

Effects of Laparoscopic Cholecystectomy on Intraocular Pressure

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Abstract

Purpose: To evaluate the effects of laparoscopic cholecystectomy in patients with gall stones under general anesthesia using carbon dioxide (CO₂) insufflations on the intraocular pressure (IOP). **Methods:** The study was an observational case series, involved 24 non-glaucomatous patients with gall stones who underwent laparoscopic cholecystectomy surgery under general anesthesia using (CO₂) insufflations in the period from January 2016 to April 2016 in Zagazig University Hospitals. IOP was measured preoperatively, intra-operatively and shortly postoperatively. Interpretation of the results was performed. **Results:** The study revealed that IOP was elevated significantly during laparoscopic cholecystectomy surgery ($P < 0.001$), as the mean preoperative IOP was (15.21 ± 1.61 mmHg) compared to intra-operative (24.55 ± 6.28 mmHg) and nearly returned to the normal level after 8 hours postoperatively (16.13 ± 2.44 mmHg). **Conclusion:** Laparoscopic cholecystectomy surgery elevated IOP significantly which is not favorable for glaucoma or ocular hypertension patients, especially for the old.

Keywords

Intraocular Pressure, Laparoscopic Cholecystectomy, Carbon Dioxide Insufflations

1. Introduction

During laparoscopic cholecystectomy, to make the gravitational displacement of the viscera away from the site of surgery, patients must put in reverse Trendelenburg position. That improves the patient's respiration. However, this position results in decreased venous return, right atria pressure, and hence falls in mean arterial pressure and cardiac output [1] [2]. Also Central Venous Pressure (CVP) increased due to abdominal carbon dioxide (CO₂) insufflations. Intraocular

pressure (IOP) is significantly increased during laparoscopic cholecystectomy due to elevated CVP in CO₂ filled abdomens in spite of reverse Trendelenburg position [3]. Also, alterations of the CVP induced by hydrostatic factors in postural changes during laparoscopic cholecystectomy, placing the head 15 degrees above or below the horizontal level, caused IOP changes [4].

Laparoscopic cholecystectomy significantly and reversibly decreases cardiac performance. Compromised patients may be at increased risk for complications not previously recognized with this procedure and also affect IOP, increasing the risk for glaucomatous patients making surgeons alarming for measuring IOP before taking the decision for laparoscopic procedure. Elevated IOP during laparoscopic cholecystectomy was mainly due to abdominal CO₂ insufflations rather than other mechanisms [5] [6] [7].

This study was performed to monitor the changes in IOP that may happen during laparoscopic cholecystectomy in patients with gall stones under general anesthesia using CO₂ insufflations. Also the study was limited in studying these changes without attention to other possible contributing factors that may be incriminated in this procedure.

2. Patients and Methods

This observational study included 24 non glaucomatous patients with gall stones who were prepared for laparoscopic cholecystectomy under general anesthesia in Zagazig University Hospitals in the period from January 2016 to April 2016. The study was performed according to WMA Declaration of Helsinki-Ethical Principles for Medical Research Involving Human Subjects.

Criteria for patient's selection:

- No history of intraocular surgery such as cataract or glaucoma surgeries;
- No history of glaucoma disease or treatment-Normal (IOP) below 20 mmHg;
- Normal optic disc by fundus examination (No glaucomatous cupping).

Cases were subjected to the followings:

- Full medical history;
- General medical examination for fitness for general anesthesia;
- General surgical examination for surgical evaluation of gall bladder;
- Abdominal ultrasonography.
- Laboratory investigations including: Complete blood count (CBC), liver and kidneys functions tests, bleeding and clotting time and hepatitis B and C Elisa body's detection.

IOP measurement shortly from 6 - 12 hours preoperatively, intra-operatively and shortly 6 - 12 hours postoperatively using indentation tonometer (Shoitz tonometer) under topical anesthesia using (Benoxinate Hcl 0.4%).

