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Research Article

Assessment of the effect of dexmedetomidine in high risk cardiac patients undergoing laparoscopic cholecystectomy

Rabie Soliman [a,b,*], Gomaa Zohry [b,1]

[a] Department of Anesthesia, King Fahad Military Hospital, Khamis Mushait, Saudi Arabia
[b] Department of Anesthesia, Cairo University, Egypt

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KEYWORDS

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Abstract *Background:* Laparoscopy results in pathophysiologic changes and potentiates a neurohormonal stress response which increases systemic vascular resistance, mean arterial blood pressure, and heart rate and the aim of present study was to evaluate the effect of dexmedetomidine in high risk cardiac patients undergoing laparoscopic cholycystectomy.
Methods: The study included 80 patients [cardiac patient with ASA physical status III–IV], and scheduled for elective laparoscopic cholycystectomy. The patients were classified randomly into two groups: Group D: The patients received a loading dose of 1 μg/kg dexmedetomidine over 15 min before induction and maintained with 0.3 μg/kg/h infusion during the procedure. Group C: The patients received an equal volume of normal saline.
Results: The heart rate increased greatly after induction in the control group compared to the group D ($P < 0.05$) and the heart rate remained elevated during the procedures and post-operatively. There was an attack of tachycardia affected 4 patients in group D and 10 patients in group C and the comparison was significant ($P = 0.044$). The mean arterial blood pressure increased greatly after induction in the control group compared to the group D ($P < 0.05$) and the mean arterial blood pressure remained elevated during the procedures and post-anesthesia care unit The total fentanyl dose was higher in the group C patients more than group D ($P < 0.001$). The end-tidal sevoflurane was lower in group D patients than group C patients ($P < 0.001$).
Conclusion: Dexmedetomidine is safe for cardiac patients undergoing laparoscopic cholycystectomy. It minimized the changes in heart rate and blood pressure and decreased the total dose of fentanyl and end-tidal sevoflurane and the requirement for medications in high risk cardiac patients.

* Corresponding author at: Department of Anesthesia, King Fahad Military Hospital, Khamis Mushait, Saudi Arabia. Tel.: +966 504852971.
E-mail addresses: rabiesoliman@hotmail.com (R. Soliman), gomaaneel@hotmail.com (G. Zohry).
[1] Tel.: +20 1140333553.

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1. Introduction

Laparoscopy has now become the standard technique for cholycystectomy. Pneumoperitoneum required for laparoscopy results in pathophysiologic changes and potentiates a neurohormonal stress response which increases the systemic vascular resistance, arterial blood pressure, and heart rate [1–3], and reduces the venous return, preload, stroke volume, and cardiac output [4,5]. These factors increase the afterload and decreases the preload which are tolerated in ASA I and II patients [6,7], and poorly tolerated by patients with cardiac dysfunction (ASA III–IV) [8,9].

Dexmedetomidine is a highly selective alpha-2 agonist that provides sedation and analgesia. It activates pro-survival kinases and attenuates ischemia and hypoxic injury, including cardioprotection [10]. Concurrent infusion during surgery reduces anesthetic consumption by 20–50% [11], and produces a decrease in heart rate and blood pressure that may be advantageous in ischemic heart disease by improving oxygen supply and demand balance [12].

The aim of the present study was to evaluate the effect of dexmedetomidine on the intraoperative hemodynamic stability in high risk cardiac patients undergoing laparoscopic cholycystectomy.

2. Methods and patients

After approval from the local ethics committee and obtaining written informed consent in the King Fahd hospital, Saudi Arabia, a study included 80 patients [cardiac patient with ASA physical status III–IV], undergoing elective laparoscopic cholycystectomy through 2012–2014. The inclusion criteria were patients with hypertension, coronary artery disease (ischemic heart disease or percutaneous transluminal coronary angioplasty, coronary artery bypass grafting), poor ventricular function, or valvular disease.

The patients were assessed using New York Heart Association (NYHA) [13], and American Society of Anesthesiologists Physical Status Score (ASA) [14]. Exclusion criteria included patients with congestive heart failure, obese patients or emergency. All patients were evaluated preoperatively by cardiologists and anesthesiologists. Investigations such as ECG and transthoracic echocardiography were done for all patients for evaluating the function of the myocardium and cardiac valves, diagnosis and treatment of ischemic heart diseases and patients on anticoagulants were managed by cardiologist preoperatively. All patients received their medications for hypertension, ischemic heart disease, or arrhythmia approximately two hours prior to anesthesia induction. The patients were classified randomly by simple randomization through a process of coin-tossing into two groups:

Group D: The patients received dexmedetomidine as a loading dose of 1 μg/kg over 15 min before induction and maintained with 0.3 μg/kg/h infusion during the procedure.

Group B (control group): The patients received equal amount of normal saline.

2.1. Anesthetic technique

For all patients and under local anesthesia, a radial arterial cannula and peripheral venous cannula G 18 or 16 were inserted and central venous line was inserted after induction for administration of inotropic drugs and vasodilators if needed. Anesthesia induction was started by preoxygenation with 100% oxygen, intravenous fentanyl (1–2 μg/kg), etomidate (0.3 mg/kg), and cisatracurium (0.2 mg/kg). After tracheal intubation, the anesthesia was maintained with sevoflurane (1–3%), fentanyl infusion (1–3 μg/kg/h), cisatracurium (1–2 μg/kg/min) and oxygen:air (50:50%).

For all patients, carbon dioxide insufflation was initiated and maintained at 5 L/min and the highest limit of intra-abdominal pressure was kept at 10 mmHg and the surgery was done in the supine position. Intraoperative fluids were given cautiously. Intraoperative increased heart rate and systemic hypertension were managed by bolus doses of fentanyl (1–2 μg/kg) and increasing of sevoflurane concentration 1–2%, and if hypertension persists, nitroglycerine infusion 0.5–1 μg/kg/min was started. Intraoperative hypotension was managed by bolus doses of ephedrine 5–10 mg and if persisted, dopamine infusion was started. At the end of the intervention and deflation of peritoneum, dopamine infusion was weaned gradually and discontinued in the operative room. The patients were transferred to post-anesthesia care unit with closed monitoring and observation for 2–4 h. Most of the patients were shifted to the ward, while few patients were transferred to the intensive care unit according to preoperative plan.

2.2. Monitoring of patients

The monitors included the heart rate, mean arterial blood pressure (MAP), a continuous electrocardiograph with automatic ST-segment analysis (leads II and V), arterial oxygen saturation, end-tidal carbon dioxide, end tidal sevoflurane, total dose of fentanyl, arterial blood gases. The heart rate and mean blood pressure were serially collected at the baseline; after induction of anesthesia; every 5 min during the procedure; at the end of surgery; and every 5 min in the post-anesthetic care unit. Also the incidence of hypotension, hypertension, tachycardia or bradycardia, and any adverse effects were recorded.

2.3. Outcomes

The primary outcome was stability of the hemodynamic status of the patients assessed by changes in the heart rate and blood pressure.

Secondary outcomes were total dose of fentanyl and end-tidal sevoflurane %. The safety of the procedure was assessed by the occurrence of any adverse events and the requirements to pharmacological support.

2.4. Sample size calculation

Power analysis was performed using Chi square test for independent samples on frequency of patients complaining of perioperative hemodynamic instability, because it was the main outcome variable in the present study. A pilot study was done before starting this study because there are no available data in the literature for the role of dexmedetomidine in high risk cardiac patients undergoing laparoscopic cholycystectomy. The results of the pilot study showed incidence of hemodynamic instability was of 20% in dexmedetomidine group, and 50%