

## Hemodynamic Stability of Dexmedetomidine in Laparoscopic Cholecystectomy Cases

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### Abstract

The advent of minimally invasive surgeries has heralded a new field in surgical practice. The procedure of laparoscopy has been most beneficial to the clinician and patient alike however, it has also been responsible for newer complications. The present study was conducted with a view to ascertain if the hemodynamic instability brought about by pneumoperitoneum be effectively counteracted by using dexmedetomidine in cases of elective laparoscopic cholecystectomy. The study employed 30 subjects and who were evaluated in pre, intra and post operative stages for HR and BP. The results showed a significant difference between parameters of subjects who were administered the study drug and a corresponding control sample. The study concluded that the benefits of dexmedetomidine are accurate and the drug must be considered as a necessary adjuvant in all minimally invasive surgeries.

**Keywords:** Cholecystectomy; Dexmedetomidine; Laparoscopy.

### Introduction

Presently, Laparoscopic cholecystectomy (LC) enjoys the status of being a safe, reliable and routine procedure, preferred by both surgeons and patients due to its minimal access technique which includes reduced postoperative pain, faster mobilization of the patient, reduced hospital stay, and better cosmetic results as compared to the open technique, which have further increased its applications.<sup>1</sup>

During laryngoscopic procedures done under general anaesthesia, such as intubation and extubation, these procedures which instigate a transient but marked sympathetic response in the patient which causes hypertension and tachycardia, both of which are detrimental to intra and postoperative recovery. Additionally, during laparoscopic surgery, to create a pneumoperitoneum

the most routinely used substance is CO<sub>2</sub>. This may lead to an increased level of catecholamines and vasopressin compounds in the patient, which further elevates the heart rate and blood pressure.<sup>2</sup>

An increase in intra-abdominal pressure with a raised diaphragm which occurs commonly with pneumoperitoneum, causes adverse effects on the cardiovascular system which include decreased cardiac output, raised arterial pressure, and increased systemic and pulmonary vascular resistance which further leads to hypertension and tachycardia, proving detrimental to the safe execution of procedure.<sup>3</sup>

Such elevations in blood pressure can be a risk factor in patients with pre-existing cardiac disease, or increased intracranial pressure. To avoid such adverse circulatory responses to pneumoperitoneum, drugs such as opioid

analogues, alpha-2-adrenergic agonists, beta-blockers, or vasodilators are administered.<sup>1,3</sup>

The present study was conducted to assess the effectiveness of dexmedetomidine in reducing the unfavourable inter operative cardiac manifestations during laparoscopic cholecystectomy.

## Material and Methods

The study was an prospective double blind study conducted in the OT and recovery ward of Pacific Institute of Medical Sciences, in Udaipur Rajasthan, the study employed a patient pool of 30 subjects who were divided in two groups. The first group involved subjects who were administered study drug viz dexmedetomidine, while the corresponding group was administered normal saline in similar doses. Institutional ethical clearance and written informed consent were obtained prior to start of the study.

The subjects included in the study were posted for elective laparoscopic cholecystectomy and were evaluated as Grade I or Grade II as per ASA. The patients were subjected to routine pre-anesthetic evaluation and fasting as per department protocols. Patients were blinded to the intervention used. All patients were made to undergo general anesthesia with similar protocol. The study drugs were given before the creation of pneumoperitoneum as a loading dose. Maintenance dose was given after creation of pneumoperitoneum and stopped at a predefined time interval before extubation.

Group 1 subjects received a loading dose of 1 ug/kg and maintenance infusion at the rate of 0.4 ug/kg/hr. Group B subjects received a similar dose and maintenance infusion at the rate of normal saline. Intra-operative haemodynamic parameters such as heart rate, blood pressure were measured at regular intervals in the OT. Parametric notations continued in the recovery room for post operative assessment. Demographic and clinical data was collected as per a predefined proforma. Analysis was done using SPSS statistical analysis software in consultation with institutional statistician.

## Results

The study involved a sample size of 30 patients who were equally divided in two groups. The average of the subjects was  $47 \pm 3.77$  years. There were no statistically significant differences between the age and gender of the subjects. Prior history and clinical evaluations showed no significant findings.

No pre existing cardiac or systemic illnesses were reported by the subjects. Duration of surgery was between 60 to 120 minutes with an mean duration of  $78 \pm 18.14$  minutes.

