COMPARATIVE STUDY OF FENTANYL, BUTORPHANOL AND NALBUPHINE IN ATTENUATION OF HAEMODYNAMIC RESPONSES IN LAPAROSCOPIC CHOLECYSTECTOMY

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ABSTRACT

BACKGROUND

Numerous attempts have been made in the past to attenuate the haemodynamic responses occurring during laparoscopic cholecystectomy. The present study compared the effect of three opioids namely Butorphanol, Fentanyl and Nalbuphine in obtundation of haemodynamic responses in laparoscopic cholecystectomy in terms of Heart rate, BP (SBP, DBP and MAP) and secondary aim was to calculate duration of analgesia and sedation score.

MATERIALS AND METHODS

This was a randomised study comparing three opioid drugs- nalbuphine, fentanyl and butorphanol. It was carried out on 75 patients of either sex aged 18 - 60 years scheduled for elective laparoscopic cholecystectomy under GA. Subjects were enrolled into three groups- Group B (n= 25) patients received inj. Butorphanol 25 mcg/kg IV, Group F (n= 25) received inj. Fentanyl 2 mcg/kg IV and Group N (n= 25) patients received inj. Nalbuphine 0.2 mg/kg 5 minutes before the induction.

RESULT

At the time of extubation, mean MAP in Group B, F and N was 99.88, 95.32 and 97.24 respectively. This difference is highly significant when compared statistically (p value is 0.005).

CONCLUSION

With this study, we conclude that the administration of intravenous fentanyl and nalbuphine five minutes prior to induction of anaesthesia helps in better obtundation of haemodynamic responses to laparoscopic cholecystectomy than butorphanol.

KEYWORDS

Butorphanol, Fentanyl, Nalbuphine, Laparoscopic Cholecystectomy, Pneumoperitoneum, Obtundation, Haemodynamic Response.

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BACKGROUND

Laparoscopic surgeries form an essence of today's surgical practice because of its magnification, dexterity, less cosmetic scar, less post-operative pain and decreased hospital stay because of decreased morbidity and mortality.(1)

However, pneumoperitoneum created to visualise intra-abdominal organs along with positional changes (Reverse Trendelenburg position) results in a significant haemodynamic and respiratory changes.(2)

The cardiovascular changes are characterised by decrease in cardiac output and increase in systemic vascular resistance which in turn results in sudden tachycardia, hypertension and increased myocardial oxygen requirement. CO2 (Used for abdominal insufflation) readily absorbed from peritoneal cavity into the circulation resulting in hypercapnia.(3)

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These changes though better tolerated in ASA I and II, patients can be detrimental in elderly and ASA III patients particularly with compromised cardiovascular physiology. Various surgical methods like change in nature of insufflating gas, use of low intra-abdominal pressure, use of abdominal wall lift methods have been tried to decrease the haemodynamic alterations associated with pneumoperitoneum, but all with practical limitations.(4)

The inclusion of an opioid can reduce pre-operative pain and anxiety, decrease somatic and autonomic responses to airway manipulation, improve haemodynamic stability, lower requirement for inhaled anaesthetics and provide immediate post-operative analgesia. Each drug has its advantages and disadvantages depending upon its pharmacokinetic and pharmacodynamic profile.(5)

Fentanyl has been identified as an effective agent in this regard. Fentanyl citrate is a synthetic phenylpiperidine opioid and analgesic and chemical congener of pethidine. It is 100 times more potent than morphine. It is a μ (mu) receptor agonist which belongs to G protein-coupled receptor family. Metabolism is mainly via the hepatic route and it has a high first pass metabolism.

