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COMPARISON BETWEEN TRANSVESICAL INTRA-ABDOMINAL PRESSURE MEASUREMENT, AND ACTUAL INTRA-ABDOMINAL PRESSURE DIRECTLY MEASURED BY CO2 INSUFFLATOR DURING LAPAROSCOPIC SURGERY

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ABSTRACT
The aim of our study is to compare, is there a difference in measured directly by CO2 insufflator IAP in laparoscopic surgery and the transvesical measurement by pressure transducer. Prospective observational study in University Hospial. In selected group of 30 patients, who underwent laparoscopic transumblical cholecystectomy, pressure was measured transvesical with a self-prepared set, the results obtained were compared with those obtained by CO2 insuflatora. After an paired t test, it was found that there was no significant difference in the values of IAP obtained by the one or the other method, which suggested that the use of the transvesical method for monitoring of IAP may be considered non-invasive and accurate.

Key words: Abdominal hypertension; Monitoring; Critically ill patients.

INTRODUCTION

Intra-abdominal pressure (IAP) is a harbinger of intra-abdominal mischief, and its measurement is cheap, simple to perform, and reproducible. Intra-abdominal hypertension (IAH), especially grades 3 and 4 (IAP>20 mmHg), occurs in over a third of patients and is associated with an increase in intra-abdominal sepsis,bleeding, renal failure, and death.

Intra-abdominal hypertension has adverse effects on cardiovascular, respiratory, renal gastrointestinal and neurological function. General surgeons should therefore have a clear understanding of IAH and its potential progression to ACS.

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Although it has been shown that the use of regular IAP measurements and early detection of IAH can alert the attending surgical team of an impending abdominal catastrophe, few ICUs around the world regularly measure IAP (Sugrue M., Buhkari Y.).

Normal intra-abdominal pressure (IAP) is between 0 and 5 mmHg. The harmful effects of raised pressure in the peritoneal cavity have been recognized and studied for over a century. The pathophysiological effects of raised IAP include reduced venous return and decreased cardiac output, decreased lung compliance and increased airway pressure , alterations in renal blood flow resulting in a reduced glomerular filtration rate, and impaired blood flow to all abdominal organs (Scollay J. De Beaux I., Parks R)

In 1984 Kron et al. described a method for transvesical IAP measurement that allowed for repetitive minimally invasive IAP measurement in critically ill patients. Many other methods of IAP measurement have been

described since, most of them experimentally or in animal models. So far, no gold standard for IAP measurement has been set although the World Society on Abdominal Compartment Syndrome (WSACS) advocates the use of bladder pressures as gold standard estimates for IAP (De Waele J.J., De laet I., Malbrain M.L.N.G).

THE AIM

The aim of our study is to compare whether there is a difference between actual direct intra-abdominal pressure measured through CO2 insufflator during laparoscopic surgery procedures and indirect transvesical pressure measured with pressure transducer and self-prepared set for connection between the Foley catheter and transducers dome in those patients.

Study Design

Prospective observational study in operation theater, University Hospital, Stara Zagora.

Patients and methods

For the period from April 2011 to April 2012 was selected a group (n = 30) of adult patients unified by diagnosis - Laparoscopic Transumbilical Cholecystectomy, for treating Chronic cholecystitis with cholelithiasis. In the group were included 18 women (60%) and 12 men (40%) aged: 52.3 (±14.54) years, with BMI:24.79 (±4.94) and ASA grade: 2 (± 1). All measurements were performed simultaneously in both methods, after entering the patients in general anesthesia. IAP measurement was done directly through CO2 insufflator – Olympus Abdominal CO2 Insufflator 16L, and indirect through transvesical route via indwelling Foley bladder catheter, in the complete supine position, at end-expiration. The transducer was nullified at the level of the mid-axillary line. We used closed system for measurement of bladder pressure. A self-prepared technique was used, that consist of a set of three stopcocks, first connected with pressure line via connector to Foley catheter and 50 ml syringe, a bag of 0.9% NaCl 500 ml attached to the second stopcock, and the third stopcock is connected to transducer dome. The system is flushed to remove the air. Oscillation test and respiratory pressure variation was used to confirm the proper functioning of the system.

20 ml of 0.9% NaCl was administrated then a period of 2 minutes was waited before we register the value on the monitor, as well as the value on the display of the insufflator. For each patient a series of 3 measurements at 10 minutes intervals was recorded and mean values were used for statistical analysis. All measurements were performed by the same observer. For control group we used the results from direct measurement (Data set-A), the results from the indirect measurement formed the second group (Data set-B). A statistical analysis for searching the differences between the two groups with level of significance P value ($\acute{\alpha} < 0.05$) was used.

Table 1. *Intra-bladder pressure in mmHg, measured by the two methods expressed as mean, median values, SD, SE, CI.*

	Data set-A	Data set-B
Number of values	30	30
Minimum	11,00	11,00
25% Percentile	12,00	12,00
Median	12,00	12,00
75% Percentile	13,00	13,00
Maximum	14,00	14,00
Mean	12,30	12,13
Std. Deviation	0,8367	0,8193
Std. Error	0,1528	0,1496
Lower 95% CI of mean	11,99	11,83
Upper 95% CI of mean	12,61	12,44
D'Agostino & Pearson omnibus normality test		
K2	0,2736	1,958
P value	0,8722	0,3756
Passed normality test (alpha=0.05)?	Yes	Yes
P value summary	ns	ns
Coefficient of variation	6.80%	6.75%
Skewness	0,1211	0,5470
Kurtosis	-0,4380	0,1997
Sum	369,0	364,0

RESULTS

The results of the performed measurements are presented in **Table 1.** To define the differences between the two groups a parametric analysis and Paired t test **(Table 2)** were used, the results are presented graphically **(Figure 1)**. There is no significant difference and the null hypothesis for the existence of such difference may be rejected (P<0.05).

