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INTERMITENT TRANSVESICAL INTRA-ABDOMINAL PRESSURE MONITORING – EFFECT OF DIFFERENT BODY POSITIONS IN PATIENT UNDERGOING MAJOR ABDOMINAL SURGERY

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ABSTRACT
The aim of this study is to identify, whether there is any significant difference in intra-abdominal pressure measured in different body positions in patients hospitalized in intensive care unit (ICU) of university hospital. The prospective study involved 50 patients undergoing major abdominal surgery. The pressure was measured in supine position, and then the patients were set at 30 ° and 45 ° and lateral position. Following a statistical analysis of the results, we found a significant difference between the intra-abdominal pressure measured in supine position and elevation of the body and the lateral position. In conclusion we can say that despite the inconveniences and risks of placing a patient, who is subject of intensive treatment in supine position, we should not measure IAP in other positions due to significant differences.

Key words: abdominal hypertension; ventilator-associated pneumonia, monitoring

INTRODUCTION

Correct bed-side measurement of intra-abdominal pressure (IAP) is the first, necessary condition to deal with intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS), since clinical examination or CT–derived parameters have little role in diagnosis. Moreover, unreliable IAP measurement may lead to inappropriate treatment. The World Society of Abdominal Compartment Syndrome (WSACS) stated that until other methods are validated, the bladder method is considered as the gold standard for indirect IAP measurement(1, 2).

According to consensus definition 4 of the (WSACS): IAP should be expressed in mmHg and measured at end-expiration in the complete supine position after ensuring that abdominal muscle contractions are absent and with the transducer zeroed at the level of the midaxillary line(3).

Supine positioning of patients is associated with aspiration of abnormally colonized oropharyngeal or gastric contents and increased incidence of ventilator-associated pneumonia (VAP). Positioning of patients is a modifiable risk factor for ventilator-associated pneumonia. Current guidelines for prevention of ventilator-associated pneumonia recommend semirecumbency at 30º, with 45º preferable unless contraindicated. Prevention of VAP is a priority of care for patients who require mechanical ventilation. Mortality associated with VAP exceeds mortality due to severe sepsis, central catheter infection, and respiratory tract infection for patients who are not ventilator dependent. VAP also results in prolonged stays in the intensive care unit (ICU) and in the hospital and substantial

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increases in the use of health care resources(4, 5 ,6, 7, 8).

Common practice in our ICU is patients to lie with elevation of the upper body in a semi recumbent positioning with the head of the bed (HOB) positioned at 30 ° -45 °, as well as patient positioning in the left or right lateral position for a period of 2-4 hours for prophylaxis of pressure ulcers. The monitoring of intra-abdominal pressure requires putting the patient in a horizontal position, which affects the patient adversely, especially when the pressure should be monitored at short intervals.

THE AIM

The aim of our study is to compare whether there are significant differences in the measured IAP in supine and semi recumbent positions with the head of the bed elevation, as well as in the lateral position, at the usual patient population in our ICU, underwent major hepatic pancreatic and colonic surgery.

Study Design

Prospective observational study in which were included patients underwent major abdominal surgery and admitted in the ICU for more than 24 hours.

Including criteria: Age> 18 years. Exclusion criteria: BMI> 40, baseline IAP> 12 mmHg; SOFA score> 10, Classification of surgical complication (CSC)> grade IVa, and patients in whom the transvesical measurement of IAP is contraindicated.

Patients and methods

Patient's demographic characteristics: N=50; Age(years; mean ±SD): 65.4±9.2; Gender (M/F): 34/16; SOFA total 6.3±2.2; CSC: II-IVa;

Study Procedures: All patients were placed on anti-decubitus air mattress. The IAP was measured via a indwelling Foley bladder catheter, according to a standardized technique. The IAP was always measured at end-expiration in the complete supine position and stable conditions. The transducer was zeroed at the level of the mid-axillary line, and 20 ml NaCl 0.9% was used to instill the bladder. 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 with room temperature 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 and a period of 2 minutes was waited before we register the value on the monitor.

The obtained base results formed the control group (Data set-A), then the patients were set in a semirecumbency position with the head of the bed (HOB) positioned at 30°and 45° and the measured IAP was registered (Data set-B, and Data set C), after that the patients were set in a lateral position and IAP was once more registered (Data set-D).

