complications is not going to be modified by the administration of either novel assorted combinations or a unique old drug. To be precise, morphine alone is not going to affect the incidence of complications like airway foreign bodies.

MECHANICAL CAUSES

In a few uncommon settings, the tube cannot be removed or pulled out. The pilot balloon and the inflation channel may be damaged thereby hindering deflation and removal. Herniation of the cuff and the adhesions to the tracheal wall may also be a reason. Even an abnormal fixation by a plaster may kink the tube. Most of these problems are not common in the era of disposable PVC tubes. The deflation of the cuff by a direct transtracheal puncture or with the help of a USG machine will help settle the problem in certain situations. In certain instances, reinflation, pushing the tube further and deflation and retrying for extubation may help. Tethering of the tube by surgical sutures will need re-exploration and cutting off the sutures to free the tube. Such mechanical causes may occur with any technique of drug administration^{7,29}. Hence a cost-effective singular drug like morphine can be definitely preferred to polypharmacy.

DISCUSSION AND ANALYSES

Smooth extubation is a long-quested phenomenon and to achieve the same in every case becomes a dream for every anesthesiologist. Yet, this aspect of anaesthesia is not studied much in detail. The complications which prevent smooth extubation can be mechanical causes like forgotten packs and trapped tube cuffs. These can be addressed after a timely diagnosis. The most common complications with disorderly extubation are cough, adrenergic response, pain and agitation. Intravenous lignocaine can counter both coughing and cardiovascular response but is inefficient in completely helping tolerate the tube due to the absence of narcotic property. For this to be achieved, a narcotic like fentanyl along with a sedative like dexmedetomidine need to be combined. Dexmedetomidine alone can cause bradycardia with less analgesic and narcotic component. The need for an infusion device makes dexmedetomidine more cumbersome. Inflation of the cuff with lignocaine can decrease cough but this may numb the tracheal mucosa which may prove counterproductive due to the risk of aspiration. The oldest known opioid, morphine, produces enough narcosis to make patients tolerate the tube yet conscious enough to answer oral commands. It produces significant analgesia and is an efficient antitussive. The problem of respiratory depression is equivalent to multiple doses of fentanyl; still, it is a better adrenergic suppressant than fentanyl. It has been pronounced for decades about the associated problem of nausea and vomiting with opioids. When compared to morphine, fentanyl produces a lesser incidence of nausea and vomiting at the cost of decreased pain relief. This morphine associated nausea is usually seen a few hours after administration especially in ambulated patients. Otherwise, the side effect profiles of both the drugs are similar. The question remains: Is Morphine the answer for smooth extubation than switching over to multiple newer drugs? Yes, thought should be given for the resurgence of morphine, at least in routine cases undergoing general anaesthesia to ensure cost-effective and comfortable extubation.

CONCLUSION

Respiratory complications after tracheal extubation are three times more common than those occurring during tracheal intubation. It's essential to decrease the incidence of such complications and their associated morbidities. Extubation is also associated with adverse cardiovascular events and emergence agitation. Smooth extubation is desirable in every case. There is increased use of polypharmacy of fentanyl, lignocaine and dexmedetomidine to handle extubation. These drugs have their side effects other than escalating cost. Instead of multiple newer drugs addressing every component of adverse effects, it is possible to have the old warhorse morphine as a single drug to achieve smooth extubation in the majority of the routine cases.

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Authors Contributions:

Dr. SPS has designed the concept, written the script and searched the database.

Dr V.V.Subramanian has helped in writing and editing the script.

Dr MR has done the supervision and communication.

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