

## **2005 IAH/ACS references**

(2005). "[Modern approaches to the problem of temporary closure of the abdominal cavity]." Klin Khir(3): 5-11.

The literature data are adduced concerning the problem of the abdominal cavity temporary closure after performance of operative intervention in the enhanced intraabdominal pressure conditions, in particular in patients with diffuse peritonitis, extended abdominal wall defect, abdominal trauma and intestinal ischemia. Retrospective analysis of the treatment results was conducted in 35 patients with peritonitis and abdominal trauma, in whom the laparostomy method was applied in the clinic. The operations for the abdominal wall restoration or the operative wound edges approximation were performed under the intraabdominal pressure control. Application of the method of the abdominal cavity temporary closure in the treatment of severe forms of peritonitis have promoted the complications rate lowering, the treatment duration reduction and the patients quality of life improvement.

(2005). "WORLD CONGRESS ON ABDOMINAL COMPARTMENT SYNDROME, QUEENSLAND, AUSTRALIA, DECEMBER 2004: SELECTED ABSTRACTS (www.wsacs.org)." ANZ J Surg **75**(4): A1-A23.

Al-Haddad, A., M. L. Cheatham, et al. (2005). "Temporary abdominal closure should not be considered an age limited option." Crit Care Med **33**(12 (Suppl.)): A42, Abstract 156-S.

Al-Mufarrej, F., C. Nolan, et al. (2005). "Laparoscopic procedures in adults with ventriculoperitoneal shunts." Surg Laparosc Endosc Percutan Tech **15**(1): 28-9.

Until recently, the presence of a ventriculoperitoneal shunt (VPS) was considered an absolute contraindication to laparoscopy. In some cases, intraabdominal insufflation causes a rapid, sustained increase in intracranial pressure (ICP). Such intracranial hypertension may result in hindbrain herniation. To prevent this, the use of lower abdominal pressures, intraoperative ICP monitoring, intraoperative ventricular drainage, and distal shunt catheter clamping/externalization has been reported in some studies. However, other studies show that laparoscopy is safe even without VPS catheter clamping and with only routine anesthetic monitoring. Moreover, the risk of retrograde failure of the valve system has been shown to be minimal even with intraabdominal pressures as high as 80 mm Hg. We report how we managed a hydrocephalic adult with a VPS shunt undergoing laparoscopic cholecystectomy in the hope that our experience contributes to the successful management of such patients in the future.

Artuso, D., M. Wayne, et al. (2005). "Hemodynamic changes during laparoscopic gastric bypass procedures." Arch Surg **140**(3): 289-92.

HYPOTHESIS: Significant detrimental intra-operative hemodynamic and respiratory changes occur in the morbidly obese during laparoscopic gastric bypass. DESIGN: Case series. SETTING: Tertiary care university hospital.

**PATIENTS:** Thirteen patients, 10 women and 3 men, undergoing uncomplicated laparoscopic gastric bypass for morbid obesity. **INTERVENTIONS:** Using a pulmonary artery catheter and an arterial line, we intraoperatively monitored hemodynamic and respiratory parameters. Parameter values were recorded at set points of the procedure, and the changes were statistically analyzed. **RESULTS:** Significant hemodynamic and respiratory changes, mostly unfavorable, occur in the morbidly obese when creating the pneumoperitoneum in preparation for laparoscopic gastric bypass. The hemodynamic changes are attenuated when the patient is placed in the reverse Trendelenburg position and almost completely corrected when the abdomen is deflated at the completion of the procedure. The respiratory changes are more persistent. **CONCLUSIONS:** Laparoscopic gastric bypass surgery for morbid obesity leads to a number of predominantly detrimental, if temporary, respiratory and hemodynamic changes, which are most pronounced at the time of creation of the pneumoperitoneum. In the presence of significant cardiopulmonary comorbidities, the use of invasive intra-operative hemodynamic monitoring of the morbidly obese undergoing laparoscopic gastric bypass appears therefore justified.

Bakker, J. (2005). "[The abdominal compartment syndrome]." Ned Tijdschr Geneeskd **149**(41): 2310.

Balogh, Z. and F. A. Moore (2005). "Intra-abdominal hypertension: not just a surgical critical care curiosity." Crit Care Med **33**(2): 447-9.

Bangert, K., T. Standl, et al. (2005). "Hemodynamic and Respiratory Changes in Morbidly Obese Patients Undergoing Laparoscopic Gastric Banding." ASA Abstracts: A-1109.

Maintenance of adequate pulmonary ventilation and oxygenation under general anesthesia is a problem in grossly obese patients. With increasing body-mass index functional residual capacity, compliance and oxygenation decrease<sup>1</sup>. During capnoperitoneum (CP) further worsening of pulmonary function must be expected. Moreover, cardiocirculatory complications caused by CP were described even in healthy subjects<sup>2</sup>. Thus the aim of this study was to investigate the hemodynamic and respiratory effects of CP on patients with adipositas permagna. **Methods** After IRB approval 20 morbidly obese patients (BMI>40kg/m<sup>2</sup>) undergoing laparoscopic gastric banding were included. Besides respiratory parameters and blood gases under a volume-controlled ventilation mode we evaluated hemodynamic changes (B P, CVP and heart rate as well as determinants of left ventricular function and filling by transesophageal echocardiography) during general anesthesia and capnoperitoneum. **Statistics:** paired t-test p<0.05=significant. **Results** Oxygenation index (paO<sub>2</sub>/FiO<sub>2</sub>) decreased significantly from 369±68.6 to 295±118.5 under general anesthesia and CP and a mild acidosis developed, while paCO<sub>2</sub> increased significantly after insufflation from 37.3±4.8 to 46.6±6.5 with markedly increasing peak airway pressures (29 to 38 cmH<sub>2</sub>O) at a constant PEEP. After insufflation CVP, heart rate, MAP and cardiac output increased significantly, while enddiastolic area and