We plot the difference between this two methods with Bland and Altman analysis **(Figure 2).** The average bias is very small and close to zero and limits of agreements varies in small range. The analysis according to Bland and Altman (6) showed that transvesical measured IAP was almost identical to direct IAP measured via CO2 insufflator , with mean difference or bias of 0.166 ±0.74 mmHg and small limits of agreement -1.29 to 1.63, and good agreement **(Figure 2).**

Table 2. *Parametric Paired t test analysis*

Column A	
vs	vs
Column B	
Paired t test	
P value	0,2313
P value summary	ns
Are means signif. different? (P < 0.05)	No
One- or two-tailed P value?	Two-tailed
t, df	t=1.223 df=29
Number of pairs	30
How big is the difference?	
Mean of differences	0,1667
95% confidence interval	-0.1121 to 0.4454
R squared	0,04902
How effective was the pairing?	
Correlation coefficient (r)	0,5936
P Value (one tailed)	0,0003
P value summary	***
Was the pairing significantly effective?	Yes

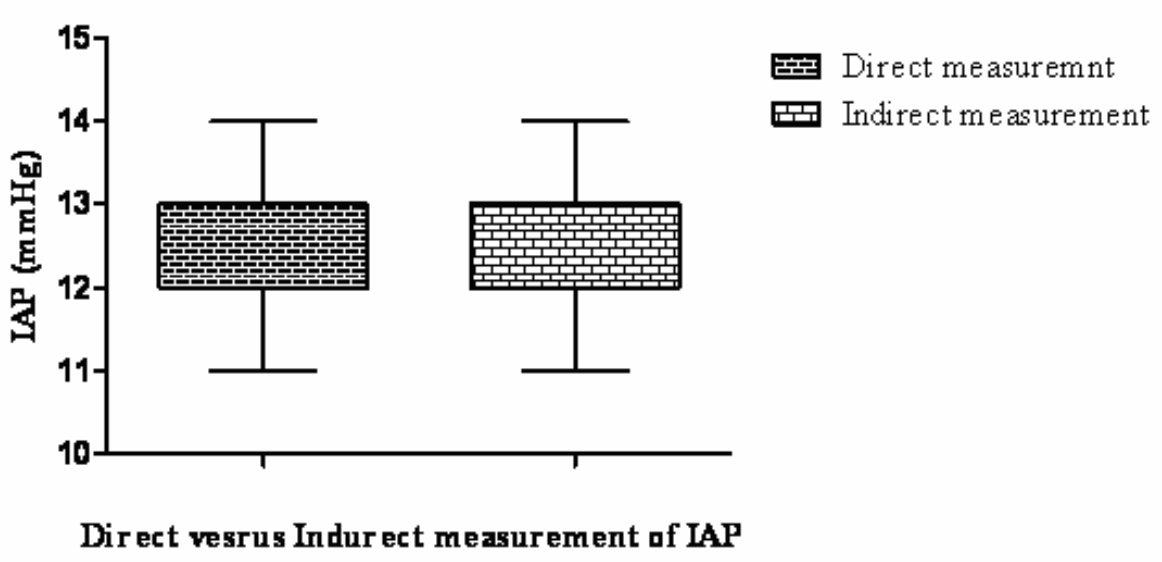

Figure 1. Box and whiskers plot, showing the values of IAP as mean value and SD, obtained by both methods of measurement

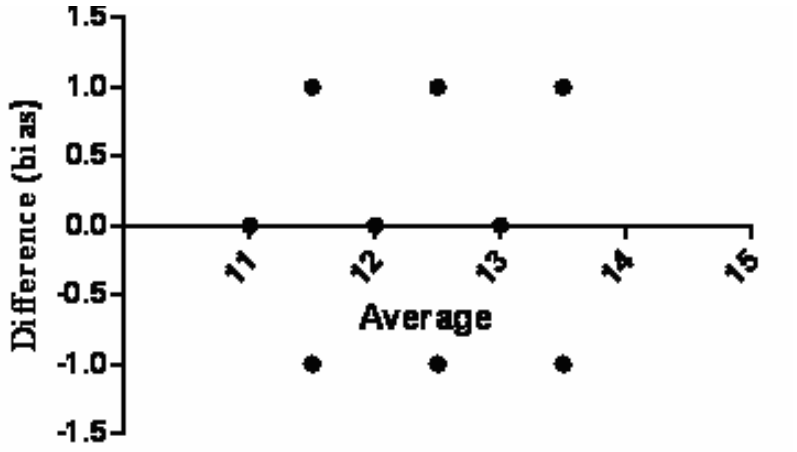

Figure 2. Bland Altman plot express the difference between actually direct method and indirect transvesical method for estimation of intra-abdominal pressure.

CONCLUSION

Intra-abdominal hypertension has adverse effects on cardiovascular, respiratory, renal gastrointestinal, and neurological function . General surgeons should therefore have a clear understanding of IAH and its potential progression to ACS.

In particular intravesical pressure measurements now became common use in critical patients in surgical intensive care units and directed surgical reintervention. The last ten years of the 20th century saw the first evidence-based results of this measurement-driven surgery: pathophysiological complications due to raised IAP could now be reversed by operative decompression of the abdomen. Several laparotomies thus proved to be life saving procedures (Van Hee R.).

Based on the results of this study we can conclude, that the transvesical method of measuring the intra-abdominal pressure is effective, cheap and easily realizable, which suggest the possibility to become a part of the basic everyday monitoring of all patients suspected of threatening abdominal hypertension in our intensive care unit.

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