

Comparison of Hemodynamic Parameters between Patients Treated with Dexmedetomidine and Those Treated with Fentanyl during Laparoscopy

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Abstract:

Background: Laparoscopic surgery is preferred for its advantages in shorter hospital stay, less amount of blood loss and aesthetic incisions. The problems are however evident when the complications of hemodynamic disturbances are enhanced due to pneumoperitoneum. Several newer formulations have been tried to overcome this problem so that issues of hemodynamic stability can be addressed. Aim: The present study aims to comparatively evaluate the hemodynamic effects of dexmedetomidine and fentanyl in subjects undergoing elective laparoscopic surgeries.

Methodology: The study involved a subject pool of 60 patients who were divided equally in two groups and administered the study drugs. Parameters of hemodynamic stability were recorded and analysed to ascertain comparative efficacy.

Results: The mean HR, SBP, DBP, MAP and sedation score were better in dexmedetomidine group as compared to fentanyl group.

Conclusion: Dexmedetomidine is an effective adjuvant to anaesthetic medications in laparoscopic surgeries with a disadvantage of longer surgery duration as compared to fentanyl.

Keywords: Dexmedetomidine, Comparative evaluation, fentanyl, Laparoscopic surgeries.

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Introduction

The advent of laparoscopy has been accompanied with a phenomenal rise in use of this minimally access process for surgical procedures in the abdominal cavity. The ease of access, a steep learning curve, aesthetic superiority and relative low loss of blood has pushed laparoscopic surgeries to the point of no return. [1] However the surgeries are not without risk. Laparoscopy involves the insufflation of the abdominal cavity with inert Carbon dioxide gas. This coupled with the positioning needs can create a number of cardiovascular complications in patients which need to be pre-treated or monitored for immediate resolution. [2] Additionally sympathetic stimulation occurs as a result of intubation, lapngoscopy and pneumoperitoneum formation. This can lead to a rise in Mean arterial pressure, heart rate and pulmonary vascular resistance. Altogether they are responsible for an elevated stress response in the body which can have a deleterious effect on the patients outcome. [3] This stress reposne management has been the core idea behind use of many drugs as anaesthetic adjuvants. The idea has been to determine a particular agent that can attenuate the responses of the sympathetic stimulation while providing a viable and pain free anesthetic experience. Among the various drugs studied,

dexmedetomidine (DEX) has been evidenced as being an agent which shows a highly specific α_2 agonist action. It has been known to reduce the stress response and provide adequate hemodynamic stability without any resultant reduction in respiration and analgesia. [4-6] Another agent, used commonly is Fentanyl. Fentanyl is a narcotic which acts primarily on the opioid receptors causing analgesia and sedation. The common sites of fentanyl use have been in the operating room and critical care sections of a hospital. [7] With this in mind, the present study was formulated to provide a comparative assessment of these two drugs in their ability to control and impart hemodynamic stability in patients undergoing laparoscopic procedures.

Material and Methods

The present study was a prospective, randomized cross sectional study conducted at Darbhanga Medical College and Hospital Darbhanga Laheriasarai, Bihar. Study Period April 2021 to May 2022, obtained prior to initiation of study. The study included a pool of 60 subjects divided in two equal groups of 30 subjects each. The first group was designated as Group D, while the second group was designated as Group F.

The inclusion criteria was as follows:

- ASA grade I and II
- Adult patients below 60 years of either gender.
- The exclusion criteria was as follows
- Pregnant/ lactating women
- Subjects on alpha blockers or heart rate less than 60/min
- Subjects with renal failure, cardiac compromises, ASA grade III or IV
- Emergency Cases

The subjects were randomly allocated as being in Group D or F. The patients were explained the need for the study and explained that the inclusion in study was voluntary. Informed consent was obtained in a language of their understanding. Routine pre-operative investigations and medications were administered as per institutional protocols.

In the operating room base line readings of Heart Rate (HR), Blood Pressure (BP), Respiratory Rate (RR), Mean Arterial Pressure (MAP) were done. The group D received 2 ml (200 µg) dexmedetomidine in 48 ml normal saline, while Group F received 4 ml (200 µg) in 46 ml Normal Saline. Ten minutes after infusion of drug dexmedetomidine or fentanyl, the parameters ECG, HR, RR, SBP, DBP, MAP and

SpO₂ were recorded.

