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Original Research Article

Investigating Trans-Vesical and Trans-Gastric intra-abdominal pressures for correlation with intra abdominal damages

Seyed Mansour Alamshah[*1], Alireza Kabiri[2] and Seyed Vahid Seyedhosseini[3]

[1]*Associate Professor in General and Vascular Surgery, Golestan Hospital, Jundishapour University of Medical Science. Ahwaz-Iran*
[2]*Assistant Professor in General Surgery, Golestan Hospital, Jundishapour University of Medical Science. Ahwaz-Iran*
[3]*Postgraduate Assistant of Surgery, Golestan Hospital, Jundishapour University of Medical Science. Ahwaz-Iran*

*Correspondence Info:

Dr. Seyed Mansour Alamshah.
Associate Professor in General and Vascular Surgery,
Golestan Hospital, Jundishapour University of Medical Science,
Ahwaz-Iran.
Tel & fax: 0098 6133743076
E-mail: Alamshah-sm@ajums.ac.ir

Abstract

Purpose: Increasing intra abdominal pressure is a warning sign interpreted as an unusual intra peritoneal occurrence. Successive measurement of abdominal pressure during management of abdominal damages may help the surgeon better for prompt judgment.

Method: A Prospective trial was performed on 50 cases of referral acute abdomens during one year. Intra abdominal Pressure was measured by trans vesical and simultaneously transgastric methods on admission, pre and postoperative for 6,12,24,48 hours respectively. The aim of the study was to evaluate the correlation of intra abdominal pressures with intra peritoneal damages or post operative complications during management.

Results: 40 males (80%) and 10 females (20%), 14-85 years old (mean40.9±21.8) were recruited. Overall, 46(92%) cases were discharged in whom 39(78%) were uneventful (33 laparotomies,6 close observations). 11 patients(22%) had complications. There was significant difference between pre and postoperative intra-abdominal pressures in two TV, TG methods respectively (P=0.008 and P=0.02) and between males and females in trans vesical method (P=0.009). Liver packing and evisceration were shown significant range of intra abdominal hypertension amongst the causes. Recorded pressure values between the two methods were similar.

Conclusion: Successive intra abdominal pressure measurements were shown to be effective and were according to pre and postoperative intra abdominal damages, more predictive in females by transvesical method at the time of admission. We conclude that periodic trans vesical measurement for equivocal abdomens, close abdominal observations and post-operative handling of traumatic and pathologic abdomens is mandatory.

Keywords: Intra abdominal pressure, Abdominal compartment syndrome, Trans vesical measurement, Trans gastric measurement.

1. Introduction

Acute abdomen as the most common surgical problem may sometimes present obscure in diagnosis especially when inexpert physician or inexperienced surgeon face it. Delayed action due to misdiagnosis leading to malpractice is caused hazard complications that endanger the patients by misled physician. Nowadays, in developed medical centers, sporadic urban abdominal crisis are well distinguished, but still, rural and sometimes urban medical centers in developing countries may face difficulties in diagnosis of abdominal emergencies during casualties especially by monopolized surgeons in wide difficult access territories. Physicians may seek help by using complementary imaging modalities to compensate vague clinical examinations during management of insidious and equivocal acute or traumatic intra-abdominal damages; but most surgeons prefer to rely on their own experiences and performing physical examinations instead of using some feasible diagnostic modalities such as interventional or minor invasive clinical methods. For instance, abdominal lavage that has defined as highly specific, reliable and usually feasible becomes neglected amongst available procedures. Although, physical examination may seem enough to determine an acute surgery demanded abdomen, but generally rate of negative

laparotomies might be increased. Believing in a negative seliotomy as an accepted issue has been preferred against existence of an insidious non-diagnosed life threatening abdominal pathology, but neither single examination then decision-making without least confirmation for seliotomy nor hesitation for a time wasting documentation is justified. Regarding optimal conditions, differentiation would be sometimes difficult unless fulfilling close observations and utilizing certain complementary methods to be helpful in the mentioned situations. Today, Intra Abdominal Pressure (IAP) has been accepted as the one of the reliable bedside diagnostic method for management and prediction for control of mortality risk factors such as sepsis, mechanical ventilation support, renal disorders and outcome of multiple organ failure especially in ICU patients (1- 4). Since alteration of IAP measurement can reflect intra abdominal pathologic events, as the aim, the study was designed to evaluate correlation of IAP alterations with intra abdominal damages or existed postoperative abdominal complications during the course of acute and traumatic abdominal management. Positive correlation reveals more strengthen indication for early surgical intervention because of on time diagnosis. IAP measurements are a simple handling, available and feasible in all situations even by educated nurse staff.