Nalbuphine is a semi-synthetic opioid agonist-antagonist of the phenanthrene series. It is chemically related to the widely used opioid antagonist naloxone and naltrexone and the potent opioid analgesic, oxymorphone. It acts as an

agonist at K (kappa) receptor and antagonist at μ (mu) receptor. Nalbuphine is a potent analgesic.[6]

Butorphanol is a synthetic opioid derivative. It is a mixed agonist-antagonist and 5 to 8 times as potent as morphine and is available only in the parenteral form. Butorphanol is agonist at K (kappa) receptor and mixed agonist-antagonist at μ (mu) receptor. Whereas duration of action of butorphanol is similar to that of morphine, its plasma $t^{1/2}$ is 2-3 hrs. Duration of analgesia is 3 to 4 hrs.[7]

The primary purpose of the present study is to compare the effects of Fentanyl, Nalbuphine and Butorphanol in obtundation of haemodynamic responses during laparoscopic cholecystectomy and secondary aim is to calculate duration of analgesia, sedation score and note any adverse effects.

MATERIALS AND METHODS

Study Design

A prospective, comparative, randomised study. After getting approval from the Institutional Ethical Committee, an informed consent was taken from the patient. This study was conducted on 75 patients aged between 18 - 60 years of either sex and ASA grade I and II scheduled for elective laparoscopic cholecystectomy under general anaesthesia in between June 2016 to Oct 2017.

Sample Size

The expected difference between two means is 3.82 and common within group standard deviation is 3.80. The per group sample size that gives an 80% chance that 0.05 level test of significance found a statistically significant difference between two sample means was approximately 17. When 3 means were compared, the approximate group size adjusted for multiple comparisons was 23.

Inclusion Criteria

Age group between 18 - 60 years, undergoing elective laparoscopic cholecystectomy and ASA grade I and II

Exclusion Criteria

Patient's refusal, h/o bradycardia, uncontrolled diabetes mellitus, arrhythmias, renal or liver dysfunction, cardiopulmonary disease, allergic to Nalbuphine, Fentanyl or Butorphanol.

Patients were familiarised with the visual analogue scale (VAS),[8] (0- No pain, 10- Worst pain) a day before surgery.

Patients were randomly allocated using computer generated random number and by picking up a sealed envelope into three groups of 25 patients each Group B, Group F and Group N.

All the patients were kept fasting and given tab ranitidine 150 mg and tab Lorazepam 1 mg at 6 am on the day of surgery.

In the operation theatre, routine monitors were attached and baseline pulse rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure and saturation of peripheral oxygen (SpO_2) were recorded. AII the patients were pre-loaded with 15 mL/kg of ringer lactate of the ringer's lactate solution and given inj. glycopyrrolate 0.2 mg.

Patients in Group B, Group F and Group N received inj. Butorphanol 25 mcg/kg IV, inj. Fentanyl 2 mcg/kg IV and inj. Nalbuphine 0.2 mg/kg IV respectively. AII the three drugs (Butorphanol, Fentanyl and Nalbuphine) were diluted in 10 mL distilled water and injected slowly 5 minutes before the induction of anaesthesia.

After 3 minutes, pre-oxygenation with 100% oxygen using a Bain's circuit and administration of study drugs, induction was done with IV propofol injection till the loss of eyelash and corneal reflex. Inj. succinylcholine IV 1.5 mg/kg was given and patients were intubated. Anaesthesia was maintained with O_2-N_2O (50%-50%), Isoflurane 1% and vecuronium bromide 0.1 mg/kg bolus followed by maintenance dose one-fourth of the initial dose as and when required. Positive pressure ventilation was continued. Cardiovascular parameters (Heart rate, SBP, DBP, MAP), $SP0_2$ and $EtCO_2$ were recorded at the following points of time:

Prior to induction (baseline), at the time of endotracheal intubation, every 2 mins interval after the endotracheal intubation till 10 minutes, before the pneumoperitoneum, every 10 mins interval till 60 mins after the pneumoperitoneum, after release of carbon-dioxide (C02) and after extubation.

