

# A new method of measuring intra-abdominal pressure

## Abstract

We propose a reliable method of direct measurement of intra-abdominal pressure. Found that all patients with acute peritonitis has increased intra-abdominal pressure greater 15mm hg art and increased intra-abdominal pressure correlates with the severity of the pathological process, the higher per the of intra-abdominal pressure, the more severe. Determination of intra-abdominal pressure is of great prognostic value indicating whether the tactics of patients with acute peritonitis.

**Keywords:** peritonitis, intra-abdominal pressure, measurement, peritoneal inflammation, intense and bloating

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**Abbreviations:** IAP, intra-abdominal pressure; ACS, abdominal compartment syndrome; AHI, intra-abdominal hypertension; MODS, multiple organ dysfunction syndrome; CVP, central venous pressure

## Introduction

Almost every sixth patient with acute surgical abdominal disease enters the hospital with symptoms of peritonitis, lethality at which on average is 20-39%, and in severe forms already reaches 80-90%.<sup>1,2</sup> Leading value in an unfavorable outcome of treatment of this pathological process is given the progressive increase in intra-abdominal pressure (IAP).<sup>1,3,4</sup> It is known that primary sanation abdominal cavity does not result in simultaneous elimination of peritoneal inflammation. Inadequate treatment tactics it promotes or development or progression of an existing IAP, which is accompanied by the syndrome of intra-abdominal hypertension (Siaha), which in English is called transcription abdominal compartment syndrome (ACS), which develops before the operation.<sup>5,6</sup> The term abdominal compartment-syndrome Kron proposed in 1980.<sup>7</sup> This syndrome occurs when the pressure in the closed abdominal cavity rises to a level that interrupts the normal blood supply contained therein tissues and organs. The threshold of this pressure depends on the voltage of the abdomen with extension of the abdominal cavity, as well as the degree of hypovolemia. Typical clinical signs of increasing IAP include: intense and bloating, peak inspiratory pressure, central venous pressure increase, decrease cardiac output, hypoxia, hypercapnia and oliguria.<sup>3,4,8</sup> IAP monitoring also allows to timely detect the early signs of multiple organ failure, which is extremely important in the development of adequate methods of its correction. The role of this study further increases in the study-abdominally perfusion pressure (AAP), which is calculated as follows:  $AUL=SBP-WBD$ , where SAD-a mean blood pressure.<sup>1,3,9</sup> which is extremely important in the development of adequate methods of its correction. The role of this study further increases in the study-abdominally perfusion pressure (AAP), which is calculated as follows:  $AUL=SBP-WBD$ , where SAD-a mean blood pressure.<sup>1,3,9</sup> which is extremely important in the development of adequate methods of its correction. The role of this study further increases in the study-abdominally perfusion pressure (AAP), which is calculated as follows:  $AUL=SBP-WBD$ , where SAD-a mean blood pressure.<sup>1,3,9</sup> ADF Index is the most accurate predictor of visceral perfusion and serves as one of the parameters of the

termination of massive fluid resuscitation in critically ill patients. It is proved that the ADF level is below 60mm Hg directly correlates with survival in patients diagnosed Siaha.

If the abdomen viewed as a fluid reservoir, is based on Pascal's law, the pressure in all of its departments early. This pattern suggested the use and Bradley SE and Bradley GP for measuring the intra-abdominal pressure, which in normal adults is 0-5mm Hg.v.<sup>3</sup> A small increase in pressure (up to 10mm Hg. Art.) Is observed in obesity, in the postoperative period, with mechanical ventilation and in some other states of the organism. Intra-abdominal hypertension (AHI)-a continuous or periodic (but not transient) increase WBD to 12mm Hg WBD growth to the level of 20mm Hg depends on multiple organ failure / dysfunction when ADF least 60mm Hg or without.<sup>2,3</sup> World Society for the Study of intra-abdominal compartment syndrome (WSACS) proposed scale on which are 4 extent of intra-abdominal hypertension: I degree-12-15mm Hg, II degree-16-20mm Hg, III degree-21-25mm Hg, IV degree>25mm Hg (for convenience in clinical practice, the measurement is conducted in millimeters of water column, each value of Hg increases 10times).

According to many authors, the diagnosis ACN likely when abdominal hypertension exceeding 150mm water column, and when the patient has two or more such features multiple organ failure (MODS), as acidosis, hypoxemia, increased CVP, hypotension oliguria. In turn, the increase in IAP negatively affect the work of all organs and systems of the body and contributes to the development of early organ failure.<sup>3,8,10</sup> When abdominal compartment-impaction syndrome occurs in the inferior vena cava and adrenal subdiaphragmatic level, as well as the mesenteric veins and lymphatic vessels. This is accompanied by a decrease in blood flow to the heart and increased peripheral vascular resistance (due to compression of the capillaries), which disrupts the activities of the cardiovascular system. It should be remembered that the decrease in cardiac output is observed at WBD amount equal to 100-150mm of water.