2. Method

Fifty patients with multiple trauma and acute abdomen were enrolled in a prospective cohort clinical study. Patients were referred to our surgical emergency departments affiliated to Jundishapour University of Medical Science, Ahwaz-Iran during one year from the May2009. All patients gave their written informed consent prior to commencement of the study based on ethical approval conform to the guidelines of 1975 declaration of Helsinki and approved research projects of university institution and faculty research registration. The aim of the study was to evaluate correlations of intra abdominal pressures with intra abdominal pathologies or complication in acute and traumatic abdomens during handling from admission to discharge by successive and periodic measurements. Patients were divided into five age groups: <20 YO, 12 cases, 24%; 20-40 YO, 18 cases, 36%; 40-60 YO, 8 cases, 16%; 60-80 YO, 10 cases 20% and>80 YO, 2 cases, 4%. IAP was measured before and after liquid therapy and resuscitation in emergency department, during observations, before surgery and 6,12,24,48 hours post operative if surgical intervention was necessary in order to control pressure variability or presence of Intra Abdominal Hypertension (IAH) until Abdominal Compartment Syndrome (ACS). Methods of measurement were Trans Vesical (TV) and simultaneously Trans Gastric (TG). A manometer containing Mercury barometric device was used to record pressures through connecting to a serum filed Naso-Gastric tube for Trans-gastric and connection to a foley catheter for Trans-Vesical method. The Zero point of manometer was set parallel to mid axillary line in TG method and parallel to Pubic Symphysis in TV method during supine position. For cases who were required only observation, measurements were followed every 24 hours but for complicated or laparotomies it was repeated every 6 hours for first 24 hours and then the usual 12,24,48 hours post-complication until recovery. All pressure ranges were compared in all steps before and after management for two methods along with demographic features. The results were analyzed trough the student T and Chi- Square with fisher's exact tests and post hoc ANOVA by version 20, SPSS software.

3. Results

50 recruited patients, 40 (80%) males and 10 (20%) females in the range of 14-85 years old (mean 40.9±21.8 years) were managed in two groups. 44 (88%) required surgical intervention laparotomies during handling and 6 patients only observed without surgical intervention until recovery and discharge. Laparotomy cases were divided into two sub groups of 33(66%) un-complicated patients and 11 (22%) complicated patients. Complicated patients were involved in liver packing, evisceration, bile peritonitis and intra abdominal abscesses. Ultimately, 46(92%) cases were discharged uneventful after completing the convalescence of surgical management and also from observed cases. 4(8%) patients died due to sepsis and cardio-pulmonary insufficiencies who were not related to any pathologic increasing of IAP. Causes of abdominal pathologies were 7(14%) intestinal obstructions and gangrene, 13(26%) splenic ruptures (falling, car accident), 7(14%) hepatic trauma and ruptures (car accident, gunshot) needed packing in or after re-explorations, 3(6%) abdominal evisceration, 16(32%) visceral perforations (blunt trauma, stab wounds), 2 (4%) appendicitis with peritonitis and abscesses and 2(4%) pancreatitis with gallstones. Mean ISS in traumatic patients was 21±9.5. Trans Gastric and Trans Vesical Comparison of IAP ranges in complicated and non-complicated cases based on measurements are shown in Table1. All the compared quantities between them in the two methods had meaningful differences (P value ranges: from 0.008 to 0.04) but overall, there were no significant differences between TV vs. TG method in measurements and their mean values (P=0.469) (Fig 1). Based on diagnostic causes, pre operative and 6 hours postoperative pressure comparisons were performed (Table 2).There were significant differences in patients with liver packing and evisceration pre and post operative in the two methods

separately. In comparing of mean values of IAP measurements for both methods between genders, significant difference was found in TV method between males and females in pre operative observation period; whereas, in TG method and post operative times no significant differences were achieved (Table3). There was no meaningful difference between pre-liquid resuscitation and post-liquid resuscitation period and between TV versus TG methods (P=0.549). Patients have been managed based on damage control programs by fluids and blood transfusions in pre operative duration. No patient was progressed to ACS during therapeutic or observation periods.