At the end of surgery, neuromuscular blockade was reversed with neostigmine 50 μg/kg and glycopyrrolate 10 μg/kg intravenously. After satisfying the extubation criteria, patients were extubated and transferred to post-anaesthesia care unit (PACU). In PACU, every patient was monitored for the haemodynamic parameters (HR, SBP, DBP, MAP) and SPO_2, sedation score, VAS score for pain relief and post-operative complications if any. Haemodynamic parameters (HR, SBP, DBP, MAP) and arterial O2 saturation were monitored every 10 mins post-operatively upto 90 minutes. Any incidence of complications/ adverse event was monitored for next 90 minutes. During the post-operative period, assessment of pain was done with the help of VAS score. VAS score was recorded at 15 and 30 mins, 1st, 2nd, 3rd and 4th hour and duration of analgesia was also recorded (Time interval from the intravenous drug administration upto time when VAS reaches 5). Thereafter, rescue analgesic (IV ketorolac) was given to the patient. The sedation score was assessed by University of Michigan Sedation Scale (UMSS),[9] post-operatively as:

University of Michigan Sedation Scale (UMSS)

1= Awake and alert.
2= Sedated and responding to verbal command.
3= Sedated but responding to mild physical stimulus.
4= Drowsy but responding to moderate physical stimulus.
5= Very drowsy not responding to severe physical stimulus.

Statistical Analysis

The mean comparisons between groups is done by ANOVA with post-hoc test. Categorical variables are compared between groups using Chi-square test Software used was SPSS version 17. A probability level of $p < 0.05$ was considered significant.

