Title: INTRA-ABDOMINAL PRESSURE MONITORING USING A URINARY CATHETER: VALIDATION OF THE TECHNIQUE IN HUMANS

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Introduction. Increased intra-abdominal pressure (IAP) may occur in a variety of clinical situations such as with ascites, intestinal obstruction, intra-abdominal hemorrhage, pregnancy, peritoneal dialysis, military anti-shock trousers, during laparoscopy, and with large abdominal tumors [1-4]. The adverse effects of increased IAP on hemodynamics (decreased cardiac output and regional perfusion, increased vascular resistance), respi- ratory (decreased diaphragmatic motion, V/Q mismatch), and renal (oliguria) have been well documented in both clinical and experimental studies [1-4]. We recently validated a simple technique for measuring IAP in the canine model using a transurethral catheter that showed bladder pressure to be an accurate estimate of IAP [1]. The purpose of this study was to assess this same technique in patients by comparing bladder pressures with direct IAP measurements in postoperative patients.

Methods. The study was approved by the Mount Sinai Research Review Board. All postoperative patients with bladder catheters were evaluated for entry into this study if they had one of the following: 1) a closed system abdominal drain ("Jackson-Pratt" type) placed intra-operatively, or 2) an paracentesis catheter. Technique: Under sterile conditions the urinary bladder was fluid filled, expurgated of air, and the catheter was clamped distal to the sampling membrane. A 20 Gauge needle was inserted into the sampling membrane and attached to pressure tubing. The closed system abdominal drain was flushed and attached to pressure tubing. The bladder catheter and the drain were transduced simultaneously, zeroed at the level of the pubis. Pressure tracings were displayed on a bedside monitor, and recorded at end expiration [Fig. 1]. The measurements were obtained in the supine and semi-erect positions, and supine with gentle abdominal compressions. Data were analyzed with linear regression (PROC REG) and correlation (PROC CORR) procedures using the SAS statistical package for microcomputers.

Results. Sixteen patients (mean age 74 ± 3 years) status post abdominal surgery were studied, and IAP measurements obtained from the bladder catheter and direct abdominal catheter/drain in the three positions described (Tables 1 and 2). Measurements in patients #3 and #4 were not obtained semi-erect due to hemodynamic instability, and compressions in patient #6 were not done due to patient agitation. The correlation between the two methods of IAP evaluation was r = 0.91 (p<0.0001) independent of patient position. With compressions the correlation was r = 0.99 (p<0.0001). Figure 2.

Discussion. This study demonstrates that 1) bladder pressures and IAP are nearly identical and 2) a simple, safe, and accurate way of measuring IAP using a standard bladder catheter. The intra-

abdominal cavity is a closed space and when distended, small changes in volume will markedly increase IAP (decreased compliance). Although marked increases in IAP have been well documented to produce severe compromise in several organ systems, there has not previously existed a safe, non-invasive technique for its measurement. The use of the bladder catheter to measure IAP should eliminate the risks involved with IAP monitoring, and allow for studies evaluating the effects of IAP in various disease states. Importantly, studies using this technique could evaluate the effect of decreasing IAP in compromised patients. IAP monitoring using the described procedure should become part of ICU monitoring in patients with abdominal distension.

References.