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EVALUATION OF INTRAPERITONEAL PRESSURE IN LAPAROSCOPIC SLEEVE GASTRECTOMY BY USING DEEP NEUROMUSCULAR BLOCK VERSUS ADEQUATE NEUROMUSCULAR BLOCK

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ABSTRACT

Background: In recent review Kopman and Naguib suggest that the benefit of deep neuromuscular block may be nonexistent, this is surprising conclusion given the increasing amount of literatures on this topic that dose show a significant clinical benefit from deep neuromuscular block. **Aim of study**: Study the effect of deep neuromuscular block on the intraperitoneal pressure during laparoscopic sleeve gastrectomy and the surgical workspace by comparing between adequate and deep neuromuscular block. **Patient and Methods**: 50 randomly chosen patients scheduled for elective laparoscopic sleeve gastrectomy were included in our study, they were divided into two groups; group 1 (25 patients with adequate neuromuscular blockade and intraperitoneal pressure of 15 mmHg) and group 2 (25 patients with deep neuromuscular blockade and intraperitoneal pressure as low as possible decided by single qualified surgeon). The neuromuscular block level was monitored during operation every 10 min. and maintained by rocuronium in both groups. The vital signs were recorded every 10 min. during the surgery. Neuromuscular block was reversed at the end of surgery by sugammadex, surgeon satisfaction was obtained at the end of surgery according to the visual analogue scale. **Results**: The vital signs were significantly improved in group 2 specially the mean arterial pressure which was significantly lower than group 1 due to deep level of neuromuscular block and low intraperitoneal pressure (14 or 13 mmHg), while the surgeon satisfaction remain at the same level in both groups; that means the quality of surgical workspace not altered by lowering the intraperitoneal pressure. **Conclusions**: The use of deep neuromuscular block with lowest intraperitoneal pressure possible to optimize the surgical workspace and keep the cardiovascular condition uncompromised.

KEYWORDS: Intraperitoneal pressure, deep neuromuscular blockade, surgical workspace, laparoscopic sleeve gastrectomy, rocuronium, sugammadex.

INTRODUCTION

Obesity is an evolving pandemic, with 380 million cases worldwide projected by 2025. It is especially challenging for those with a more sedentary occupation coupled with a sedentary lifestyle. Adipose tissue is an endocrinologically active organ, releasing a large number of adipokines that affect food intake, peripheral insulin sensitivity, muscle glucose uptake, and hepatic glucose production. Caloric restriction as an antiaging strategy has been recognized for a long time. Protective mechanisms include increased DNA repair capacity, altered gene expression, decreased metabolic rate, and reduced oxidative stress. Needless to say, anesthesiologists should not only have concern about obesity in their patients, but in themselves as well.[1]

Obesity is associated with many diseases including type II DM, hypertension, coronary artery disease, cholelithiasis, and metabolic syndrome.

Even in the absence of obvious coexisting disease, however extreme obesity profound physiological consequences.

O_2 demands, CO_2 production and alveolar ventilation are elevated because metabolic rate is proportional to body weight.[2] Minute ventilation required to maintain normocapnia is thus increased which further increases O_2 demand.[3]

Reduce FRC because of the wt. of the chest wall, FRC is especially reduced in the supine position due to the weight of the abdominal wall and contents.

Thoracic compliance is thus reduced, increasing work of breathing & O_2 demand V/Q mismatch resulting in hypoxemia.

Hypoxic pulmonary vasoconstriction increase the work of Rt. Ventricle and may lead to pulmonary hypertension and Rt. Side heart failure.[3]

Most surgeons frequently suspect the anesthesiologist of not giving sufficient relaxant in morbid obese pt. and they have to use higher pneumoperitoneum pressure to achieve again sufficient work volume. Abdominal compliance changes using the beach chair position and after more than one hour pneumoperitoneum at 15mmHg.[4]

AIM OF STUDY

We aimed to study the effect of deep NMB on IPP, surgical workspace and patients' vital signs during laparoscopic sleeve gastrectomy by comparing between adequate and deep NMB maintained by using rocuronium in titrated doses to maintain PTC<3 in order to achieve optimal surgical workspace with lowest IPP possible.

PATIENT AND METHODS

After obtaining consent from scientific council of anesthesia and intensive care of Iraqi board, a randomized nonblinded prospective clinical trial included 50 patients underwent laparoscopic sleeve gastrectomy at general surgery theaters in Baghdad teaching hospital conducted from June to December 2016 to assess the effect of NMB on IPP during laparoscopic sleeve gastrectomy by comparing deep and adequate level of NMB.

All patients were divided into two groups, group 1 (n=25) includes patients underwent laparoscopic sleeve gastrectomy under adequate level of NMB (PTC>3), and group 2 (n=25) underwent laparoscopic sleeve gastrectomy under deep level of NMB (PTC<3).

Including criteria.

- Age, 18-50years
- BMI 35-50 kg/m^2.
- ASA II-III.
- Patients scheduled for elective laparoscopic sleeve gastrectomy.