volume of the left ventricle remained nearly constant. Transmitral- and pulmonary venous flow showed a significant rise of the A-peak related to E and the S-wave to D after insufflation, respectively. All these changes are not immediately reversible after release of the CP. Conclusions The impairment of pulmonary function during CP is partly explained by the decrease in compliance (increasing airway pressures at constant PEEP) caused by high intraabdominal pressure. After insufflation a hyperdynamic cardiocirculatory state occurs. Under these circumstances the CVP does not represent the cardiac filling pressure but the intrathoracic pressure. The changes in transmitral and pulmonary venous flow may be interpreted as a beginning diastolic stiffness.

Britt, R. C., T. Gannon, et al. (2005). "Secondary abdominal compartment syndrome: risk factors and outcomes." Am Surg 71(11): 982-5.

Secondary abdominal compartment syndrome (ACS), defined as intra-abdominal hypertension with associated pulmonary, renal, or hemodynamic compromise in the absence of preceding abdominal operation or injury, can markedly increase surgical morbidity and mortality. We performed a retrospective chart review of the physiologic parameters and outcomes of 10 patients with secondary ACS. Ten patients developed secondary ACS after aggressive resuscitation, at an average of 20.2 hours. Four of the patients sustained burns greater than 40 per cent, three of the patients had penetrating extremity trauma, one patient had blunt abdominal trauma, one patient was struck by lightning, and one patient developed a retroperitoneal bleed while on heparin. The average bladder pressure was 40.6. The average volume given in the first 24 hours was 33,001 cc (range, 12,400 to 69,000). The average base deficit at admission was -12 (range, +1 to -25). Seven of the 10 patients had decreased urine output. Nine of the 10 patients had decreased tidal volumes on pressure control ventilation. All 10 patients were hypotensive, with 7 of the 10 requiring vasopressors. Overall mortality was 60 per cent, with 43 per cent mortality for those decompressed. Prompt recognition and treatment are mandatory for survival of ACS. We recommend routine bladder pressure monitoring for patients with ongoing resuscitation greater than 500 cc/hr.

Brooks, A. J., A. Simpson, et al. (2005). "Validation of direct intraabdominal pressure measurement using a continuous indwelling compartment pressure monitor." J Trauma 58(4): 830-2.

BACKGROUND: According to recommendations, intraabdominal pressure should be monitored every 8 hours for patients at high risk of abdominal compartment syndrome. Continuous intraabdominal pressure monitoring may be valuable for these patients. METHODS: For 15 patients undergoing laparoscopic surgery, a pressure monitor was introduced after formation of pneumoperitoneum. During the procedure, the laparoscopic insufflator pressure was varied. The pressure monitor values and the time to equilibrium were recorded. RESULTS: Altogether, 152 pressure recordings were taken for the patients studied. The measurements from the insufflator and pressure monitor were compared using a Bland-Altman plot. The mean difference between the techniques was 0.04 +/- 3.8, and 95% of the points from the pressure monitor were within two standard

deviations of the mean difference. Pressure changes were essentially "real time." **CONCLUSIONS:** The intracompartmental pressure monitor provides accurate, rapid, and direct measurement of intraabdominal pressure, and may be a useful tool for continuous intraabdominal pressure measurement among patients at risk of abdominal compartment syndrome.

Bulut, F., A. Dervisoglu, et al. (2005). "Is pneumoperitoneum harmful during intra-abdominal hemorrhage in rats?" *J Laparoendosc Adv Surg Tech A* **15**(2): 112-20.

**BACKGROUND:** Laparoscopic surgical interventions are being used in trauma patients for diagnostic and therapeutic purposes, but there are limited studies on this subject. The effect of pneumoperitoneum during intra-abdominal hemorrhage has not been elucidated. The aim of this study was to investigate the hemodynamic, respiratory, and renal effects of pneumoperitoneum in the splenic injury/ hemorrhagic shock model in rats. **MATERIAL AND METHODS:** In this study, 80 anesthetized Wistar male rats (294.5 +/- 31.2 g) were randomized into 2 main groups: nontraumatized (group A) and traumatized (group B). After initial preparation and monitoring, each group was divided according to the degree of pneumoperitoneum. The nontraumatized subgroups were A1, sham-operated; A2, 4-8 mm Hg; A3, 9-13 mm Hg; and A4, 14-18 mm Hg. The traumatized subgroups were B1, splenic injury without pneumoperitoneum; B2, B3, and B4, splenic injury with pneumoperitoneum at 4-8 mm Hg, 9-13 mm Hg, and 14-18 mm Hg, respectively. Mean arterial pressure, heart rate, and respiratory rate were monitored continuously. Blood samples were obtained for hemoglobin, hematocrit, arterial blood gases, and biochemical analyses. Twenty-four hour urine output was collected. **RESULTS:** In group B4, pH, pCO<sub>2</sub>, and HCO<sub>3</sub> levels were lower than in all other groups, while pCO<sub>2</sub> and base deficit levels were significantly higher (P < 0.05). Both blood and urine analysis results showed that 24-hour urine output and the glomerular filtration rate of groups A4 and B4 were significantly lower (P < 0.05), while urinary osmolarity and fractional sodium excretion levels were significantly higher (P < 0.05). **CONCLUSION:** High-pressure pneumoperitoneum in splenically traumatized rats amplifies acidosis, decreases urine output, decreases glomerular filtration rate, and increases urinary osmolarity and fractional sodium excretion significantly.