The operative procedure: Laparoscopic cholecystectomy under general inhalation anesthesia, reverse Trendelenburg position of the patient, CO₂ abdominal insufflations (15 mmHg). The surgery was performed by one surgeon in all cases.

Statistical analysis for the data using One Way ANOVA was performed.

3. Results

The demographic data of the patients revealed that 11 (45.8%) were male and 13 (54.2%) were female, age of patients ranged from 23 - 63 years with mean age (44.54 ± 11.53) years. All patients were studied bilaterally except one patient was single eyed.

As regarding to the pre-operative IOP in all patients the average IOP for both eyes was ranged from (12.2 - 18.1) mmHg with mean value (15.21 ± 1.61) mmHg.

The study reported a significant elevation of intra-operatively IOP ($P < 0.001$) in comparison to the preoperative measurements as the average IOP for both eyes was ranged from (14 - 36.15) mmHg with mean value (24.55 ± 6.28) mmHg.

Also the study reported that the IOP returned nearly to the preoperative values shortly (6 - 12 hours) post-operatively as the average IOP for both eyes was ranged from (12.2 - 21.5) mmHg with mean value (16.13 ± 2.44) mmHg. It was insignificant difference ($P > 0.05$) between the pre and the postoperative IOP measurements (**Table 1**).

The study revealed that there was positive correlation between age and intra-operative (IOP) ($r = 0.981$), ($P < 0.001$) with high significant value, denoting that the older the age, the more liability for elevation of intra-operative (IOP) (**Figure 1**).

4. Discussion

IOP changes during laparoscopic cholecystectomy were contributed to many mechanisms, the most common factors affecting IOP during this surgery were abdominal CO₂ insufflations and head down posture, but most surgeon prefer head up position (reverse Trendelenburg position) that has the little vascular and respiratory effects [4] [5].

This study was limited in evaluation of IOP in relation to CO₂ insufflations, reporting a significant elevation of intra-operatively IOP in comparison to the preoperative measurements in the procedure with abdominal CO₂ insufflations with reverse Trendelenburg position under general anesthesia, this results agree with Uno *et al.* (1994) [3] who reported similar results but under epidural block anesthesia, Marco *et al.* (1990) [1] stated that the different types of anesthesia during laparoscopic cholecystectomy had the minimal vascular effects on circulation and central venous pressure and this may explain the similarity in results between the present study and that of Uno *et al.* (1994) [3].

The present study reported a significant elevation of intra-operative (IOP) in spite of the reverse Trendelenburg position as head up, as the study of Swan *et al.* (1985) [8] and Park *et al.* (2016) [9] stated that the head elevation has lower IOP than supine position, the explanation of significant elevation in the present study may be attributed to abdominal CO₂ insufflations that had the dominant effect rather head position and this explanation agreed by Uno *et al.* (1994) [3] and Hirvonen *et al.* (2000) [4].

Table 1. Demographic and IOP results.