RESULTS

The recorded data was processed statistically, D'Agostino & Pearson omnibus normality test was performed and Pearson correlation coefficient R was calculated **(Table 1).** After that a parametric analysis was performed Repeated Measures one way ANOVA and Dunnett's Multiple Comparison Test **(Table 2)**. The differences in intra-abdominal pressure in different body positions are presented in **Figure 1.**

We used Bland and Altman analysis comparing this techniques of IAP measurement in different body position. On the X-axis the mean values of paired measurement is plotted against the difference between two measurements (the bias) on the -Y axis. The Bland and Altman plot analysis present in **figures 2; 3; 4** shows a large bias, and too wide limits of agreement, therefore we can say , that measuring the IAP in the different body positions we will receive results with significant difference.

CONCLUSION

If IAP is measured in semirecumbency position with the head of the bed (HOB) positioned at 30 ° and 45 ° and in lateral position, it can be expected that the results are significantly different from those in the supine position, which will inevitably lead to misinterpretation of the results, which will reflect on the behavior in patients assessed as developed intra-abdominal hypertension. So we can say in conclusion that, despite the inconvenience and risks of changing the position of the patient, it is necessary the measurement of intra-abdominal pressure to be performed only in supine position.

Table 1. *Normality test. Intra-bladder pressure in mmHg at different body positions, expressed as mean, median values, SD, SE, CI.*

	Data set-A	Data set-B	Data set-C	Data set-D
Number of values	50	50	50	50
Minimum	3,000	3,000	7,000	5,000
25% Percentile	6,000	7,000	10,00	8,000
Median	7,000	8,000	12,00	10,00
75% Percentile	8,250	10,00	14,00	12,00
Maximum	11,00	13,00	17,00	15,00
Mean	7,040	8,240	12,04	10,10
Std. Deviation	1,862	1,944	2,457	2,206
Std. Error	0,2634	0,2749	0,3475	0,3120
Lower 95% CI of mean	6,511	7,688	11,34	9,473
Upper 95% CI of mean	7,569	8,792	12,74	10,73
D'Agostino & Pearson omnibus normality test				
K2	0,5941	0,7659	2,215	0,3062
P value	0,7430	0,6818	0,3304	0,8581
Passed normality test (alpha=0.05)?	Yes	Yes	Yes	Yes
P value summary	ns	ns	ns	ns
Coefficient of variation	26.45%	23.59%	20.41%	21.84%

Table 2. *Repeat measured ANOVA and Dunnett's post test for comparing the differences between the control group and each other group.*

P value summary	***				
Are means signif. different? (P < 0.05)	Yes				
Number of groups	4				
F	310,4				
R squared	0,8636				
Was the pairing significantly effective?					
R squared	0,4827				
F	20,53				
P value	< 0.0001				
P value summary	***				
Is there significant matching? (P < 0.05)	Yes				
ANOVA Table	SS	df	MS		
Treatment (between columns)	718,3	3	239,4		
Individual (between rows)	776,0	49	15,84		
Residual (random)	113,4	147	0,7715		
Total	1608	199			
Dunnett's Multiple Comparison Test	Mean Diff.	q	Significant? P < 0.05?	Summary	95% CI of diff
Column A vs Column B	-1,200	6,831	Yes	***	-1.618 to -0.7823
Column A vs Column C	-5,000	28,46	Yes	***	-5.418 to -4.582
Column A vs Column D	-3,060	17,42	Yes	***	-3.478 to -2.642

Pearson correlation coefficient R (Data Set-A versus data set B, C and D) 0,9445343; 0,8335782; 0,8881802

*** P value–extremely significant (<0.001); ** P value–very significant (0.001-0.01); * P value-significant (>0.05); ns P value not significant (>0.05)