Cipolla, J., S. P. Stawicki, et al. (2005). "A proposed algorithm for managing the open abdomen." *Am Surg* **71**(3): 202-7.

Delayed abdominal closure has gained acceptance in managing a variety of surgical conditions. Multiple techniques were devised to promote safe, uncomplicated, expeditious fascial closure. We retrospectively reviewed patient records between September 22, 2001 and June 30, 2004. Of the 20 patients with open abdomen, two patients died within 24 hours and one was transferred. The remaining 17 were managed using an algorithm including a combination of delayed primary closure (DPC), vacuum-assisted fascial closure (VAFC), Wittmann Patch (WP) (Star Surgical, Inc., Burlington, WI), and planned ventral hernia via absorbable mesh with split thickness skin grafting (PVH). The mean Simplified Acute Physiology Scores (SAPS II) was 31 (predicted mortality 73%).

All patients initially underwent VAFC and re-exploration 12-48 hours later. Indications for continued VAFC included 1) gross contamination, 2) massive bowel edema, 3) continued bleeding at re-exploration. If these conditions were absent, DPC was attempted or a WP was employed until fascial closure. Twenty-eight day mortality was 5.9 per cent (1/17 patients). Enterocutaneous fistulae occurred in two patients (11.7%). Fascial closure was achieved in 6 patients (35.3%). Eleven patients were managed with PVH. Using an algorithm with a combination of several techniques, open abdomen can be managed with minimal morbidity and acceptable closure rates.

Cobb, Ws, et al. (2005). "Normal Intraabdominal Pressure in Healthy Adults." J Surg Res.

**BACKGROUND:** Intraabdominal pressure (IAP) has been considered responsible for adverse effects in trauma and other abdominal catastrophes as well as in formation and recurrence of hernias. To date, little information is available concerning IAP in normal persons. Our purpose in this study was to measure the normal range of IAP in healthy, nonobese adults and correlate these measurements with sex and body mass index (BMI). **METHODS:** After Institutional Review Board approval, 20 healthy young adults ( $\leq 30$  years old) with no prior history of abdominal surgery were enrolled. Pressure readings were obtained through a transurethral bladder (Foley) catheter. Each subject performed 13 different tasks including standing, sitting, bending at the waist, bending at the knees, performing abdominal crunches, jumping, climbing stairs, bench-pressing 25 pounds, arm curling 10 pounds, and performing a Valsalva and coughing while sitting and also while standing. Data were analyzed by Student's t-test and Pearson's correlation coefficients. **RESULTS:** Intraabdominal pressure was measured in 10 male and 10 female subjects. The mean age of the study group was 22.7 years (range, 18-30 years), and BMI averaged 24.6 kg/m<sup>2</sup> (range, 18.4-31.9 kg/m<sup>2</sup>). Mean IAP for sitting and standing were 16.7 and 20 mm Hg. Coughing and jumping generated the highest IAP (107.6 and 171 mm Hg, respectively). Lifting 10-pound weights and bending at the knees did not generate excessive levels of pressure with the maximum average of 25.5 mm Hg. The mean pressures were not different when comparing males and females during each maneuver. There was a significant correlation between higher BMI and increased IAP in 5 of 13 exercises. **CONCLUSION:** Normal IAP correlates with BMI but does not vary based on sex. The highest intraabdominal pressures in healthy patients are generated during coughing and jumping. Based on our observations, patients with higher BMI and chronic cough appear to generate significant elevation in IAP. Thus, this group of patients may potentially be at increased risk for abdominal wall hernia formation following surgery.

Daugherty, E. L., H. Liang, et al. (2005). "Abdominal compartment syndrome is common in medical ICU patients receiving large volume resuscitation." Critical Care Medicine **32**(12): A83 - Abstract 303.

**Introduction:** Intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS) have been well described in surgical patients. Large volume

resuscitation is thought to be a risk factor. In contrast, little is known of the incidence of IAH/ACS in critically ill medical patients. Hypothesis: We hypothesized that ACS is more common in medical ICUs than previously recognized. The purpose of this study was to determine the incidence of IAH/ACS in medical ICU patients receiving large volume resuscitation. Methods: We performed a prospective, cohort study screening consecutive admissions to our MICU over a 5-month period for a minimum net positive fluid balance of 5 liters within the preceding 24 hours. The primary outcome of interest was the development of ACS, defined as an IAP=20 mmHg associated with organ dysfunction. Patients who met inclusion criteria and had no exclusion criteria, including recent abdominal surgery or obesity, were entered in our study. Intra-abdominal pressure (IAP) was measured by transducing bladder pressure and recorded along with fluid balance at the time of enrollment and every 12 hours thereafter up to 96 hours. Results: Of the 234 MICU admissions screened, 21 (8.9%) were identified who met inclusion criteria. Upon enrollment, this cohort of patients had a mean APACHE II score of 25, a net positive fluid balance of 8.4 liters, and 12 of the 21 (57%) had intra-abdominal hypertension (defined by IAP=12 mm Hg). During the study period, 7 of the 21 (33%) developed IAP=20mmHg and 6 (29%) of these met criteria for ACS. None underwent laparotomy. Conclusions: ACS occurs frequently in critically ill medical patients who receive large volume resuscitation. Medical patients with a 5 liter net positive fluid balance in 24 hours should be considered for routine monitoring of IAP. Future studies evaluating both clinical outcomes of medical patients with ACS and potential risk factors for its development are warranted.

