Scholars Journal of Applied Medical Sciences (SJAMS) **ISSN 2320-6691 (Online)**
Sch. J. App. Med. Sci., 2016; 4(3B):708-711 **ISSN 2347-954X (Print)**

(An International Publisher for Academic and Scientific Resources)
www.saspublisher.com

Original Research Article

Hemodynamic effects of pneumoperitoneum in children

Dr. Shiva Prasad. D[1]*, Dr. Uma Maheswar Rao V[2]
[1]Professor, [2]Associate Professor, Dept of Anaesthesiology, MNR Medical College, Sangareddy, Telangana state, India

***Corresponding author**
Dr. Shiva Prasad. D
Email: shiva.mnrsr@gmail.com

Abstract: The objective of the study was to evaluate the hemodynamic effects of pneumoperitoneum in children. It was an observational study conducted at MNR medical college, Sangareddy, Telangana state during the period January 2015 to December 2015. A total of forty children ASA grade 1&II, aged from 1yr to 10 yr undergoing laparoscopic surgeries were included in this study irrespective of sex and surgical indication. The intra abdominal pressure exerted by CO_2 was 10 mmHg and the duration of pneumoperitoneum and laparoscopy was 30 min. After insufflations of CO2 the heart rate (110±4.2 to 132±7.2*), systolic blood pressure (100±1.2 to 114±6.2*) and diastolic blood pressure (56±1.4 to 67±4.3*) increased significantly compare to baseline values (T3 to T0, $p<0.01$). End tidal CO_2 increased to 41 mm of Hg after insufflation but came to normal in few min by increasing minute ventilation. It is concluded that anaesthesiologist should have thorough knowledge on pathophysiology of pneumoperitoneum, proper planning and vigilance for better outcome in laparoscopy of children.
Keywords: Laparoscopy, hemodynamic effects, pneumoperitoneum, children.

INTRODUCTION

Laparoscopic surgery was one of the most important diagnostic and therapeutic tools in general surgery. This minimally invasive technique potentially offers reduced operative time and morbidity, decreased hospital stay and earlier returns to normal activities, less pain and less postoperative ileus compared with the traditional open surgical procedures. Because the postoperative benefits were superior to open surgical procedures, laparoscopy used in children more frequently. The knowledge on the physiological impact of endoscopic surgery in infants and children was very limited.

This minimally invasive procedure requires pneumoperitoneum for adequate visualization and operative manipulation. Carbon dioxide was the most commonly used gas for creating pneumoperitoneum, because of its high diffusibility and rapid rate of absorption and excretion. However, insufflations of carbon dioxide into the peritoneum may lead to alteration in the acid-base balance, cardiovascular and pulmonary physiology. Therefore, it is very important that the anaesthesiologist thoroughly understands and manage the complications.

Children, infants and neonates represent an anaesthetic challenge because of age-specific anatomical and physiological issues. Apart from paediatric-specific anaesthetic considerations, the paediatric anaesthetist must understand the implications of laparoscopic surgery, and prevent and react appropriately to changes that will occur during these procedures [1].

MATERIALS AND METHODS

Forty children of ASA grade 1&II, aged from 1 yr to 10 yr undergoing laparoscopic surgeries were included in this study irrespective of sex and surgical indication. It was conducted at MNR medical college, Sangareddy, Telangana state during the period January 2015 to December 2015 after obtaining approval from institutional ethical committee. After thorough clinical examination and relevant laboratory investigations of all patients, an informed, valid, written consent was obtained, both for conduct of study as well as administration of anaesthesia. Patients with cardiovascular, respiratory, renal, hepatic, neuromuscular diseases, children having high intracranial pressure and bleeding disorders were excluded in the study.

All the patients were premeditated with oral midazolam 0.5 mg/kg bwt and anticholenergic glycopyrolate which lowers the incidence of the cardio respiratory complications. All patients received end tracheal anaesthesia with sevoflurane-N2O in 50% O2 and vecuronium for muscle relaxation. Respiration was

controlled by an Ohmeda 7000 ventilator with constant minute ventilation to maintain baseline end-tidal CO2 tension (ETCO2) between 32-33 mm Hg [2]. After anaesthesia, CO2 was insufflating into the peritoneal cavity via the opened hernia sac. The intra abdominal pressure exerted by CO2 was 10 mmHg and the duration of pneumoperitoneum and laparoscopy was 30 min.