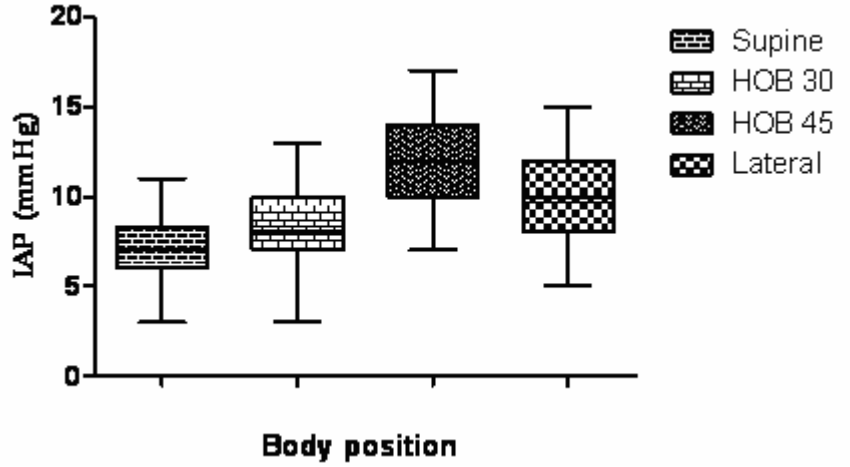
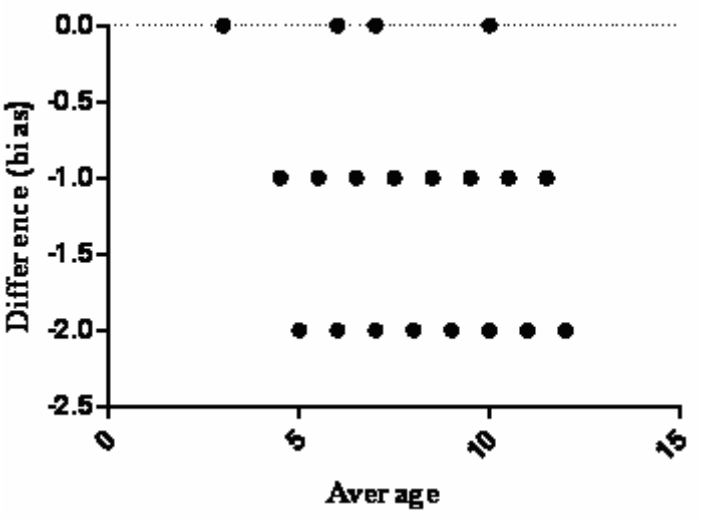
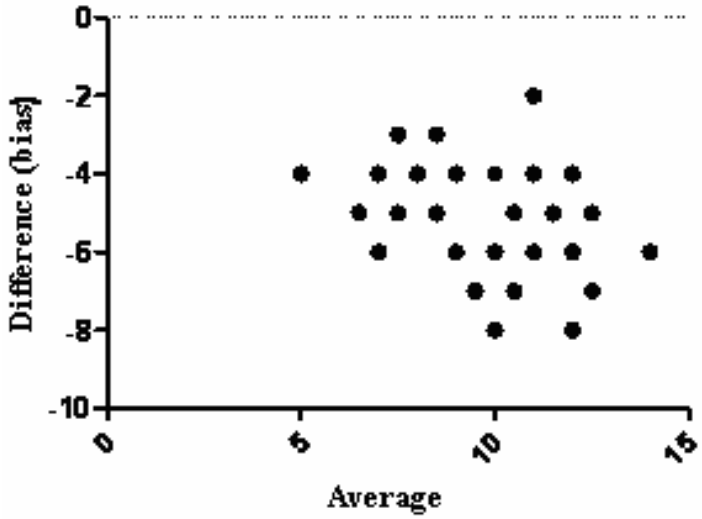


Figure 1. Shows IAP in different body position



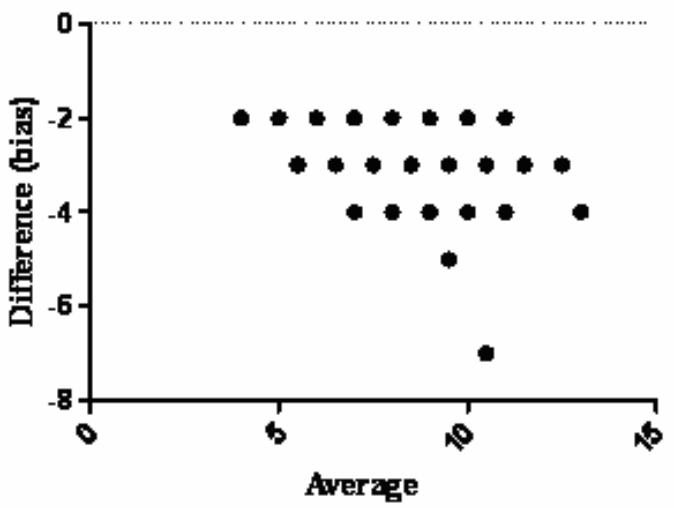
Bias	-1,20000
SD of bias	0,638877
95% Limits of Agreement	
From	-2,45220
To	0,0521981

Figure 2. The Bland and Altman plot – Difference between data set-A and Data set-B



Bias	-5,00000
SD of bias	1,37024
95% Limits of Agreement	
From	-7,68567
To	-2,31433

Figure 3. The Bland and Altman plot – Difference between data set-A and Data set-C



Bias	-3,06000
SD of bias	1,01840
95% Limits of Agreement	
From	-5,05607
To	-1,06393

Figure 4. The Bland and Altman plot – Difference between data set-A and Data set-D

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