The same parameters along with EtCo₂ were again recorded immediately after tracheal intubation and five minutes after tracheal intubation. Depending upon the vital parameters, pulse and BP, maintenance infusion rate of dexmedetomidine or fentanyl was increased in a stepwise manner from 0.2-0.7 µg/kg/hour till the end of surgery. Intraoperative sedation was augmented as and when required with Inj. propofol IV. Intraoperatively the parameters like ECG, HR, SBP, DBP, MAP, SpO₂, and EtCO₂ were continuously recorded. The parameters were recorded at pre determined intervals from prior to induction till 5 mins after release of pneumoperitoneum. Lastly two readings were done at 5 minutes and ten minutes after extubation.

The data was analyzed for central tendency and tests of significance in consultation with institutional statistician.

Results

The demographic ranges of the two groups showed no statistically significant differences when analyzed. The subjects of the two groups were comparable in their demography. (Table 01)

Table 1: Subject Demographics

Parameter	Group D	Group F	P Value
Age	36.88 ± 14.54	37.78 ± 12.34	NS
Gender (M:F)	12:18	11:19	NS
Weight	62±11.22	65 ± 10.43	NS
Duration of Surgery	91±32.04	86.22±18.23	NS

Table 2: Mean Hemodynamic Parameters

Parameter	Group D	Group F	P Value
Heart Rate	80.53±11.89	91.87±10.444	<0.05
Systolic BP	120.37±8.231	129.57±14.246	<0.05
Diastolic BP	74.27±4.168	79.17±11.815	<0.05
Mean Arterial Pressure (MAP)	90.17±8.069	98.03±11.028	<0.05
EtCO ₂	34±6.2	33.5±4.9	NS

The mean values of various hemodynamic parameters recorded in the pre-operative, intra-operative and post-operative period were compiled together. (Table 02) They showed that a statistically significant difference was seen in the values of Mean HR, Systolic BP, Diastolic BP and Mean Arterial Pressure (MAP) between the two groups. The Group D had lower values in all these parameters, while Group F had a significant elevation when analyzed at 95 % confidence interval. No significant difference was observed in values of EtCO₂ in between these two groups, denoting respiration was not affected.

Discussion

It is established that formation of a pneumoperitoneum will cause a elevation in resistance of blood

vessels, mean arterial pressure while reducing the cardiac activity in terms of contractility. It also causes a hypercarbia stage due to the use of CO₂ which can further cause a stimulation of sympathetic centers leading to an elevation in blood pressure. [8,9] In terms of sedation scores, it was observed in the present study that dexmedetomidine produces a better sedation with a higher Ramsay sedation score as compared to fentanyl. This is similar to studies by Keniya VM et al and Vaswani JP et al who reported similar results. [7,10]

The present study showed a lower mean heart rate in dexmedetomidine group of patients as compared to fentanyl group of patients. It is postulated that dexmedetomidine has a better sympatholytic action and is able to depress the adrenergic responses to

intubation. This is seen in our study and is in concurrence with Suparto et al [11] In the present study, there is less fluctuation in SBP and DBP and MAP in dexmedetomidine group in comparison to fentanyl with p-value <0.05. This implies that dexmedetomidine had attenuated stress response at these time points. Similar findings were observed by Vaswani JP et al and Patel CR et al who found lesser increase in SBP (6% vs 23%), DBP (7% Vs 20%) after intubation with dexmedetomidine 1 µg/kg as compared to fentanyl 2 µg/kg when given as loading dose prior to induction [7, 12]. The present study also showed observation in concurrence with studies by Gupta K et al and Shareef SM et al who concluded that pre medication with dexmedetomidine reduced the hemodynamic response to pneumoperitoneum. These authors also added that a reduced increase in BP, MAP and HR was seen as a direct result of dexmedetomidine. [13,14]

Conclusion

The present study concludes that when compared to fentanyl, dexmedetomidine causes greater attenuation of stress response to tracheal intubation, following pneumoperitoneum and in peri-operative period resulting in greater stabilization of HR, SBP, DBP, MAP, thus ensuring better haemodynamic stability in patients undergoing elective laparoscopic surgery. Dexmedetomidine also provides better sedation while maintaining patients arousability and has more analgesic sparing effect and causes lesser requirement of anaesthetic agent in perioperative period without much adverse effect. A limitation in the present study was the small sample size, but further studies with larger and diverse sample sizes can provide with a better overview of the conclusions of this study.

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