RESULTS

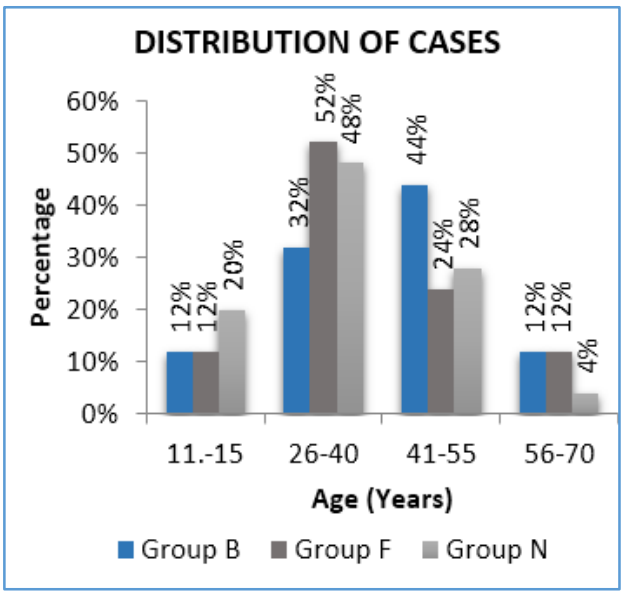

Figure 1

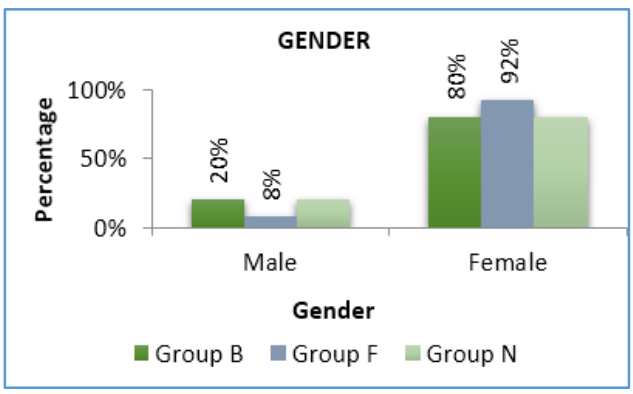

Figure 2

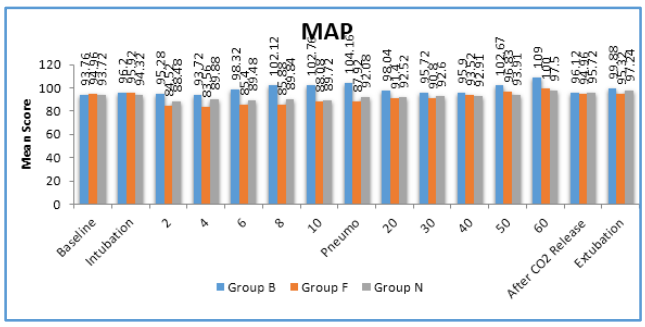

Figure 3

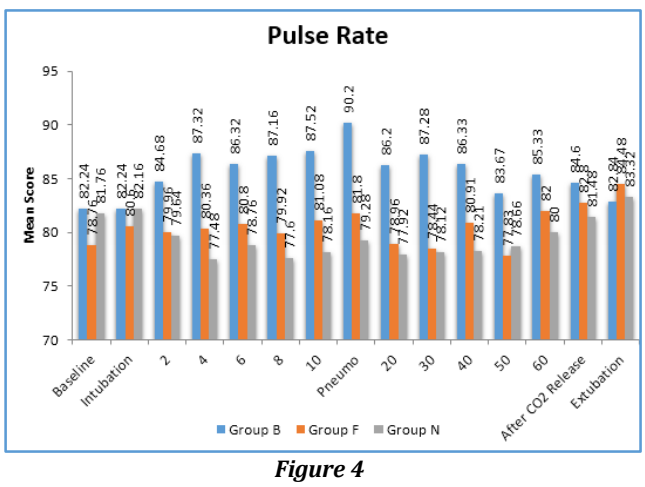

Figure 4

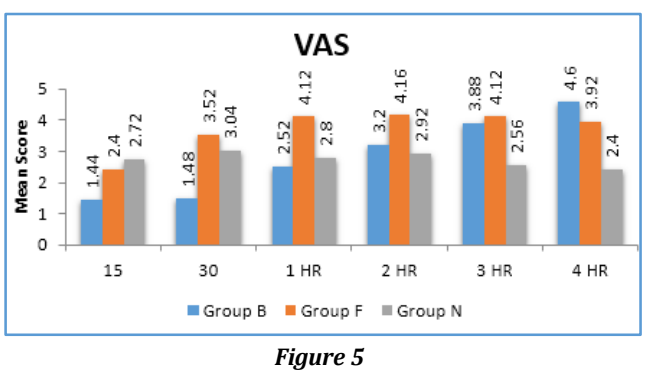

Figure 5

Age	Group B		Group F		Group N	
	Number	Percentage	Number	Percentage	Number	Percentage
11-25	3	12.0	3	12.0	5	20.0
26-40	8	32.0	13	52.0	12	48.0
41-55	11	44.0	6	24.0	7	28.0
56-70	3	12.0	3	12.0	1	4.0
Total	25	100.0	25	100.0	25	100.0
Mean ± S.D	41.20 ± 10.92		38.64 ± 12.41		35.84 ± 11.49	
Chi-Square	4.893					
P value	0.558					
Significance	NS					

Table 1. Age

Sex	Group B		Group F		Group N	
	Number	Percentage	Number	Percentage	Number	Percentage
Male	5	20.0	2	8.0	5	20.0
Female	20	80.0	23	92.0	20	80.0
Total	25	100.0	25	100.0	25	100.0
Chi-Square	1.786					
P value	0.409					
Significance	NS					

Table 2. Sex

Demographic profile was comparable between the three groups as shown in Fig. 1, Table 1, Fig. 2 and Table 2.