We recorded ETCO2, body temperature, systolic and diastolic blood pressure, pulse, pulmonary airway pressure, heart rate, heart rhythm, and oxygen saturation simultaneously at different intervals. Time intervals were

T0-before induction,
T1- after induction,
T2- 5 min after insufflations,
T3-before desufflation,
T4-5 min after desufflation

RESULTS

The study includes forty children of ASA grade 1&II, aged from 1 yr to 10 yr undergoing laparoscopic surgeries. Mean age was 5.2±2.33 yr. Among these 28 were male and 12 females. The weight of patients was between 10-35 kgs. Mean weight was 22.62±5.62 kg. Thirty two patients were of ASA grade I and eight were grade II. Surgical procedures were femoral hernia, inguinal hernia and appendix. The patient's demographic data was given in table 1.

Table-1: Demographic data

Mean age	5.2±2.33 yr
Mean wt	22.62±5.62 kg
Sex	Male -28 Female -12
ASA Grade	Grade I-32 Grade II-8
Surgical indications	inguinal hernia-20 femoral hernia-10 appendix-10

All the patients were stable during the surgery and post operative period. All the baseline parameters (T0) were measured. After induction of anaesthesia(T2) there was a slight rise in the heart rate(HR), systolic blood pressure(SBP) and diastolic blood pressure(DBP) but after insufflations during the surgical procedure there is a significant rise (T3 to T0, $p<0.01$) in HR, SBP, DBP. End tidal CO_2 raised to 41 mm of hg after insufflations but came to normal in few min by increasing minute ventilation. All the hemodynamic parameters were given in table 2.

Table-2: Hemodynamic parameters a different time intervals

Time	Heart rate (min)	Systolic blood pressure (mm of Hg)	Diastolic Blood pressure (mm of Hg)	$Spo_{2(\%)}$	$ETCO_2$ (mm of Hg)	ECG
T0	110±4.2	100±1.2	56±1.4	98±1.2	33±2.3	SA
T1	122±5.8	105±3.6	60±1.8	99±0.8	33±4.2	SA
T2	126±6.5	107±5.2	63±6.2	99±1.5	35±3.2	SA
T3	132±7.2*	114±6.2*	67±4.3*	98±2.1	41±4.6*	SA
T4	116±3.4	106±2.2	58±2.5	99±1.7	34±3.1	SA

All values were in Mean±S.E (T3 to T0 is significant at $p<0.01$)

Cardiovascular effects of pneumoperitoneum were mainly the result of an increase in intra abdominal pressure (IAP), absorption of carbon dioxide, and a stimulation of the neuro humoral vasoactive system. In infants, pneumoperitoneum alters the heart rate, mean arterial pressure, left ventricular end systolic and end-diastolic volume. An increase in IAP also causes a decrease in venous return (VR) and an increase in systemic vascular resistance (SVR). This increase in SVR was caused directly by pressure on the abdominal arterial vessels, and indirectly by catecholamine release. A decrease in VR and an increase in SVR will cause a decrease in cardiac output and a decrease in arterial blood flow. The degree to which this occurs depends on the IAP. The abdominal wall was very compliant in children compared with that in adults. The insufflating pressure required to facilitate surgery was therefore lower in children. In children modification of principle parameters depends on the intra abdominal pressure but not on its duration.

In young children co_2 was absorbed very quickly it leads to rise in $ETCO_2$ levels and lowers the serum P^H levels. Hypercarbia in turn leads to an

increase in the heart rate and blood pressure mediated by sympathetic nervous system and it also sensitizes the myocardium to the arrhtymogenic effects of catecholamine especially with volatile anaesthetic drugs [3&4].

Gueugniaud *et al.;* [5] describe the hemodynamic effects of peritoneal insufflation of CO_2, maintaining an intra abdominal pressure (IAP) of 10 mm Hg, in children aged 6-30 months undergoing laparoscopic surgery. Hemodynamic changes were assessed at three time intervals: t_0 (after the induction of anesthesia), t_1 (5 min after peritoneal insufflation), and t_2 (5 min after desufflation). The induction of pneumoperitoneum resulted in a significant decrease in aortic blood flow and stroke volume and a significant increase in systemic vascular resistance. These changes completely resolved after peritoneal desufflation. No significant changes in mean arterial pressure and end-tidal CO_2pressure were noticed but in our study there was significant rise in the $ETCO_2$.