Davis, Pj, et al. (2005). "Comparison of indirect methods of measuring intra-abdominal pressure in children." Intensive Care Med 31(3): 471-475.

OBJECTIVE: To determine the most accurate indirect method of measuring intra-abdominal pressure (IAP) in children. DESIGN AND SETTING: Single-centre, prospective, clinical study in a 23-bed specialist paediatric intensive care unit in Australia. PATIENTS AND PARTICIPANTS: 20 children admitted to paediatric intensive care with a peritoneal dialysis catheter in situ following congenital cardiac surgery. INTERVENTIONS: IAP was measured directly via the peritoneal dialysis catheter and by intragastric manometry via an indwelling nasogastric tube, and by intravesical manometry via an indwelling transurethral urinary catheter, using volumes of 0, 1, 3 and 5 ml/kg body weight of sterile saline instilled into the bladder. MEASUREMENTS AND RESULTS: Across the range of IAPs of 1-8 mmHg the Bland-Altman method for assessing agreement between two methods of clinical measurement showed bladder pressure measured via the urinary catheter with 1 ml/kg body weight of saline instilled to be the most accurate indirect measurement technique, tending to give pressures between 0.07 and 1.23 mmHg higher than the direct measurement (95% CI for bias). Measuring bladder pressure with either no saline instilled or more saline per kilogram body weight instilled was less accurate over the same range of pressures, as was measuring the gastric pressure. CONCLUSIONS: The most accurate indirect method of measuring IAP in children over the normal range of IAPs involves

measuring bladder pressure via a transurethral urinary catheter with 1 ml/kg body weight of sterile saline instilled into the bladder.

Davutoglu, Kervancioglu, et al. (2005). "Large rectus muscle hematoma with intraperitoneal bleeding and fatal abdominal compartment syndrome complicating anticoagulant therapy." Clin Appl Thromb Hemost **11**(1): 109-11.

de Jong, I. J., H. Veeken, et al. (2005). "[Clinical reasoning and decision-making in practice. A patient with oliguria following prostatectomy]." Ned Tijdschr Geneesk **149**(49): 2720-7.

A 70-year-old man with clinically localised prostate carcinoma underwent extraperitoneal endoscopic radical prostatectomy. His medical history revealed hypertension, renal colic, hypogonadotropic hypogonadism and recurrent deep venous thrombosis in the legs. The operation was uneventful with 500 ml blood loss and no periods of hypotension. The patient developed oliguria within 12 h after surgery. A hypovolemic state was initially suggested to explain the oliguria and increasing amounts of intravenous fluids were administered. The oliguria persisted, however, and the patient did not respond to a diuretic. There was no fluid loss in the drain. Blood pressure, pulse and temperature were normal. Peritonitis and bowel perforation were excluded. Ultrasound examination of the bladder and kidneys revealed an empty bladder and no dilatation of the upper urinary tract, which excluded a post-renal obstruction. The clinical situation deteriorated within hours as the patient developed anuria, bowel distension, metabolic acidosis with progressive renal failure and signs of respiratory distress for which mechanical ventilation was needed. A chest X-ray prior to intubation did not show pneumonia or signs indicating pulmonary embolism. CT of the abdomen was performed to evaluate urinary leakage but revealed no fluid collection or urinoma. Thus pre- and post-renal causes of oliguria were excluded. In view of the systemic symptoms, intra-abdominal pressure was measured using a bladder catheter; it varied between 25 and 35 cm water. Together with the clinical situation, a diagnosis of abdominal compartment syndrome was made and coeliotomy was performed immediately. Within 10 min after decompression of the peritoneal cavity, diuresis started spontaneously. Renal function was restored to preoperative levels in 3 weeks. Abdominal compartment syndrome is a potentially life-threatening cause of anuria. The syndrome should be part of the differential diagnosis for patients with postoperative anuria, including those who underwent extraperitoneal minimally invasive procedures.

DePotter, T. J. R., H. Dits, et al. (2005). "Intra- and interobserver variability during in vitro validation of two novel methods for intra-abdominal pressure monitoring." Intensive Care Med **31**(5): 747-51.