Compression accompanied by abdominal compression portal system, which leads to disruption and thrombosis of the microcirculation in small vessels. There is ischemia of the intestinal wall, which is accompanied by the swelling of the development of intracellular acidosis, which is in turn followed by extravasation and exudation, ie a vicious circle. These disorders manifest themselves

clearly when WBD is equal to 150mm of water and at 250mm water already developed ischemia intestinal wall.<sup>7</sup> When control of diffuse peritonitis WBD to be performed every 2-4hours, it is important to determine the perfusion pressure in the abdominal cavity, which is the difference in mean arterial pressure and intra-abdominal and largely determines the severity and prognosis of the disease process. This study can be attributed to the mandatory manipulation, which is ahead of the clinical manifestation of this complication. It can be attributed not only to the most reliable diagnosis, but also to a prognostic test.

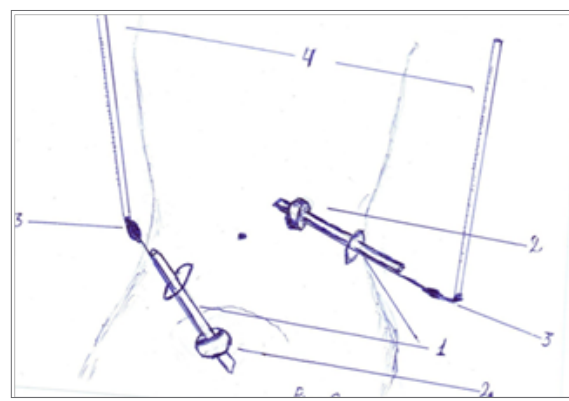
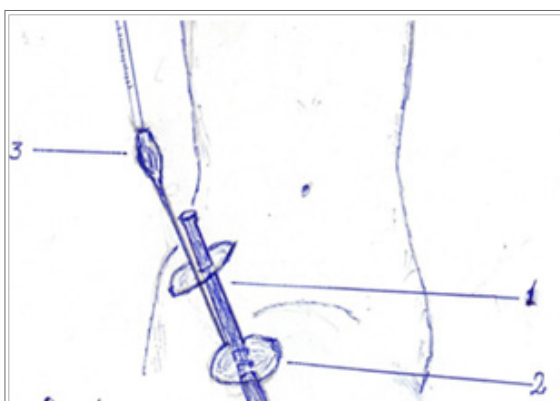
## Materials and methods

Known methods for diagnosis of intra-abdominal hypertension syndrome is mainly based on analyzing indirect measurements WBD through the cavity of the bladder, stomach, rectum, uterus, inferior vena and femoral veins using or transurethral catheter or nasogastric tubes, or other device, introduced into the cavity of the above authorities. Described and indirect signs of intra-abdominal hypertension in the performance of computed tomography of the abdomen. Proposed and direct methods for determining the IAP-in case of laparoscopy through laparotomy and drainage tubes. They are made by introducing into a particular zone free abdomen certain amount of saline followed by determination of abdominal pressure therein. According to the cumulative literature WBD through measurement bladder used in 92.8% of cases, direct method to 4.2%, through the stomach - 2.8%. Some of these methods are used only once, and they are not only complex, but also unreliable, while others have several serious drawbacks and contraindications, chief among which is the mediation of measurement. This also applies to now most frequently employed method for measuring the IAP by the bladder which is proposed in 1980 godu Kron.<sup>10</sup> Direct methods generally do not provide the dynamic monitoring of the state of WBD and therefore not widely used.<sup>3,7,11</sup> Chief among which is the mediation of measurement. This also applies to now most frequently employed method for measuring the IAP by the bladder which is proposed in 1980 godu Kron.<sup>10</sup> Direct methods generally do not provide the dynamic monitoring of the state of WBD and therefore not widely used.<sup>3,7,11</sup> Chief among which is the mediation of measurement. This also applies to now most frequently employed method for measuring the IAP by the bladder which is proposed in 1980 godu Kron.<sup>10</sup> Direct methods generally do not provide the dynamic monitoring of the state of WBD and therefore not widely used.<sup>3,7,11</sup>

According to the World Society recommendation to study intra-abdominal hypertension syndrome (WSACS) into the bladder to

be administered no more than 25ml of warm sterile saline solution, whereas 52.8% of respondents introduced 50ml, 21.9%-100ml, 4.3%-200ml that It causes confusion in the evaluation of the measurement results.<sup>1,3,7</sup> On this basis, we have developed a simple and accessible way to the direct determination of IAP that allows for an unlimited number of dimensions in any patient and at the same time to make it, and drainage of the abdominal cavity of the same tube (RF patent number 2,488,346 from 27.07.2013, the). For these purposes the bioinert 8,5mm diameter tube having a distance from the working end of 15-20cm built capacity with elastic wall, which acts as a membrane. The most accessible and convenient for this purpose is a conventional tube used for the production of endotracheal anesthesia, through which counter opening introduced into the free peritoneal cavity, having at the side of its surface.