In previous studies with children, noted a statistically significant increase in cardiac output; cardiac index; heart rate; and systolic, mean, and diastolic arterial pressures during the insufflation period compared with baseline, and End-tidal CO_2 increased from before insufflation after the onset of insufflations [6-9].

In some studies children are divided into groups based on age (1-10 yr) studied the body temperature and hemodynamic including blood pressure, heart rate, heart rhythm, oxygen saturation during laparoscopy were not significantly changed according to age but clinically the changes were considerable among the groups[3]. The oxygen saturation in all patients maintained good levels (97-99%) throughout the surgery in our study as that of previous studies[7, 8].

Laparoscopy was known to be associated with reduced heat and sensibility losses, prolonged insufflations of co_2 in children lead to hypothermia and advocated to use the preheated co_2 for high flow insufflations. In this study almost the body temperature is constant and only little bit variation is noted in few cases.

All the patients were discharged from the hospital without any complications and adverse effects. Tachyarrhythmia was noted in 2 children and sinus arrhythmia was noticed in one child. Post operative nausea was noticed in 4 children and vomiting in one child.

Pain following the laparoscopy less compared to open surgery, was predominantly due to surgical incision, visceral manipulation, traction of nerves and vessels, presence of residual gas and release of inflammatory mediators. In this study within 24hours no one required analgesics but after 24 hours 12 children complained abdominal pain and treated with paracetamol.

CONCLUSION

There was a paucity of data in paediatric patients compared to the adults on the physiological effects of pneumoperitoneum. Further studies were required. The best knowledge associated with pathophysiologic changes, vigilance and proper planning was essential in children laparoscopies which prevent the deleterious effects.

Acknowledgement:

Authors acknowledge the immense help received from the scholars whose articles are cited and included in references of this manuscript. The authors are also grateful to authors/editors/publishers of all those articles, journals and books from where the literature for this article has been reviewed and discussed.

REFERENCES

1. Lasersohn L; Anaesthetic considerations for paediatric laparoscopy. South Afr J Surg. 2011; 49(1):22-6.
2. Aliya Ahmed; Laparoscopic Surgery in Children - Anaesthetic Considerations, J Pak Med Assoc, 2006, 56(2):75-79.
3. Hsing CH, Hseu SS, Tsai SK, Chu CC, Chen TW, Wei CF *et al.;* The physiological effects of CO_2 pneumoperitoneum in pediatric laparoscopy. Acta Anaesthesiol Sin, 1995; 33(1):1-6.
4. Braden DS, Leatherburg L, Treiber FA, Strong WB; Noninvasive assessment of cardiac output in children using impedance cardiography. Am Heart J 1990; 120:1166-72.
5. Gueugniaud P-Y, Abisseror M, Moussa M, Godard J, Foussat C, Petit P *et al.;* The hemodynamic effects of pneumoperitoneum during laparoscopic surgery in healthy infants: assessment by continuous esophageal aortic blood flow echo Doppler. Anesth Analg, 1998; 86(2):290-3.
6. Eric E. C. de Waal; The Hemodynamic Effects of Pneumoperitoneum during Laparoscopic Surgery in Healthy Infants: Assessment by Continuous Esophageal Aortic Blood Flow Echo Dopple Anesth Analg, 1999; 88:468-72.
7. Ahmed M, Neesa M, Islam MS, Sidiq AKMZ; Effects of pneumoperitoneum during laparoscopic surgery in young children. Journal of AFMC, 2009; 5(2):18-20
8. Laffon M, Gouchet A , Sitbon P, Guicheteau V, Biyick E, Duchalais A *et al.;* Difference between arterial and end-tidal car- bon dioxide pressures

during laparoscopy in paediatric patients Can j Anaesth, 1998; 45(6) : 561-563

9. Sarkany P, Lengyel S, Nemes R, Orosz L, Páll D, Molnár C *et al.;* Non-invasive pulse wave analysis for monitoring the cardiovascular effects of CO2 pneumoperitoneum during laparoscopic cholecystectomy--a prospective case-series study. BMC Anesthesiol. 2014; 14: 98.