OBJECTIVE: Intra-abdominal pressure (IAP) measurement techniques vary in automaticity and reproducibility. This study evaluated the intra- and interobserver variability of two new IAP measurement techniques. METHODS: A one-half open, 30-l container was used with two IAP catheters (Foley Manometer, balloon-tipped catheter) contained in a 100-ml infusion bag. To simulate intra-abdominal

hypertension the container was filled with water using 5-cm increments (0-25 cmH<sub>2</sub>O). Pressure was determined by observers using the Foley Manometer and simultaneously recorded using an IAP monitor. Observers were blinded to the reference levels. RESULTS: Fifteen observers conducted three pressure readings at each of the six pressure levels with the Foley technique, giving 270 readings. These were paired with the automated monitor readings and the height of the water column. The intra- and interobserver coefficients of variation were low for both methods. The Spearman correlation coefficient was higher than 0.9 for all paired measurements and Bland-Altman analysis comparing the reference H<sub>2</sub>O column to both measurement techniques showed a very good agreement at all pressure intervals (bias 0.1±0.6 cmH<sub>2</sub>O) and a consistent, low underestimation of the reference water column pressure by both techniques. CONCLUSIONS: Both the Foley Manometer and the IAP monitor are reliable and reproducible methods to measure IAP in this in vitro model. The coefficient of variation for each technique is low and decreases with increasing IAP, the monitor giving more reproducible results than the Foley Manometer.

DeWaele, J. J., F. Berrevoet, et al. (2005). "Validation of a new technique for continuous intraabdominal pressure measurement." Intensive Care Medicine **31, Supplement 1**(134): S59, Abstract 217.

DeWaele, J. J., E. Billiet, et al. (2005). "Fluid vs. air for semicontinuous intra-abdominal pressure measurements using a compliance catheter." Intensive Care Med **31**(4): 598-9.

DeWaele, J. J. and U. J. Hesse (2005). "Life saving abdominal decompression in a patient with severe acute pancreatitis." Acta Chir Belg **105**(1): 96-8.

Severe acute pancreatitis can be complicated early in its course by life threatening conditions such as abdominal compartment syndrome. We report a patient who needed abdominal decompression three days after admission to the intensive care unit because of intra-abdominal hypertension and end stage organ dysfunction. The clinical course was protracted, but the patient survived and was discharged from the hospital.

DeWaele, J. J., B. Hoste, et al. (2005). "Intra-abdominal hypertension in patients with severe acute pancreatitis." Crit Care **9**(4): R452-7.

INTRODUCTION: Abdominal compartment syndrome has been described in patients with severe acute pancreatitis, but its clinical impact remains unclear. We therefore studied patient factors associated with the development of intra-abdominal hypertension (IAH), the incidence of organ failure associated with IAH, and the effect on outcome in patients with severe acute pancreatitis (SAP). METHODS: We studied all patients admitted to the intensive care unit (ICU) because of SAP in a 4 year period. The incidence of IAH (defined as intra-abdominal pressure  $\geq$  15 mmHg) was recorded. The occurrence of organ dysfunction during ICU stay was recorded, as was the length of stay in the ICU and outcome. RESULTS: The analysis included 44 patients, and IAP measurements were obtained from 27 patients. IAH was found in 21 patients

(78%). The maximum IAP in these patients averaged 27 mmHg. APACHE II and Ranson scores on admission were higher in patients who developed IAH. The incidence of organ dysfunction was high in patients with IAH: respiratory failure 95%, cardiovascular failure 91%, and renal failure 86%. Mortality in the patients with IAH was not significantly higher compared to patients without IAH (38% versus 16%,  $p = 0.63$ ), but patients with IAH stayed significantly longer in the ICU and in the hospital. Four patients underwent abdominal decompression because of abdominal compartment syndrome, three of whom died in the early postoperative course. CONCLUSION: IAH is a frequent finding in patients admitted to the ICU because of SAP, and is associated with a high occurrence rate of organ dysfunction. Mortality is high in patients with IAH, and because the direct causal relationship between IAH and organ dysfunction is not proven in patients with SAP, surgical decompression should not routinely be performed.

DeWaele, J. J., P. Pletinckx, et al. (2005). "Saline volume in transvesical intraabdominal pressure measurement: Enough is enough." *Intensive Care Medicine* **31**, Supplement 1(134): S59 - Abstract 215.

Introduction: Transvesical measurement of the intraabdominal pressure (IAP) is widely used, but when a urinary catheter is in place, the bladder may become less compliant, leading to falsely increase IAP. The goal of this study was to measure bladder compliance in critically ill patients and to determine the minimal instillation volume at which an IAP curve can be observed. Methods: IAP was measured transvesically in 20 critically ill sedated patients at risk for intraabdominal hypertension (IAHT). Measurements were performed after a median of 5 days of bladder drainage. IAP was measured starting with instillation of 10ml saline, and continued with 10ml increments up to 100ml, after a 1 minute equilibration period after each instillation. An oscillation test was performed to determine the minimal volume at which the IAP could be measured. The relative increase of IAP between the minimal volumes at which an IAP could be measured (IAPmin) and the conventionally used volumes (50 and 100 ml) were calculated by dividing the difference between IAP50 or IAP100 and IAPmin by the IAPmin value. Additionally, in patients with IAHT we analyzed the correlation between the duration of bladder drainage before the measurement and the calculated difference in IAP between IAPmin and IAP100. Results: The minimal volume at which the oscillation test was positive was 10ml in all patients. Mean IAP min was 12.8 mmHg ( $\pm 4.9$ ), mean IAP50 15 mmHg ( $\pm 4.5$ ) and mean IAP100 17.1 mm Hg ( $\pm 4.7$ ). The mean relative increase between IAPmin and IAP50 was 21% ( $\pm 17\%$ ) and 40% ( $\pm 29\%$ ) between IAP min and IAP100. Twelve patients were categorized as suffering from IAHT when 10ml saline was used for IAP measurement, increasing to 15 and 17 patients respectively when using 50 and 100ml. In patients with IAHT, there was a significant correlation between the duration of bladder drainage and mean relative increase between IAPmin and IAP100 (Pearson correlation coefficient 0.60,  $p=0.03$ ). Conclusion: In this sample of ICU patients at risk for IAHT, bladder compliance was compromised in all patients. This resulted in a considerable overestimation of the IAP when

instillation volumes of 50 to 100 ml were used. In these patients, an instillation volume of 10 ml was sufficient for reliable IAP measurement.