SBP	Group I	Group II	Group III	P value	Significance	B vs. F	B vs. N	F vs. N
	Mean ± S.D	Mean ± S.D	Mean± S.D					
Baseline	125.00 ± 8.21	127.16 ± 7.76	122.52 ± 7.01	0.109	NS	0.323	0.257	0.036
Intubation	128.12 ± 11.15	128.04 ± 6.04	123.00 ± 6.97	0.052	NS	0.973	0.034	0.036
2	126.72 ± 7.77	115.00 ± 8.08	115.76 ± 9.87	<0.001	HS	<0.001	<0.001	0.756
4	124.04 ± 9.77	111.76 ± 8.40	113.88 ± 7.61	<0.001	HS	<0.001	<0.001	0.389
6	126.76 ± 13.27	112.40 ± 8.03	114.24 ± 7.61	<0.001	HS	<0.001	<0.001	0.517
8	129.76 ± 11.48	112.84 ± 9.54	116.04 ± 6.07	<0.001	HS	<0.001	<0.001	0.228
10	130.56 ± 7.81	114.80 ± 6.79	117.52 ± 5.96	<0.001	HS	<0.001	<0.001	0.168
Pneumo	130.04 ± 641	116.76 ± 7.22	119.72 ± 5.54	<0.001	HS	<0.001	<0.001	0.108
20	124.64 ± 7.12	116.32 ± 6.93	122.72 ± 7.04	<0.001	HS	<0.001	0.338	0.002
30	124.12 ± 5.50	118.04 ± 6.20	123.92 ± 5.61	<0.001	HS	<0.001	0.826	0.001
40	123.24 ± 4.65	120.04 ± 6.94	124.09 ± 4.72	0.041	S	0.062	0.615	0.017
50	120.33 ± 4.04	123.75 ± 5.36	124.33 ± 4.07	0.430	NS	0.272	0.200	0.764
60	127.00 ±5.65	122.00 ± 5.65	127.00 ± 1.41	0.542	NS	0.365	1.00	0.365
After CO2 release	124.52 ± 6.48	122.64 ± 4.63	124.24 ± 5.30	0.436	NS	0.233	0.858	0.310
Extubation	125.60 ± 8.88	125.40 ± 3.86	125.12 ± 6.45	0.967	NS	0.914	0.796	0.880

Table 3

As shown in Table 3, all the three groups showed rise in SBP at the time of intubation when compared to baseline, but this was non-significant (p value is 0.052).

However, this difference was statistically significant between Group B and Group N (p value 0.034), Group F and Group N (p value 0.036) and highly significant during 2 to 10 minutes after intubation (p value < 0.001).

During the pneumoperitoneum mean SBP in Group B was 130, while in Group F was 116 and 119 in Group N. A decrease in SBP was noted in Group F and Group N during the pneumoperitoneum. Thereafter, it started rising gradually and returned to baseline at the time of extubation. This difference was highly significant statistically (p value < 0.001).

A decrease in mean SBP was noted in Group B during extubation with mean SBP 125.60. Mean SBP in Group F was 125.40 and in Group N was 125.12. This difference was statistically non-significant (p value > 0.05).

DBP	Group I	Group II	Group III	P value	Significance	B vs. F	B vs. N	F vs. N
	Mean ± S.D	Mean ± S.D	Mean ± S.D					
Baseline	78.24 ± 7.54	79.76 ± 5.23	79.40 ± 5.16	0.655	NS	0.380	0.502	0.835
Intubation	80.32 ± 8.80	79.92 ± 5.00	80.12 ± 4.14	0.975	NS	0.824	0.911	0.911
2	79.64 ± 7.35	69.36 ± 5.35	74.72 ± 7.49	<0.001	HS	<0.001	0.013	0.007
4	78.64 ± 9.72	69.52 ± 3.88	77.92 ± 5.63	<0.001	HS	<0.001	0.712	<0.001
6	83.96 ± 10.20	71.88 ± 4.72	77.24 ± 6.55	<0.001	HS	<0.001	0.002	0.014
8	88.32 ± 10.62	72.44 ± 4.60	76.72 ± 5.57	<0.001	HS	<0.001	<0.001	0.045
10	88.88 ± 7.47	74.80 ± 3.36	75.88 ± 5.71	<0.001	HS	<0.001	<0.001	0.510
Pneumo	91.20 ± 6.84	73.52 ± 4.59	78.32 ± 5.89	<0.001	HS	<0.001	<0.001	0.005
20	84.72 ± 9.44	78.96 ± 6.14	77.36 ± 5.43	0.001	HS	0.006	0.001	0.436
30	81.48 ± 4.87	77.20 ± 7.95	76.92 ± 6.55	0.028	S	0.024	0.017	0.881
40	82.14 ± 4.38	80.17 ± 5.49	77.34 ± 6.63	0.022	S	0.250	0.006	0.093
50	93.66 ± 11.59	83.33 ± 5.54	78.66 ± 11.59	0.002	HS	0.010	<0.001	0.058
60	95.33 ± 10.06	89.00 ± 1.41	83.00 ± 4.24	0.298	NS	0.405	0.144	0.466
After CO2 release	81.88 ± 5.68	81.24 ± 6.14	81.56 ± 6.11	0.931	NS	0.706	0.851	0.851
Extubation	87.08 ± 5.88	80.72 ± 5.71	83.16 ± 5.53	0.001	HS	<0.001	0.018	0.135