Excluding criteria

- Patient refusal.
- Patient had pervious opened laparotomy for other cause.
- Patient with neuromuscular disease, e.g.: myasthenia gravis, multiple sclerosis... etc.
- Contraindications to drugs used in study.

All patients were assessed for difficult airway (Mallampati score) and difficult cannulation.

Baseline HR, BP, MAP, BMI were recorded preoperatively.

Intraoperative preparation including good IV access, antithrombotic measures include subcutaneous LMWH and elastic stockings, were applied.

Operating table elected for such intervention and has electric control to facilitate patient positioning during the operation.

Standard monitoring with pulse oximeter, ECG, NIBP with suitable cuff size placed on the forearm to avoid wrong readings in case of wide arm circumference, $EtCO_2$, NMB monitoring with nerve stimulator. The nerve used for monitoring NMB was ulnar nerve (electrodes are placed along the ulnar border of forearm with numerical assessment of thumb adduction).

All patients received 100% O_2 for 3min. as preoxygenation before conducting anesthesia, ranitidine 50 mg, dexamethasone 8 mg, midazolam 1 mg, ondansetron 8 mg, metoclopramide 10 mg had been given as premedication.

Induction of anesthesia was on 50 mg ketamine, 1 microgram /kg LBW fentanyl, 2-3 mg /kg TBW propofol, 1 mg /kg LBW rocuronium, intubation was done with pt. in ramping position, direct laryngoscope and proper size ETT was inserted, NG tube was inserted to decompress the stomach. Ventilation setting was adjusted to maintain $EtCO_2$ between 35-40 mmHg, SPO2 around 97%-100%.

Anesthesia was maintained with 1- 2% Isoflurane, rocuronium in titrated doses to maintain PTC <3 in group 2, while in group 1, NMB was maintained by 10 mg of rocuronium according to clinical signs of neuromuscular activity.

Intravenous fluid requirement maintained by crystalloid solution calculated according to (4,2,1) formula adding to it the deficit and losses.

Intraoperatively measurement of TOF, PTC, HR, MAP every 10 min., starting after intubation until extubation was done. Pts. were taped to the operating table to prevent spilling from the table during reversed Trendelenburg position and lower limbs abducted.

As a part of our study IPP in group 1 was pre-sated by the surgical staff on 15 mmHg, while in group 2; IPP was sated at 14 mmHg or 13 mmHg done according to surgeon request, on the other hand we kept the PTC<3 mostly all the time during operation with recording the HR, MAP every 10 min. and obtained the surgeon satisfaction at the end of surgery according to visual analogue scale (from 0-10 as 0 is the poorest satisfaction and 10 is the optimum regarding the surgical workspace quality.

All pts. received paracetamol 1000mg, tramadol 100 mg, nefopam 20 mg as a postop. analgesia and remifentanil infusion at a rate of 0.1 microgram/kg/min. as an analgesia during operation.

At the end of surgery NMB was reversed by sugammadex, the dose was calculated according to response to TOF. Extubation was done whenever pts met the extubation criteria.

Statistical Package: - for Social Science (SPSS) program version 17, MINITAB V 16 and, two sample t test for measure the difference, and p-value of less than 0.05 considered statistically significant.

RESULTS

This is a prospective clinical trial, to study the effect of deep NMB on IPP during laparoscopic sleeve gastrectomy.

In our study pts. were randomly chosen to be included into two groups, group 1 (adequate NMB) and group 2 (deep NMB).

The baseline MAP in group 2 was higher than that in group 1, but still within normal range of BP (table 1).

At the pre-insufflation period (table 2) there is no significant difference in HR in both groups but the MAP was slightly lower in group 2 than that in group 1.

After insufflation, there was a difference in the HR between the two groups but statistically not significant, while the MAP remain unchanged as shown in table 3.

The time during operation (table 4) was divided into 3 periods.

- Period includes 3 readings were taken every 10 minutes after insufflation, the HR was slightly lower in group 2 than group 1 but it was statistically not significant, while the MAP was significantly low in group 2.
- Period 2 includes 3 readings were taken during operation from minute 60-80, HR and MAP were significantly low.
- Period 3 includes 3 readings were taken during operation from minute 90-110, HR and MAP also were significantly low.

The HR and MAP after extubation were significantly low in group 2.

Surgeon satisfaction shown in table 6 was taken at the end of every surgery remain unchanged in both groups which is statistically not significant but of clinical value, that means the quality of the workspace not decreased by lowering the IPP from 15 mmHg to 14 or 13 mmHg while keeping deep level of NMB in group 2.

Table 1: HR & MAP difference in the two study group at baseline.

Baseline parameters	G1 Adequate Neuromuscular block		G2 Deep Neuromuscular block		p-Value
	Mean	SD	Mean	SD	
HR	84.16	10.77	84.04	5.58	0.961
MAP	94.64	8.44	97.36	6.49	0.208

Table 2: HR, MAP and PTC difference in the two study group at pre-insufflation.