Diaz, J. J., Jr., V. Mejia, et al. (2005). "Protocol for bedside laparotomy in trauma and emergency general surgery: a low return to the operating room." *Am Surg* **71**(11): 986-91.

Bedside laparotomy (BSL) was introduced as a heroic procedure in trauma patients too unstable for safe transport to the operating room (OR). We hypothesize a BSL protocol would maintain patient safety while reducing OR use. Patients were prospectively entered into a BSL protocol from July 2002 to June 2003 and retrospectively reviewed. Protocol indications for BSL were abdominal compartment syndrome, decompensation due to hemorrhage, washout/closure, and sepsis in a patient too unstable for safe transport to the OR. Primary outcomes were mortality, emergent return to OR, and primary fascial closure (PFC). Trauma operating room charges and OR time were analyzed. One hundred thirty-three BSL were performed on 60 patients with an overall mortality of 23.3 per cent (14/60). There was an average of 2.2 BSL per patient (range 1-8). Indications for BSL were 1) explore/washout (n = 100, 75.2%), 2) decompression (n = 14, 10.5%), 3) infection/abscess (n = 12, 9.0%), 4) hemorrhage (n = 7, 5.3%). Five of 133 BSL (5.8%) were emergently returned to the OR because of perforation or compromised bowel. Trauma OR charges were dollar 5,300 per cases with 2.12 hours per cases. The protocol standardized the conduct of BSL procedure to allow for a low return to OR rate of 5.8 per cent and had an overall in-hospital mortality rate of 23.3 per cent. Primary fascial closure of the abdomen had a significantly reduced hospital stay. BSL allowed trauma OR charges of dollar 5,300 per cases with 2.12 hours per cases savings.

Efstathiou, E., M. Zaka, et al. (2005). "Intra-abdominal pressure monitoring in septic patients." *Intensive Care Medicine* **31, Supplement 1**(131): S183, Abstract 703.

**INTRODUCTION.** Intra-abdominal pressure measurement through the urinary bladder in critically ill patients is easily obtained by low cost means. Recent studies revealed the possible significance of this parameter variation in critically ill. Special attention was paid until now in cases of abdominal compartment syndrome (IAP > 20 mm Hg). Intra-abdominal hypertension is recognized when the elevation of the parameter exceeds 12 mm Hg.

**METHODS.** In a prospective study, in our mixed ICU we monitored on six hour basis for 3 days intra-abdominal pressure in 26 patients with sepsis (confirmed by elevated Procalcitonin values) with a device standardized by our team through the urinary bladder. The mean age of the patients was 64±5 years. 16 of them were medical and 10 surgical admissions.

**RESULTS.** Intra-abdominal hypertension is recognized in the majority of the cases we included in the study. Specific procedures like neuromuscular blockade, decompression of the gastro-intestinal tract (Levin / rectal tube, enemas) and dialysis seem to lower intra-abdominal pressure. On the contrary, massive fluid resuscitation (more than 5 liters) results in elevation of the parameter.

IAP (mm Hg)	Medical Admissions (%)	Surgical Admissions (%)	Total (%)
> 12	52.1	67	58
> 15	27.6	25.2	29
> 20	9.3	4.1	6

**CONCLUSION.** No specific relation is revealed between sepsis and the fluctuation of the intra-abdominal pressure but continuous IAP monitoring might prove to be a significant index of fluid resuscitation in septic patients.

Ejike, J. C. and M. Mathur (2005). "Occurrence and outcome of abdominal compartment syndrome in critically ill children." Critical Care Medicine **33**(12 supplement): A95, Abstract 158-M.