Table 4

DBP in all the three groups increased at the time of intubation, but change is non-significant between the three groups (p value is 0.975).

Fig. 4 and Table 4 shows DBP in Group B again increases at pneumoperitoneum. This change is highly significant when compared to Group F and Group N (p value is < 0.001).

Mean DBP in subjects of Group B remained significantly higher from the pneumoperitoneum to 50 minutes after the intubation (p value < 0.05).

At the time of extubation, mean DBP in Group B, F and N were 87.08, 80.72 and 83.16 respectively. The difference between the means was highly significant statistically (p value < 0.001).

MAP	Group I	Group II	Group III	P value	Significance	B vs. F	B vs. N	F vs. N
	Mean ± S.D	Mean ± S.D	Mean ± S.D					
Baseline	93.76 ± 5.63	94.96 ± 5.72	93.72 ± 4.72	0.653	NS	0.267	0.979	0.256
Intubation	96.20 ± 8.37	95.92 ± 4.60	94.32 ± 3.85	0.487	NS	0.868	0.268	0.345
2	95.28 ± 6.26	84.52 ± 5.97	88.48 ± 7.75	<0.001	HS	< 0.001	0.001	0.041
4	93.72 ± 8.60	83.56 ± 4.27	89.88 ± 5.15	<0.001	HS	<0.001	0.034	0.001
6	98.32 ± 10.33	85.40 ± 3.81	89.48 ± 5.61	<0.001	HS	<0.001	<0.001	0.047

8	102.12 ± 10.05	85.88 ± 4.15	89.84 ± 4.68	<0.001	HS	<0.001	<0.001	0.044
10	102.76 ± 6.48	88.08 ± 3.27	89.72 ± 4.80	<0.001	HS	<0.001	<0.001	0.253
Pneumo	104.16 ± 6.00	87.92 ± 5.14	92.08 ± 4.89	<0.001	HS	<0.001	<0.001	0.008
20	98.04 ± 7.43	91.40± 5.18	92.52 ± 4.49	<0.001	HS	<0.001	0.001	0.500
30	95.72 ± 3.52	90.80 ± 6.16	92.60 ± 4.95	0.003	HS	0.001	0.031	0.207
40	95.90 ± 3.01	93.52 ± 4.40	92.91 ± 4.98	0.057	NS	0.043	0.542	0.146
50	102.67 ± 8.62	96.83 ± 3.85	93.91 ± 3.44	0.013	S	0.046	0.004	0.109
60	109.00 ± 7.07	100.00 ± 1.41	97.50 ± 3.53	0.169	NS	0.694	0.782	0.913
After CO2 release	96.12 ± 4.24	94.96 ± 445	95.72 ± 5.16	0.670	NS	0.380	0.761	0.564
Extubation	99.88 ± 5.90	95.32 ± 4.21	97.24 ± 4.14	0.005	HS	0.002	0.057	0.233

Table 5

MAP in all the three groups increased at the time of intubation (Fig. 5 and Table 5), but change is non-significant when compared statistically (p value is 0.868). At the pneumoperitoneum, mean map in Group B was 104.16, in Group F was 87.92 and in Group N was 92.08. The difference was highly significant statistically (p value < 0.001). After pneumoperitoneum, mean MAP in Group B is more than Group N and Group F. This difference is highly significant when compared statistically (p value < 0.001).