Table 1: Comparison of IAP in complicated and non-complicated cases based on measurement hours

IAP	Trans Gastric method (Ranges and Mean)			Trans Vesical method (Ranges and Mean)		
	Un-complicated	Complicated	P value	Un-complicated	Complicated	P value
Pre-OP	8.4-15.4 (11.3±1.2)	11.2-20.3 (15.2±2.7)	**0.02**	9.8-23.8 (14.3±3.8)	8.4-16.8 (11±1.4)	**0.02**
6h, Post-OP	6.3-9.8 (7.9±1)	6.3-15.4 (10.4±2.3)	**0.008**	7-17.5 (9.4±2.8)	5.6-10.5(7.6±1.1)	**0.02**
12h,Post-OP	5.6-11.2(7.6±0.9)	6.3-14(9.4±1.9)	**0.01**	6.3-14 (8.4±2)	6.3-9.1(7.3±0.7)	**0.01**
24h,Post-OP	6.3-9.8(7.6±0.8)	7-12.6(9.1±1.6)	**0.01**	6.3-12.6(8.4±1.7)	5.6-9.1(7.4±0.7)	**0.01**
48h,Post-OP	5.6-9.1(7.7±0.7)	6.3-10.5(8.6±1.2)	**0.02**	6.3-12.6(8.3±1.5)	5.6-9.1(7.4±0.7)	**0.04**

Abdominal pressure measured using both trans gastric and trans vesical methods in two cohorts of un-complicated (n= 33) and complicated (n=11) patients. The data is expressed as mean ± SD (Standard Deviation). P values were determined using ANOVA statistical tests.

Table 2: Comparison of mean IAP based on diagnosis and causes in methods, pre and 6 hours post operative

Patients Diagnosis	Trans Gastric method (Mean)			Trans Vesical method (Mean)		
	Pre-OP IAP	6h Post-OP IAP	P value	Pre-OP IAP	6h Post-OP IAP	P value
GI obstruction	11.7±1.5	7.8±0.9	0.98	10.3 ±0.5	7.1 ±0.5	0.08
Splenic rupture	11.6±1.4	7.7±0.9	0.31	11 ±1.9	7.2 ±1.2	0.10
Liver packing	15.8±1.6	10.9±1.1	**0.014**	14.1 ±2.1	8.9 ±1.1	**0.017**
Evisceration	14.2±5.3	10 ±4.7	**0.006**	15.6 ±7.2	11.2 ±5.5	**0.004**
Visceral perforation	11 ±1.3	8 ±1.1	**0.05**	11.2 ±1.6	8.2 ±1.1	0.13
Peritonitis (appendix)	9.8 ± 0	6.7 ±0.5	0.11	10.8 ±0.5	6.7 ±0.5	0.26
Pancreatitis & gallstones	13.3 ± 1.9	9.5 ±0.5	0.09	10.8 ±1.4	7.3 ±0.5	0.69

Mean ± SD (Standard Deviation). IAP (Intra Abdominal Pressure). P values Extracted using T and Chi-square and ANOVA statistic tests.

Table 3: Pre-operative means of IAP between genders in both methods

Method of measurement	**Males** (Mean IAP)	**Females** (Mean IAP)	**P value**
Trans Gastric	11.9 ± 2.3	12.9 ± 2.8	0.78
Trans Vesical	11.5 ± 1.9	12.7 ± 4.4	**0.009**

P values determined by T, Chi square and Fischer correlation statistic tests as mean ± SD (Standard Deviation). Significant difference is expressed the better response of females with Trans Vesical method for intra abdominal pressure recording.

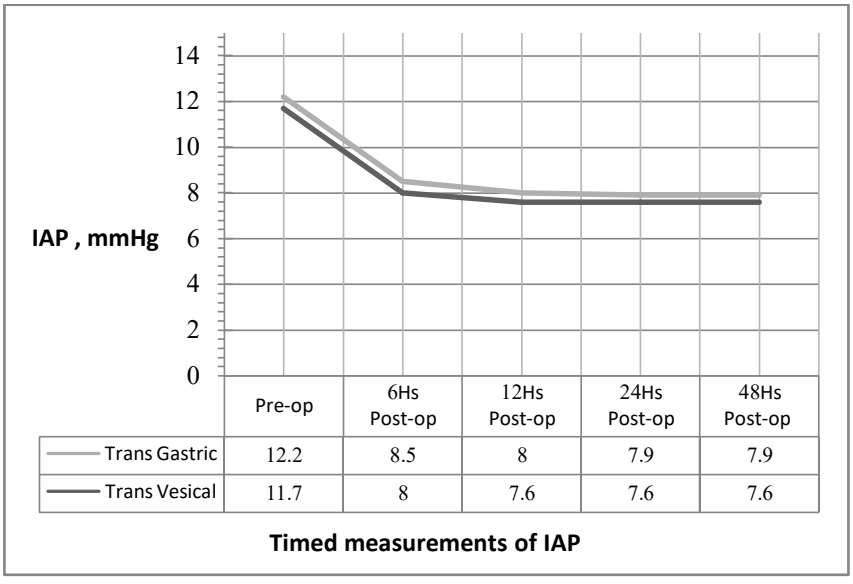

Figure 1: Comparison of Trans Vesical and Trans Gastric methods based on IAP measurements
Measurements that were attained during all defined periods of the trial have been considered for comparison in the chart. Based on pressures, the curve in both methods is parallel and slope in pre-operative periods until 6 hours post operative, express meaningful regression in the pressure with progression of the therapeutic approach.