Patients	Age In years	Sex	Preoperative IOP mmHg			Intra-operative IOP mmHg			Postoperative IOP mmHg		
			Rt	Lt	Average	Rt	Lt	Average	Rt	Lt	Average
1	56	M	15.9	15.9	15.9	20.6	20.6	20.6	14.6	13.4	14
2	42	M	17.3	15.9	16.6	20.6	22.4	21.5	18.9	17.3	18.1
3	33	F	13.4	-----	13.4	15.9	-----	15.9	13.4	-----	13.4
4	43	F	18.9	15.9	17.4	18.9	18.9	18.9	17.3	15.9	16.6
5	61	F	17.3	17.3	17.3	31.6	29	30.3	20.6	18.9	19.75
6	55	F	14.6	14.6	14.6	26.6	26.6	26.6	17.3	15.9	16.6
7	43	F	13.4	15.9	14.65	29	31.6	30.3	20.6	20.6	20.6
8	23	M	13.4	13.4	13.4	22.4	22.4	22.4	15.9	15.9	15.9
9	28	M	13.4	13.4	13.4	22.4	22.4	22.4	15.9	15.9	15.9
10	56	M	18.9	17.3	18.1	34.5	31.6	33.05	18.9	18.9	18.9
11	45	F	12.2	12.2	12.2	14.6	14.6	14.6	12.2	12.2	12.2
12	44	F	13.4	14.6	14	13.4	14.6	14	13.4	14.6	14
13	49	F	17.3	17.3	17.3	31.6	31.6	31.6	18.9	17.3	18.1
14	53	M	14.6	14.6	14.6	26.6	26.6	26.6	14.6	14.6	14.6
15	55	M	15.9	15.9	15.9	29	29	29	17.3	17.3	17.3
16	58	F	14.6	14.6	14.6	24.4	29	26.7	17.3	17.3	17.3
17	26	F	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
18	29	M	14.6	14.6	14.6	29	26.6	27.8	14.6	14.6	14.6
19	63	M	14.6	14.6	14.6	29	29	29	14.6	14.6	14.6
20	34	F	13.4	14.6	14	24.4	26.6	25.5	13.4	13.4	13.4
21	47	F	18.9	17.3	18.1	37.8	34.5	36.15	22.4	20.6	21.5
22	48	F	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
23	44	M	13.4	14.6	14	24.4	26.6	25.5	13.4	13.4	13.4
24	35	M	14.6	14.6	14.6	29	29	29	14.6	14.6	14.6
Mean	44.54 ± 11.53		15.21 ± 1.61*			24.55 ± 6.28**			16.13 ± 2.44***		

One Way ANOVA, F = 39.696. P < 0.001, between * and ** Significant. P > 0.05 between * and *** Insignificant. P < 0.001 between ** and *** Significant. Correlation between age and intra-operative IOP r = 0.981** P < 0.001.

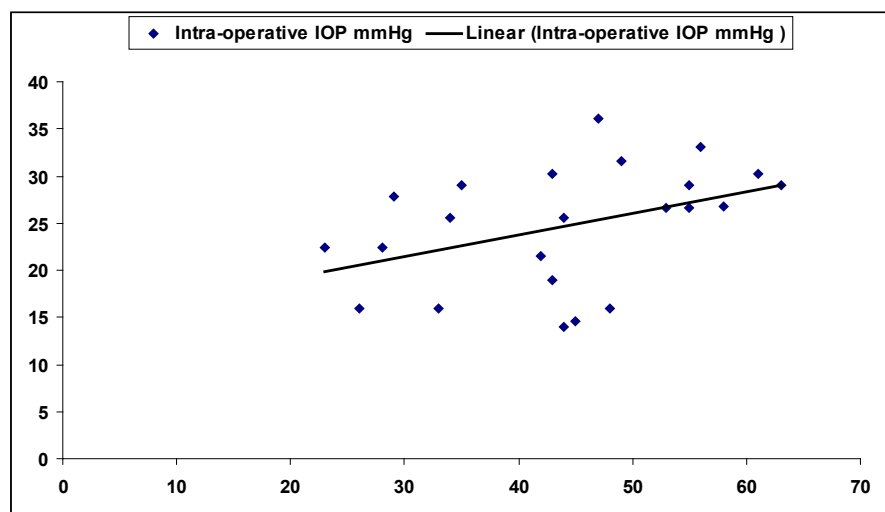


Figure 1. Correlation between age and intra-operative (IOP).

The study revealed also that there was a positive correlation between age and intra-operative (IOP) which may be explained by the senile cardiovascular and atherosclerotic changes that may play a role in that result. Also, Cunningham *et al.* (1993) [2] and McLaughlin *et al.* (1995) [7] reported such cardiovascular and hemodynamic changes especially with aging during laparoscopic cholecystectomy.

5. Conclusion

During laparoscopic cholecystectomy surgery, IOP was significantly elevated in spite of the head up position which is not favorable for glaucoma or ocular hypertension patients. Head down position and old age patients also should be avoided as it may increase the risk of more IOP elevation. Further studies are needed on large numbers of patients to allow surgeons to re-evaluate the decision.

Conflict of Interest

The authors declare no conflict of interest.

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