**INTRODUCTION:** Abdominal compartment syndrome (ACS) is a potential problem in critically ill children. The occurrence in adults ranges from 1- 8% with mortality as high as 61%. **HYPOTHESIS:** ACS is a significant problem in critically ill children with an occurrence similar to critically ill adult patients. **METHOD:** A prospective, observational study done in a tertiary PICU to determine the occurrence of ACS in critically ill children. Intra-abdominal pressures (IAP) were recorded in 6 patients clinically suspected of ACS and 45 mechanically ventilated pediatric patients if parental consent was given. Patients were enrolled within 24 hours of PICU admission and monitored every 6 hrs for 24 hrs. The intra-vesical technique was employed using optimal bladder volumes determined for each patient or 1cc/kg (up to 25cc) of 0.9%NaCl. Intra-abdominal hypertension (IAH) was defined as IAP sustained at > 12mmHg and ACS was defined as (IAP) >12 mm Hg accompanied by at least 2 acute organ system dysfunction or decompensation. Data was presented as median (range) and analyzed by Mann-Whitney U test. Significance was accepted as  $p < 0.05$ . **RESULTS:** Of 146 mechanically ventilated patients admitted, 51 (34.9%) were studied. Ten of 45 (22.2%) not clinically suspect for ACS had IAH of which 3 developed ACS. The 6 clinically suspected of having ACS had ACS. Therefore 9/51 (17.6%) mechanically ventilated PICU patients had ACS. The median IAP with ACS was 18mmHg (13-32mmHg). The mortality associated with ACS was significant, 3/9 (33.3%) ACS vs 1/41 (2.4%) non-ACS; ( $p=0.01$ ). Of the 6 ACS patients who survived, 1 had decompressive laparotomy with open abdomen management and 1 had abdominal decompression by peritoneal drain placement for ascitis. The median length of PICU stay for patients with ACS was 13d (5-35d) compared to 6d (1-72d) ( $p=0.06$ ) of non-ACS patients. **CONCLUSION:** The occurrence of ACS in a subset (mechanically ventilated) of patients admitted to the PICU is higher than the occurrence in adults. It is associated with a long PICU stay and significantly higher mortality compared to non-ACS patients.

Ejike, J. C. and M. Mathur (2005). "Optimal Bladder Volumes For Intra-abdominal Pressure Measurement In Small Children." Critical Care Medicine **33**(12 supplement): A93, Abstract 150-M.

**INTRODUCTION:** The optimal volume to instill in the bladder for accurate intra-abdominal pressure (IAP) measurements in adults has been determined to be 50ml

and is used in adult-sized pediatric patients. Very little literature exists on appropriate volumes to use for IAP measurements in smaller pediatric patients. Inappropriate volumes instilled in the bladder for IAP measurements can give erroneous readings which could potentially affect adequate intervention.

**HYPOTHESIS:** Optimal Volumes for IAP measurements in pediatric patients < 40kg are smaller and consistently less than 50ml. **METHOD:** The objective was to determine optimal volumes for IAP measurements in small children. Criteria for enrollment included: PICU admission, mechanical ventilation, weight up to 40 kg and the presence of a Foley catheter. Patients with abdominal distention, abdominal surgery or suspicion of abdominal compartment syndrome were excluded. Graduated volumes of 0.9% NaCl in increments of 3ml (up to 50ml) were instilled in the bladder. IAP measurements were taken using the AbViser device with each instillation. A pressure - volume curve was generated and the mean volume of the pressure plateau was taken as the optimal volume and the volume at the start of the plateau was taken as the minimal optimal volume for each patient. The data was analyzed by stratification of patients (groups A-D) according to weights 0-10kg (group A), >10-20kg (group B), >20-30kg (group C), >30-40kg (group D). Mean and standard deviation was used for statistical analysis.

**MAIN RESULTS:**

<b>Groups</b>	<b>n</b>	<b>Wt (kg)</b>	<b>Mean Optimal Vol.</b>	<b>Minimal optimal vol</b>	<b>Mean IAP</b>
A (0-10kg)	18	5.8 ± 2.3	13.7 ± 5.3	5.4 ± 3.2	6.8 ± 2.7
B (>10-20kg)	11	13.4 ± 2.0	21.4 ± 5.5	4.3 ± 2.3	4.7 ± 2.6
C (>20-30kg)	5	26.6 ± 4.4	23.7 ± 7.7	5.7 ± 3.3	6.0 ± 1.4
D (>30-40kg)	5	35.8 ± 3.8	24.8 ± 0.4	5.6 ± 2.9	7.8 ± 6.2

**CONCLUSION:** Volumes as little as 4 ml for IAP measurements can be used in patients up to 40kg in weight and volumes greater than 25ml are not necessary.

Ernits, M., P. S. Mohan, et al. (2005). "A retroperitoneal bleed induced by enoxaparin therapy." *Am Surg* **71**(5): 430-3.

Retroperitoneal bleeding is one of the most serious, potentially lethal complications of anticoagulation therapy. Although well documented in fully heparinized and coumadinized patients, there are only few reports of life-threatening hemorrhages in low-molecular-weight heparin (LMWH)-treated patients. We present a case of almost fatal spontaneous retroperitoneal bleeding in a 71-year-old woman with pneumonia and acute coronary syndrome. After receiving combination therapy with Lovenox (enoxaparin), aspirin, and Plavix for 5 days, she developed acute hemorrhagic shock and possible intra-abdominal compartment syndrome. Urgent computed tomography scan of the abdomen and pelvis was performed and showed a left retroperitoneal hematoma. The patient's condition continued to deteriorate, which prompted emergent exploration. After evacuating 3 L of free blood from the peritoneal cavity, we managed to stabilize the patient. Our case of spontaneous retroperitoneal bleeding adds to the growing number of cases in which enoxaparin has been associated with severe bleeding. A high index of suspicion is necessary if the patient displays any of the signs and symptoms that suggest major hemorrhage. It appears that those at highest risk

receive doses approaching 1 mg/kg subcutaneously every 12 hours, have renal impairment, are of advanced age, and receive concomitant medications that can affect hemostasis. On average, a retroperitoneal hematoma occurs within 5 days of therapy with enoxaparin. In high-risk patients, enoxaparin activity (anti-factor Xa) should be carefully monitored.

