Impact of Dexmedetomidine Infusion on Desflurane Consumption and Hemodynamics during Laparoscopic Cholecystectomy:Randomized and controlled study

Thesis

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Dedication

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Ahmed hassanmohammed

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List of Abbreviations

α_2-AR	Alpha-2 receptors
µg	Microgram
ASA	American Society of Anesthesiologists
ATPase	Adenosine triphosphate
BMI	Body mass index
Ca	Calcium
CNS	Central nervous system
Co	Cariac output
CO_2	Carbon dioxide
cTn	cardiac troponin
DBP	Diastolic blood pressure
ECG	Electrocardiograph
EEG	electro encephalo gram
$ETCO_2$	End tidal carbon dioxide
FDA	Food and Drug Administration
FGF	Fresh gas flow
GABA	Gama amino butyric acid
H	Hour
HR	Heart rate
IM	Intramuscular
IV	Intravenous
Kg	Kilogram

L	Liter
MAC	Minimum alveolar concentration
MBP	Mean blood pressure
mg	Milligram
mL	Milliliter
NIBP	Noninvasive blood pressure
PACU	Post anesthesia care unit
PP	pneumoperitoneum
SBP	Systolic blood pressure
SD	Standard deviation
SpO_2	Peripheral capillary oxygen saturation
SVR	Systemic vascular resistence
t½α	Distribution half-life
t½β	Elimination half-life
vol	Volume

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Abstract

Desflurane is the most expensive inhalational agent so it is better to maintain its anesthetic effect with a lesser amount for cost consideration and reducing the incidence of any adverse effects. Previous studies reported that dexmedetomidine reducedthe anesthetic consumption concerning sevoflurane, isoflurane and total intravenous anesthesia with propofol together with intraoperative hemodynamic stability as well asreduction of postoperative analgesic requirements. However no study was performed on dexmedetomidine effects on desflurane consumption.

Laparoscopic cholecystectomy is considered as a “gold standard” treatment of choice for cholelithiasis. Carbon dioxide (CO_2) is, usually, used to produce pneumoperitoneum (PP) during laparoscopic surgical procedures. Both CO_2 and PP cause adverse cardiovascular and hemodynamic effects.

Key words:

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Introduction &
Aim of the Work

INTRODUCTION

Dexmedetomidine, the pharmacologically active d-isomer of medetomidine, is a potent and highly selective α-$_2$ adrenoceptor agonist with sympatholytic, sedative, amnestic, and analgesic properties. Clonidine, the prototype of alpha$_2$-agonists, has been widely used as an adjunct to anesthesia and pain medicine; however, it has been little used as sedative [(1)].

Dexmedetomidine compared to Clonidine is a much more selective alpha$_2$-adrenoceptor agonist, which might permit its application in relatively high doses for sedation and analgesia without the unwanted vascular effects from activation of alpha$_1$-receptors. In addition, Dexmedetomidine is shorter-acting drug than clonidine and has a reversal drug for its sedative effect, Atipamezole [2]. In addition to sedative effects, dexmedetomidine has been labeled as "analgesia sparing" by the Food and Drug Administration (FDA). It decreases central nervous system sympathetic outflow in a dose dependent manner and has analgesic effects without respiratory depression and can be used safely for patients at risk for respiratory decompensation even when co-administered with opioids [3]. Dexmedetomidine is suitable for sedation and analgesia during the whole perioperative period: as premedication, as an anesthetic adjunct for general and regional anesthesia, and as postoperative sedative and analgesic. In addition, the infusion of dexmedetomidine will not significantly affect the recovery from anesthesia as indicated by time for tracheal extubation [(4)].

Desflurane exhibits very low solubility in water with a corresponding low blood/gas partition coefficient (0.42) which is lower than that of other potent inhaled anesthetics such as isoflurane (1.4) and even lower than that of nitrous oxide (0.46). Pharmacokinetic studies in animals as in man indicate that

desflurane washes into the body more rapidly than other volatile anesthetics. It also washes out of the body more rapidly allowing quick recovery and flexibility in adjustment of the depth of anesthesia. Desflurane is eliminated via the lungs, undergoing only minimal metabolism (0.02%) [(5)].

Desflurane is the most expensive inhalation agent so it is better to maintain an anesthetic effect with a lesser amount of volatile anesthetics because cost considerations and decrease any adverse effects. Previous studies reported that the consumption of sevoflurane, isoflurane and total intravenous anesthesia with propofol was decreased when combined with dexmedetomidine providing intraoperative hemodynamic stability and reduces the requirements of postoperative opioid analgesics. But to our knowledge, no researches was performed to evaluate the combination of dexmedetomidine with desflurane [(6)].

Laparoscopic cholecystectomy is considered as "gold standard" treatment of choice for cholelithiasis. Carbon dioxide (CO_2) is, usually, used to produce pneumoperitoneum (PP) during laparoscopic surgical procedures. Both CO_2 and PP causes adverse cardiovascular and renal effects. There is a significant change in the homeostasis observed after PP and position (reverse Trendelenburg position) used for laparoscopic surgeries. Hypercapnia and PP lead to stimulation of the sympathet ic nervous system, which causes release of catecholamine and vasopressin. PP affects several homeostatic systems, which leads to alteration in acid-base balance, stress response, cardiovascular and pulmonary physiology. The extent of cardiovascular changes associated with PP includes decrease in cardiac output and increase in systemic vascular resistance (SVR) which in turn compromise tissue perfusion and increase in mean arterial pressure. Hence, α2 adrenergic receptor agonist was used for prevention of hemodynamic responses associated with laparoscopic surgery [(7)].