Abdominal Compartment Pressure Monitoring - A Simple Technique

Lt Col P Rao*, Col R Chaudhry, vsm⁺, Lt Col S Kumar[#]

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Introduction

Intra-abdominal hypertension, also known as Abdominal Compartment Syndrome (ACS) is a common and life threatening complication which occurs after surgery for major abdominal trauma. In the post operative period an intra-abdominal pressure of 3-15 mm Hg is considered normal [1]. Raised intra-abdominal pressure causes derangement of renal, pulmonary and cardiovascular systems leading to decreased urine output, hypoxaemia, and decreased cardiac output ultimately leading to death. The rise of intra abdominal pressure in trauma patients occurs due to severe bowel oedema caused by bowel ischemia, massive fluid resuscitation, intra abdominal bleeding, collection of body fluids and packing of intra abdominal organs to arrest bleeding.

Variety of methods have been described for measuring intra-abdominal pressure, most of which require complicated procedure and costly equipment, like placing catheter and pressure transducers directly into the abdominal cavity, the stomach, rectum and inferior vena cava. We describe a simple and practical method of measuring the intra-abdominal pressure which can be set up easily even in a peripheral hospital and has been validated in experimental and clinical studies [2].

This technique uses the urinary bladder, an intra-abdominal and extra-peritoneal organ for indirect pressure measurement. The urinary bladder has a compliant wall which acts as a passive reservoir at volumes of less than 100 ml and is capable of transmitting abdominal pressure without imparting any additional pressure from its own musculature. Elevation of head end of bed, adhesions and loculations may give falsely elevated or low measurements. Contraindication for use of this technique is in the patients with pre-existing bladder disease and those with bladder trauma. In such case the intra-gastric route can be used [3].

Method

We recommend a 3-way Foley catheter, which allows intra abdominal pressure to be monitored via the irrigation limb. The use of the irrigation limb avoids the need to repeatedly access a closed system thereby reducing the risk of needle stick injuries and chances of error in pressure monitoring [4]. Most of the patients requiring intra abdominal pressure monitoring are critically ill and on ventilator. The positive pressure ventilation clinically does not lead to any significant increase of intra-abdominal pressure in such patients [3].

The setup for using a 3-way Foley catheter consists of one litre bag of normal saline, one set of pressure or intra venous tubing, one set of water manometer (similar to that used for central venous pressure monitoring), one clamp, one 50 cc syringe, one 3-way connector and one urinary drainage bag.

The drainage limb of 3-way Foley's is connected to drainage bag (urobag) and the water manometer is connected to the irrigation limb of the catheter by intra venous/pressure tubing via a 3 way stopcock. A 50 cc syringe filled with saline is connected to the 3 way stopcock as shown in the photograph (Fig 1). The circuit is primed with the normal saline (the flush solution does not require heparin or pressurisation). Before measuring the bladder pressure, the catheter remains open to continuous drainage, and hence there is no residual urine. Now clamp the drainage tubing and fill the bladder with 50 cc of normal saline using the syringe. This ensures that the volume of fluid in the bladder is constant for each measurement. Then ensure that the manometer is at level with the bladder (which should be approximately at the level of pubic symphysis in supine position of patient). Now close the stopcock of the syringe and obtain the mean pressure reading. The abdominal blood flow should produce fluctuations in the waveform with

*Classified Specialist (Surgery and GI Surgeon), Command Hospital (SC), Pune – 411040. *Professor and Head (Department of Surgery), Armed Forces Medical College, Pune -411040. #Classified Specialist (Surgery and Trauma Surgeon), Military Hospital Kirkee, Pune.

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Fig. 1 : Abdominal compartment pressure monitoring setup

the heart beat. Should the waveform fail to produce fluctuations, flush the line as you would to troubleshoot dampening of any pressure waveform and monitor

pressure every 2 - 4 hours.

Alternatively, if a 2-way catheter is already connected, an 18 gauge needle inserted in the drainage limb of Foley's catheter can be used to connect to the manometer. Optionally a 'Y' connector can be attached to the drainage limb to create separate channel for pressure monitoring and bladder drainage. Just raising the catheter tubing above pubic symphysis, unclamping the tube and measuring water column has also been described [5]. Measurement of intraabdominal pressure is recommended every 2 to 4 hours so as to take timely corrective actions. Some patients may develop gut ischaemia prior to elevation of intraabdominal pressure hence it is vital that the decision regarding management should be based on overall clinical findings.

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