The heart rate and blood pressure of both the groups did not display any significant differences in the pre operative stage. The mean systolic blood pressure for the entire population subset was  $108 \pm 14$  mmHg while diastolic was  $72 \pm 9$  mmHg. None of the subjects were on hypertensive medications. The observations showed a reduction in mean heart rate after the loading dose was administered in group 1. The analysis revealed that a statistically significant difference in values of mean HR between the two groups ( $p < 0.05$ ). The mean blood pressure values as recorded in the intra operative period at regular intervals from loading dose to extubation also revealed a statistically significant difference between the two groups. Fig. 1 and 2 represent the changes as recorded. The changes were recorded after loading dose of dexmedetomidine/saline, after intubation, after 20 min of pneumoperitoneum, after 60 min of pneumoperitoneum, after infusion was stopped, after extubation.

The observations revealed that the mean values were significantly lower in group that was administered dexmedetomidine as compared to the saline group. No post operative complications were reported in any of the cases.

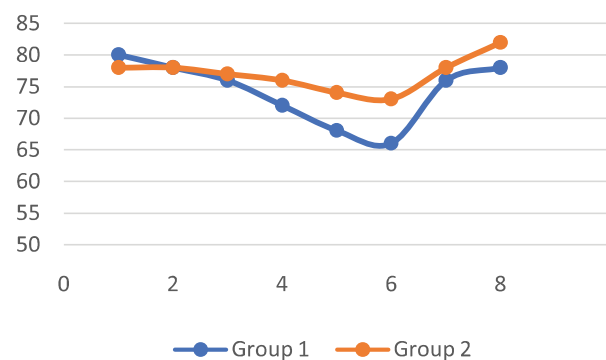


Fig. 1: Mean HR Values.

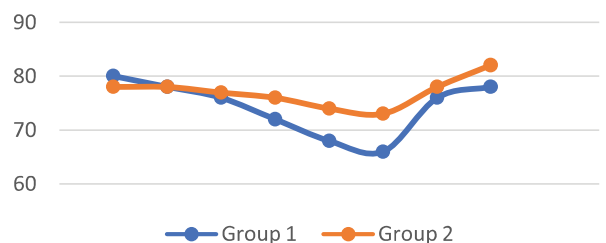


Fig. 2: Mean BP Values.

## Discussion

The present study was conducted with the objective to assess the hemodynamic efficiency of dexmedetomidine in reducing the unfavourable outcomes such as tachycardia, elevated BP in patients undergoing laparoscopic cholecystectomy. The literature review revealed that the effects of dexmedetomidine are due its activity on the central and peripheral nervous system, wherein its action leads to a reduction in circulation adrenaline levels which further cascades its action via a reduction in arterial blood pressure and heart rate. The central nervous system is acted upon through the activation of medullary receptors which lead to an activity on peripheral vasoconstriction modules leading to a stable and sustained reduction in blood pressure. This activity though still in the form of a accepted hypothesis may be the reason for the reduced levels of HR and BP in the group of patients who were subjected to dexmedetomidine use.<sup>4,6</sup>

Study by Lawrence CJ and De Lange S<sup>7</sup> had stated that hemodynamic stability and dexmedetomidine use were corelated in their study sample and concluded that this may infact be a drug of choice when cases are suspected of having a cardiovascular element that can cause intra and post operative complication, which is further concurrent with the findings observed in our trial. The findings were similarly reported in studies by Aho M et al<sup>8</sup> wherein the authors reported a sustained hemodynamic stability from the initial administration upto the stage of extubation in subjects given the drug. This further strengthen s ours findings.

We surmised that the use of a drug such as dexmedetomidine was effective in supplementing the anaesthesia protocol by providing a stable hemodynamic environment from the induction to post operative stage with no complications seen in recovery.

## Conclusion

The study concluded that the use of dexmedetomidine as an anaesthetic adjuvant was effective and beneficial in reducing the onset of any possible intra operative and peri operative complications. The drug showed a substantial stabilization of blood pressure and heart rate in the selected study sample and displayed no

post operative adverse reactions in the selected subjects. In minimally invasive surgery the use of dexmedetomidine can prove to be a beneficial additive for the surgeon, anaesthetist as well as the patient.

*Limitations:* The study is limited by the lack of a larger sample size/

*Conflict of Interest:* Nil

*Source of Funding:* Self Funded.

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