Technical result IAP measurement is achieved by elastic and the hermetic container into which is poured through the capillary 10 to 12ml of fluid at zero pressure. Increasing it above the atmospheric pressure occurs only when it is compressed by swollen bowel loops and exudate, that is, when there is a growth of WBD. From the container on the lateral surface of the tube extends soldered nipple tube of the same length and diameter of 1.0-1.5mm, which has on the end of the valve device allowing sealingly connect the container with a cannula device for measuring the intraluminal pressure in mm Hg. This device may be a capillary or transparent wall and the edge or gage. These design parameters tubes provide continuous monitoring of the magnitude of intra-abdominal pressure during provided it in one or other area of the abdominal cavity. The liquid in specified amounts, and it is usually saline, is poured into the vessel or the end of the operation, or immediately after the arrival of the patient in the intensive care unit. For the visual accuracy of the measurement liquid is slightly stained with brilliant green. A zero measurement value is set at or mid-axillary line, or the upper edge of the pubic symphysis. The very same tube is designed to remove exudate from the peritoneal cavity. The value of its lumen allows the well to sanitize the cavity or immediately after the arrival of the patient in the intensive care unit. For the visual accuracy of the measurement liquid is slightly stained with brilliant green. A zero measurement value is set at or mid axillary line, or the upper edge of the pubic symphysis. The very same tube is designed to remove exudate from the peritoneal cavity. The value of its lumen allows the well to sanitize the cavity. Figures 1 shows the arrangement of tubes and cuffs in the abdominal cavity, while in Scheme 1 only when the introduction tube in the pelvic cavity, and at 2 and the left subdiaphragmatic region. The arrow 1 shows the entire tube, 2-its mantle 3 transitional reservoir capillary 4-manometer.



Figures 1 The tube for measuring the intra-abdominal pressure.

## Research

The described method of measuring the IAP produced U15 patients with generalized purulent peritonitis, treated at the emergency hospital MBUZ SCC and showed good results, both in terms of early detection of their intra-abdominal hypertension syndrome, and correction of the pathological process. Iz15 patients y10 specified amount of the colored saline solution was introduced into the vessel at the end of the operation (before suturing the wound in the median), and at 5-within 1-2hours after surgery. Following this, using the transparent capillary line and carry out certain WBD that all patients was higher than 15mm Hg. Art. Dynamic observation for WBD within 1 to 4days after surgery was performed every 2-4hours, with 6 out of them is not reduced, but rather increased. These data were the main indications for their relaparotomies. During the second operation, it was found in 5 patients continued because abdominal hypertension was undocked peritonitis, and at 1-failure of the anastomosis seam. All of these patients underwent corrective surgery, aimed at creating a decompression of the abdominal cavity. 2 patients died. The cause of death for both was not related to the procedure for determining the value of the intra-abdominal pressure.

## Observation

Patient L., 74years old. IB №2183 entered into 2EHO 08.01.2012g with symptoms of acute intestinal obstruction. Colliotomy with drainage abdomen-After 2 chasa operation has been performed. After 3days (11.01.12) she developed clinical peritonitis. Relaparotomy performed, during which revealed segmental necrosis of the small and large intestines. Performed resection of the affected areas every bowel with imposition ileotransverzoanastomoza. The patient's condition was not improved after relaparotomii and 3days later (14.01.12) made relaparotomy programmed with readjustment of the abdomen and pelvic cavity drainage silicone tube with a diameter of 8,5mm capacity at the end, through which a pin at the end of the operation was poured 10ml of physiological tinted solution. After delivery in intensive care unit patients abdominal pressure measured by the developed technique. It was equal to 18mm Hg the blood pressure was equal to 150/64. Abdominally perfusion pressure was 89mm Hg. WBD monitoring every 4 chasa was conducted From this day on, the 1day after relaparotomii measurement rate was 12 14mm Hg (AUL=82-88mm Hg) after 2days- 8-10mm Hg (ADF=88-95mm Hg), after 3days-15-16mm Hg (ADF=72-69mm Hg .st). The increase with decrease IAP ADF served as an indication for abdominal revision, although the overall condition of the patient was stable heavy. 17.01.12 during relaparotomy detected inconsistency of anastomotic sutures. Resection anastomosis with there imposition of ileotransverzoanastomoza. 18. 01.12., i.e. 1day after the third step, VBD was 15-16mm Hg (ADF-72-82 mm Hg). 19. 01.12 the patient's condition deteriorated rapidly. Blood pressure decreased to 110 / 40mm Hg, 12mm Hg to WBD (APD=63mm Hg), and after 8hours was 60 have AD/0mm Hg VBD-12mmrt.st, ADF-48mm.rt.st. These figures showed a severe multi-organ failure, which was the cause of the patient's death.

## Discussion of the research results

To perform timely and effective correction of pathological processes accompanying peritonitis, it is of great importance to

determine the pressure in the cavity. Defining it through the lumen of the bladder, as do other surgeons, cumbersome and requires a finding in her catheter, which inevitably ends with the development of cystitis. Proposed by the contact method is devoid of these shortcomings and allows at any time if there is a need for this, to carry out a reliable measurement.

## Conclusion

The described method of measuring the IAP objectively reflects the state of the microcirculation in the tissues and organs of the abdomen. It is simple to perform and publicly available.

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None.

## Conflict of interest

The author declared that there is no conflict of interest.

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