After CO2 release, the difference between the mean MAP becomes non-significant statistically (p value > 0.05).

At the time of extubation, mean MAP in Group B, F and N was 99.88, 95.32 and 97.24 respectively. This difference is highly significant when compared statistically (p value is 0.005).

PR	Group I	Group II	Group III	P value	Significance	B vs. F	B vs. N	F vs. N
	Mean ± S.D	Mean ± S.D	Mean ± S.D					
Baseline	82.24 ± 8.84	78.76 ± 7.36	81.76 ± 9.43	0.306	NS	0.156	0.844	0.221
Intubation	82.24 ± 8.29	80.60 ± 8.29	82.16 ± 10.02	0.711	NS	0.521	0.975	0.541
2	84.68 ± 8.84	79.96 ± 7.59	79.64 ± 7.89	0.055	NS	0.044	0.032	0.890
4	87.32 ± 8.28	80.36 ± 7.18	77.48 ± 6.12	<0.001	HS	0.001	<0.001	0.164
6	86.32 ± 8.72	80.80 ± 8.48	78.76 ± 6.37	0.004	HS	0.016	0.001	0.366
8	87.16 ± 9.28	79.92 ± 8.58	77.60 ± 6.78	<0.001	HS	0.003	<0.001	0.326
10	87.52 ± 10.31	81.08 ± 9.51	78.16 ± 6.72	0.002	HS	0.013	<0.001	0.254
Pneumo	90.20 ± 6.99	81.80 ± 8.75	79.28 ± 5.35	<0.001	HS	<0.001	<0.001	0.218
20	86.20 ± 9.01	78.96 ± 5.96	77.92 ± 7.41	<0.001	HS	0.001	<0.001	0.629
30	87.28 ± 8.28	78.44 ± 5.76	78.12 ± 7.11	<0.001	HS	<0.001	<0.001	0.874
40	86.33 ± 11.15	80.91 ± 5.41	78.21 ± 4.27	0.002	HS	0.019	0.001	0.223
50	83.67 ± 7.09	77.83 ± 3.53	78.66 ± 4.47	0.138	NS	0.050	0.089	0.645
60	85.33 ± 6.02	82.00 ± 8.48	80.00 ± 2.00	0.535	NS	0.538	0.290	0.708
After CO2 release	84.60 ± 10.84	82.80 ± 6.77	81.48 ± 5.92	0.401	NS	0.437	0.179	0.568
Extubation	82.84 ± 9.17	84.48 ± 6.36	83.32 ± 4.97	0.701	NS	0.414	0.811	0.563

Table 6

As shown in Fig. 6 and Table 6, pulse rate in all the three groups rises at the time of intubation. Mean pulse rate during intubation was 83.24 in Group B, 80.60 in Group F and 82.16 in Group N. This difference was not significant when compared statistically between the groups (p value is 0.711).

Mean pulse rate was higher in Group B at 4 minutes after the intubation and shows an increasing trend till 40 minutes after the pneumoperitoneum. This difference was highly significant when compared between the three groups (p value < 0.05).

During extubation mean pulse rate in Group B, F and N were 82.84, 84.48 and 83.32 respectively. The difference in the mean pulse rate during extubation was non-significant when compared between the groups (p value is 0.701).

The difference in the post-op SBP, DBP and MAP between different groups was non-significant when compared statistically (p value > 0.05).

Mean VAS score in Group B, F and N at 15 minutes post-operatively was 1.44, 2.40 and 2.72 respectively. This difference was highly significant when compared statistically.

VAS score in Group F showed an increasing trend over the next 3 hours. This difference was highly significant statistically when compared with other groups (p value < 0.001). The reason being short duration of action of fentanyl, 30 - 60 minutes.