Pre-insufflation parameters	G1 Adequate Neuromuscular block		G2 Deep Neuromuscular block		p-Value
	Mean	SD	Mean	SD	
HR	95.08	13.77	94.72	17.35	0.936
MAP	95.36	12.98	92.84	14.19	0.516
PTC	3.48	3.54	1.48	1.66	0.015

Table 3: HR, MAP and PTC difference in the two study group after insufflation.

After insufflation parameters	G1 Adequate Neuromuscular block		G2 Deep Neuromuscular block		p-Value
	Mean	SD	Mean	SD	
HR	90.2	12.8	87.1	12.4	0.393
MAP	87.1	11.9	87.1	14.5	0.992
PTC	1.32	2.32	0.36	0.49	0.042

Table 4: HR, MAP and PTC difference in the two study group intraoperatively.

Intra-operative parameters		G1 Adequate Neuromuscular block		G2 Deep Neuromuscular block		p-Value
		Mean	SD	Mean	SD	
Intra-operative 30-59 min.	HR	86.5	12.5	84.21	9.53	0.204
	MAP	92.6	12	88.2	12.4	0.028
	PTC	4.33	3.61	1.29	1.23	0.001
Intra-operative 60-89 min.	HR	88.8	15.5	85.85	8.51	0.15
	MAP	98.9	10.1	87.55	8.33	0.001
	PTC	6.47	4.67	1.28	1.8	0.001
Intra-operative 90-110 min.	HR	99.2	15.8	85.73	6.98	0.001
	MAP	98.9	10.1	87.55	8.83	0.001
	PTC	9.98	3.38	3	1.15	0.001

Table 5: HR, MAP and PTC difference in the two study group extubation.

After Extubation parameters	G1 Adequate Neuromuscular block		G2 Deep Neuromuscular block		p-Value
	Mean	SD	Mean	SD	
HR	101.28	7.05	88.3	11.1	0.001
MAP	101.88	5.99	94.96	6.91	0.001
TOF	0.694	0.136	0.762	0.074	0.023

Table 6: Surgeon satisfaction in both groups.

	G1 Adequate Neuromuscular block		G2 Deep Neuromuscular block		p-Value
	Mean	SD	Mean	SD	
Surgeon Satisfaction	6.64	1.25	6.44	1.78	0.649

DISCUSSION

This is a prospective clinical trial, to study the effect of deep NMB on IPP during laparoscopic sleeve gastrectomy.

Most surgeons frequently suspect the anesthetist not giving muscle relaxant deep enough in morbidly obese pts. so they have to use higher IPP to achieve sufficient work space.

Many studies were aimed to improve the surgical conditions in laparoscopic surgeries.

Kopman and Naguib suggest that the benefits of deep NMB may be not exist, this is surprising conclusion, given the increasing amount of literatures on this topic dose show a significant clinical benefit from deep NMB. The study conclude that there is not enough good evidence available to justify the routine use of deep neuromuscular block for laparoscopic surgery and the associated expense of high- dose sugammadex.[5] Kopman study was against ours.

Martini et al, demonstrated in a blind, randomized, control trail that the use of deep compared with moderate NMB is associated with improved quality of surgical conditions in retroperitoneal laparoscopic surgeries as determined by an experienced surgeon on a 5 points surgical rating scale, moreover the pre and postoperative cardiorespiratory conditions of pts. recovered deep NMB were not compromised.[6] Martini study included twenty-four patients undergoing elective laparoscopic surgery for prostatectomy or nephrectomy were randomized to receive moderate NMB (train-of-four 1-2) using the combination of atracurium/mivacurium, or deep NMB (post-tetanic count 1-2) using high dose rocuronium. Moderate block resulted in 18% of scores at the low end of the scale (Scores 1-3); deep block resulted in 99% of scores at the high end of the scale (Scores 4 and 5)[7] This has great similarity with our study except for surgeon satisfaction which remain unchanged.

Three different studies conducted by Mulier J. P. in different years (2013-2014) all the studies conclude that it is important to use all methods described to reduce the IPP for the anesthesiologist or to increase the workspace for the surgeon, the most important method valuable for everyone is to use a deep NMB[8] Also he concludes that sufficient workspace at the lowest airway pressure requires that every pt. should be maximal relaxed verify that muscle relaxation is sufficient deep at TOF 0 and PTC <4 measured at the thumb.[9]

These conclusions are similar to ours.

CONCLUSION

Regarding the results we obtained from our study, by using deep level of NMB the vital signs become more stable and surgical workspace in low IPP was as good as that in IPP 15 mmHg as demonstrated by unchanged surgeon satisfaction, we conclude that the use of deep NMB has a great role in optimizing surgical workspace and maintaining cardiovascular conditions uncompromised in pts. undergo laparoscopic sleeve gastrectomy by using lowest IPP possible.

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