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Post-Operative Respiratory Complications in Morbidly Obese, What can we do?

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Abstract

Morbidly obese patients are subjected to postoperative respiratory complications due to the presence of respiratory co-morbidities, inadequate pain relief and the extensive use of opioids with its ventilatory depressiveside effects. The use of combination of multiple analgesic adjuvants such as Dexmedetomidine, Ketamine and Xylocaine that are not only devoid of respiratory depression but also enhance bronchodilatation and prevent bronchospasm could be of help to provide effective analgesia, substantially reduce or eliminate the need for opioid analgesics, reduce respiratory complications in morbidly obese patients.

Introduction

For long period of time opioids has been considered as the gold standard for relieving the postoperative pain because it possesses a very strong analgesic action [1]. As time passes, the disadvantages of opioids have drawn the attention to its limitations because of its profound adverse effects such as, nausea, vomiting, pruritus, urinary retention and respiratory depression [2]. Since then, an enormous effort was devoted demanding the discovery of new analgesics that are devoid of such side effects. On the way of searching an opioid alternative and implementing multimodal analgesia many analgesic adjuvants have been tried. The idea was to reduce the opioid dosage and subsequently, reduce their adverse effects. Nevertheless, up to date opioids are still being extensively used for postoperative analgesia. Indeed, a single analgesic adjuvant only provides weak analgesia that cannot stand alone to confrontanagonizingpostoperative pain storm. Therefore, combination of multiple analgesic adjuvants may lead to an effective reduction of opioids and their unwanted effects. Morbidly obese patients suffer many respiratory problems including, reduced functional residual capacity and increased shunting and obstructive sleep apnea. These characteristics render them more susceptible to postoperative pulmonary complications such as pulmonary atelectasis, increased sensitivity to opioids, hypoxia and hypercarbia [3,4]. Amongst these, increased sensitivity to narcotic induced respiratory depression is of particular concern [5]. This particular issue would limit the use of high doses of narcotic analgesics for controlling their postoperative pain resulting in inadequate pain control and more atelectasis. Amongst analgesic adjuvants, Dexmedetomidine have shown attractive pharmacological properties. Dexmedetomidine is the pharmacologically active dextro-isomer of medetomidine and displays specific and selective α2-adrenoceptor agonism [6]. Dexmedetomidine has 8 times more affinity to the receptor than does clonidine [7]. Dexmedetomidine has a wide safety window regarding its respiratory effects, increasing its dosage up to15 times does not result in respiratory compromise where hypercapnic arousal is still preserved [8]. Unlike opioids, benzodiazepines, or Propofol, Dexmedetomidine can safely be infused during tracheal extubation and in the recovery room [9]. DX sedation is associated with preservation respiratory rate, CO_2 tension and Oxygen saturation making it a good candidate for sedation in pediatric and bariatric population [10-12].

The Use of Dexmedetomidine for Morbidly Obese

Respiratory co- morbidities in morbidly obese may extensively influence the anesthetic management of these patients. The anesthetic goals are to produce adequate pain relief without respiratory compromise. Dexmedetomidine has been used as an adjuvant to general anesthesia to reduce the use of narcotics and hence decrease the incidence of respiratory depression [12]. When compared to fentanyl, dexmedetomidine appeared to provide better postoperative analgesia and to blunt hemodynamic changes [13]. Dexmedetomidine offers a unique advantage to morbidly obese patients providing sedation and analgesia without respiratory depression. It has been shown that a continuous Dexmedetomidine intraoperative infusion improves postoperative analgesia

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Table 1: Pharmacological actions of dexmedetomidine versus ketamine.

	Dexmedetomidine	Ketamine	Effect
Mechanism	α 2 receptor agonist	NMDA receptor antagonist	
Sympathetic outflow	Inhibit	Stimulate	Antagonism
Blood pressure	Decrease	Increase	Antagonism
Heart rate	Decrease	Increase	Antagonism
Airway reflexes	Preserve	Preserve	Synergism*
Respiration	No effect on normal breathing	Bronchodilation	Synergism*
Agitation	Reduce	Increase	Antagonism
Salivation	Reduce salivation	Increase salivation	Antagonism
Analgesia	Increase	Increase	Potentiation.

and reduces opioid consumption following laparoscopic sleeve gastrectomy [14].

Baerdemaekera and Margarson reported that Dexmedetomidine is an ideal adjuvant for morbidly obese anesthesia and is usually started with a loading dose of 0.5 ug/kg lean body weight over 10 min, followed by continuous infusion of 0.2 ug/kg/h to 0.8 ug/kg/h. If necessary postoperative dexmedetomidine can be continued at an infusion rate of 0.1 ug/kg/h to 0.2 ug/kg/h [10].

Combination of Dexmedetomidine, Ketamine and Xylocaine do this help?

One of the promising combination is Dexmedetomidine with ketamine, this combination has many attractive benefits given the diversity of pharmacological action of both drugs, it appears that they have both antagonistic and synergistic effects Table 1 shows the diverse clinical effects of both dexmedetomidine and ketamine. Their antagonism would decrease the side effects of each other while their synergism would enhance the wanted pharmacological effects therefore, it is expected that this combination would provide an effective analgesia without respiratory depression or inhibition of airway reflexes.

Both dexmedetomidine and Ketamine work together to augmentthe analgesic effect without respiratory depression. In the meantime, they work against each other to reduce their own adverse effects (Table 1). Ketamine is a non-specific NMDA receptor antagonist that inhibit the N-methyl-D-Aspartate receptors by a noncompetitive antagonism pathway [15,16]. It has an analgesic effect persists for steady-state plasma concentrations above 100 ng/ml to 160ng/ml [17,18]. Ketamine increases salivary secretion [19], and this may benefit from the antisialogouge action of dexmedetomidine [20]. Both Corssen and colleagues and Strube et, al used ketamine as bronchodilator for asthmatic patients and status asthmaticusit decreasedbronchospasm and the airway resistance [21,22]. The mechanism of this bronchodilatation is a combination of drug-induced increase in sympathetic stimulation, a directsmooth-muscle dilating effect, and decreased centrallymediated vagal outflow.

Alpha-2 agonists such as clonidine and dexmedetomidineare able to decrease this hyperadrenergic state as well asthe psychic phenomena induced by ketamine [20]. Adding xylocaine to this combination would have a synergistic analgesic action that may result in an opioid free anesthesia and analgesia. Choice of the doses and modes of administration warrants further research. Perioperative systemic lidocaine has analgesic, anti-inflammatory properties and is reported to accelerate the return of bowel function after surgery [23]. Xylocaine may enhance analgesia through inhibition of peripheral neuropeptide release or by its central antihyperalgesic effect [24,25]. Combination of the three drugs to replace opioids as adjuvant to general anesthesia and postoperative analgesia would be of particular benefit for the morbidly obese patients. All the three medications provide additive analgesia without respiratory depression. In addition, ketamine and xylocaine can benefit asthmatic patients and patients with hyperactive airways providing bronchodilatation and preventing reflex laryngospasm and bronchospasm in response to airway instrumentation.The opioid free multimodal anesthesia and analgesia is expected to substantially reduce the postoperative respiratory complications in morbidly obese patients.

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