4. Discussion

Intra abdominal pressure measurement has begun from eighty decade. Normal abdominal pressure is less than atmospheric pressure towards zero, but in severe diseased adults and victims of abdominal trauma, levels may be fluctuating and is usually about 20-35 mmHg [5]. As expected, IAP ranges are always assumed relevant to the changes of intra abdominal content physiology. Therefore, the pressure is highly depended to surrounding intra abdominal viscera especially in obese [6] and term pregnant in whom IAP have considered about mild increasing more than 12 mmHg that is acceptable in an adequate course of physiologic function [5,7]. Hallow viscus changes produced by gastro-intestinal obstructive disorders, abdominal organomegaly, masses and free intra peritoneal fluids have also been implicated. Based on the literature, acute disorders such as sepsis on admission [6], kidney injuries [8], hepatic injuries that affect hepatic clearance, ascites [9] and pancreatitis with the incidence of 60-80% [10] have been accounted as common pathophysiologic causes of Intra Abdominal Hypertension (IAH). Accordingly, the risk of developed IAH is postulated to be minimal without severe intra abdominal inflammations presented due to pancreatitis, hepatic failure, gastrointestinal bleeding and in patients with no indication for laparotomy; thus, advocates to believe IAP measurements can be omitted in the lack of intra abdominal inflammations [11]. Today, current practice and using damage control strategies with confined pre operative fluid resuscitation has lead to control of IAH and made it appear as a transient phenomenon that blocks progression of ACS [12]. Nevertheless, justification for taking certain history and accurate physical examinations simultaneous with IAP recording is still existed and advocated that are able to diagnose abdominal organ injuries in order to decrease mortality especially for ICU patients [4,13]. Decreasing mortality and morbidity through finding a simple feasible bedside guide accompanied by physical examination in order to reinforce better diagnosis and prove indication of surgical abdominal intervention, explain the aim for this study. According to achieved data, meaningful differences between pressures in complicated and non-complicated patients in pre and postoperative periods were shown that increasing of intra abdominal pressure could presume as a warning sign of intra abdominal damages (Table 1). It presents that successive timed bedside IAP measurement for emergency management and follow up of acute abdomens is helpful as much as surgeons can rely on its alterations beyond the normal value that reflects intra abdominal damages.

Genders were presented meaningful difference in pre operative TV mean ranges (P=0.009). The difference demonstrates that detection of pre operative IAP, before surgery or on admission by TV method is more valuable and indicative in females rather than males for diagnosis (Table 3).

Similar to the results of Early GL, et al [13], in the trial, liver packing and evisceration in both methods between the other diagnosed causes of IAH, were shown important meaningful differences. The above finding has again emphasized on the capability of IAP measurement in reflecting any imposed pathologic condition produces IAH along with its efficacy for presenting on time required

laparotomy and releasing IAH to prevent ACS during packing and handling (Table 2). Furthermore, comparing intra-operative and postoperative pressure control were assisted us in adjusting suitable towel packing for intra-abdominal damages and to manage the secondary repair of inadvertent eviscerations as the two significant events compared to the other complications. Intra-abdominal pressure increasing was being directly produced by more than four sub-diaphragmatic packs of liver with the sponges of standard size. Periodic supervision of IAP measurements was implied on the ability to perform close observation and expectant therapy of some equivocal abdomens, as there were no differences among them on admission and during follow up until discharge. Overall, In spite of obtaining such differences in the study, the TV and TG methods were identical in mean ranges and the ranges were almost the same and parallel to each other (P=0.469) (Figure 1).

Consequently, successive measurement of IAP preferably Trans Vesical, advocate the effectual role of its capability as a reliable managing index, during acute and traumatic abdominal crisis and follow up control for abdominal damages. Method of measurement is very simple and convenient for all range medical student and nurse staff and is feasible with the least required facilities. Administration of periodic IAP measurements depends on abdominal damage severity is conclusively suggested and has to be performed and considered for all abdominal trauma and abdominal conditions need to be admitted and observed.

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