At the end of four hours post-operatively, Group B was having VAS score of 4.60, Group F and Group N were having 3.92 and 2.40 respectively. This difference was highly significant when compared statistically (p value < 0.001).

Sedation score was maximum in the nalbuphine group at 15 minutes post-operatively. This was statistically highly significant when compared to other groups (p value is 0.001). Group N and Group B both showed significant sedation upto 3 hours post-operatively.

DISCUSSION

Pneumoperitoneum during laparoscopic surgery leads to significant haemodynamic changes such as increase in MAP and systemic vascular resistance and a decrease in cardiac output. These haemodynamic changes can be detrimental due to associated risk of myocardial ischaemia or cerebral haemorrhage; therefore, these should be attenuated.

Rao et al 2013[9] compared butorphanol and fentanyl in patients undergoing laparoscopic surgeries and concluded that no significant difference was observed in systolic blood pressure till 9 minutes after intubation similar to present

study. Sharma et al (2014)[10] compared the haemodynamic responses to intubation with fentanyl and nalbuphine and concluded that nalbuphine group had significant rise in BP (p value < 0.05) at the time of intubation when compared to fentanyl in contrast to present where this rise was non-significant (p value > 0.05). Our results are similar to Balasubramaniam et al[11] (2016) who observed that the DBP after intubation in Group B becomes comparable to the pre-operative DBP at the third minute after intubation. The DBP in Group F becomes significantly lower than the pre-operative DBP at the tenth minute after intubation. Prasad et al[12] (2016) conducted a comparison between fentanyl and nalbuphine and observed that there is a significant rise in DBP in patients who receive nalbuphine in comparison to those who received fentanyl (p value < 0.05). Similar results have been noted in the present study as DBP in nalbuphine group is higher than fentanyl group. Verma et al[13] (2006) conducted a study on total intravenous anaesthesia in laparoscopic cholecystectomy and compared butorphanol with fentanyl. They found out that butorphanol and fentanyl both showed a decreasing trend in MAP at the time of pneumoperitoneum when compared to baseline, but this decrease was statistically not significant (p value > 0.05). However, in the present study Group B depicted an increasing trend in the MAP at the time of pneumoperitoneum. FA Khan et al[14] (2002) compared fentanyl and nalbuphine in total intravenous anaesthesia in laparoscopic cholecystectomy and found a significant increase in heart rate in nalbuphine group (25%) as compared to fentanyl group (p value < 0.05). They concluded that fentanyl provided better haemodynamic stability. In this study, there was no significant difference noted between fentanyl and nalbuphine group in terms of pulse rate changes at the time of intubation and pneumoperitoneum.

Patel et al[15] in 2016 compared intravenous butorphanol with intravenous fentanyl in general anaesthesia and concluded that rise in pulse rate was more in fentanyl group when compared with butorphanol group. The difference between the group was statistically significant for 5 minutes after intubation. Thereafter, it was insignificant for upto 30 minutes. Chawda et al[16] in 2010 stated that patients given nalbuphine 2 mg/kg showed 4.39% rise in MAP, which was statistically non-significant. Ahire et al 2016 studied effect of equipotent dose of butorphanol and fentanyl on intraoperative anaesthesia course and postoperative recovery characteristics in laparoscopic surgeries and observed that pain measured by VAS score and requirement of rescue analgesia in postoperative period were found to be lower in patients receiving butorphanol when compared to fentanyl.

Complications like nausea, vomiting, bradycardia, hypotension, chest wall rigidity, pruritus and respiratory depression were recorded.

CONCLUSION

Sympathetic activation during pneumoperitoneum is attenuated by all the three drugs- Butorphanol, Fentanyl and Nalbuphine. Fentanyl and nalbuphine both were more effective than butorphanol in obtunding the haemodynamic response during pneumoperitoneum. Fentanyl produced even more significant attenuation than nalbuphine.

Nalbuphine and butorphanol both provided good post-operative analgesia and post-operative light sedation without any respiratory depression, adverse effects like nausea and vomiting were infrequent and statistically non-significant.

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