Espeel, B., C. Gerard, et al. (2005). "[Late abdominal compartment syndrome secondary to traumatic gallbladder rupture]." *Gastroenterol Clin Biol* **29**(4): 453-5.

A case of abdominal compartment syndrome following hepatic rupture with gallbladder tear is reported. We discuss the physiology, diagnosis criteria and treatment of this potentially life-threatening complication.

Flores-Alvarez, E., G. E. Avila-Cuevas, et al. (2005). "[Early diagnosis and risk factors associated with abdominal compartment syndrome.]" *Cir Cir* **73**(3): 179-83.

Introduction: Abdominal compartment syndrome (ACS) is a clinical entity that develops after sustained and uncontrolled intraabdominal hypertension (IAHT). The ACS is clinically characterized by a massively distended abdomen and respiratory, cardiovascular, neurologic, and renal dysfunction. Objective: The goal of this study was to demonstrate the benefit of early diagnosis of intra-abdominal hypertension and ACS and to identify risk factors associated with mortality. Material and methods: We used a prospective study that included all patients admitted to Hospital de Especialidades Miguel Hidalgo with known ACS risk factors between January 2002 and December 2003. All patients were submitted to systematic measurements of intra-abdominal pressure (IAP). Those patients with grade III-IV IAHT were treated with decompressive laparotomy. Results: Included in the study were 32 patients (23 males and 9 females). Mean age was 45.0 +/- 18.34 years. Twenty three patients developed IAHT grade I-II (group I) and nine developed grade IIIIV (group II). All group II patients were treated with abdominal descompression. The most common clinical entities associated were closed abdominal trauma (28%), hernias (15%), intestinal Conclusions: (12.5%), acute pancreatitis (9.4%) and mesenteric ischemia (6.3%). Grade III-IV IAHT was statistically associated with reoperation ( $p = 0.038$ ), acidosis ( $p = 0.003$ ), anuria ( $p < 0.001$ ) and sustained arterial hypotension ( $p = 0.004$ ). The significant variables associated to mortality were anuria ( $p = 0.024$ ) and grade III-IV IAHTA (0.017). Conclusions: It is possible to make an early diagnosis of IAHT and ACS with an indirect measurement of IAP. The most important factors related to mortality are anuria and IAHT.

Garner, W. L. and M. Reiss (2005). "Burn care in Los Angeles, California: LAC+USC experience 1994-2004." *Burns* **31 Suppl 1**: S32-5.

The LAC+USC Burn Center has admitted 3118 patients for treatment in the last 10 years. A majority of patients were young adults (1868), with the second largest group being small children (543). The ethnicity of the patients reflects the diverse nature of the population of Los Angeles County. Forty-eight percent of injuries were less than 5% TBSA and approximately 2% were greater than 60% TBSA. Eighty-two percent were accidental injuries. Sixty percent of admitted patients

underwent skin grafting. Mortality was negligible in the group with burns over less than 10% of their body and very high (15/19), 79% in the most severely burned group. Further, there was a high correlation between age and mortality. Complications during treatment included: deep venous thrombosis 1% per year; pulmonary emboli in 5 patients; endotracheal tube dislodgment early or self-extubation about 1 month (11.3 per year); 4.5 patients per year who developed acute renal failure; abdominal compartment syndrome developed in 4.7 patients each year; heterotopic ossification was seen in 4 patients (0.4%); 4 patients (0.4%) developed stage II-IV pressure sores; hypothermia was present in 0.8% of patients.

Gianini, F., R. de Cleva, et al. (2005). "Subcompartmental intra abdominal hypertension." Intensive Care Med.

Gonullu, D., A. Ceylan, et al. (2005). "[The effect of selective bowel decontamination and mechanical bowel preparation on bacterial translocation due to intraabdominal hypertension.]" Ulus Travma Derg **11**(3): 201-205.

**BACKGROUND:** The objective of our study is to evaluate the preventive effects of selective digestive decontamination (SDD) and mechanical bowel preparation in rats with experimentally induced bacterial translocation. **METHODS:** Forty adult male Sprague Dowley rats weighing 250-300 g. were divided equally into four groups as Group 1 (sham [control]), Group 2 (experimentally induced IAH at 19 mmHg), Group 3 ( SDD group) and Group 4 (SDD and mechanical bowel preparation with 19 mmHg intraabdominal pressure). Group 3 and 4 were treated at 12 hours intervals with oral gentamycine 5 mg/kg and IM sefotaxime 100mg/kg. Mechanical bowel preparation was performed by oral administration of sodium phosphate. After 24 hours all rats were sacrificed; mesenteric lymph nodes, spleen and liver biopsy specimens were harvested aseptically. Specimens were diluted and cultured in McConkey medium and the colony-forming units (CFU/gr ) were calculated. **RESULTS:** In Kruskal Wallis tests there were no significant differences between Group 1 and 3 or 4, and also Group 3 and 4 ( $p > 0.05$ ,  $p = 0.872$  respectively), while differences between Group 1 and 2, and also Group 3 and 4 were statistically significant ( $p < 0.001$ ) with respect to CFU/g estimates. **CONCLUSION:** These data indicate that selective intestinal decontamination and mechanical bowel preparation prevent bacterial translocation due to intraabdominal hypertension.

Handschin, A. E., M. Weber, et al. (2005). "Abdominal compartment syndrome after liver transplantation." Liver Transpl **11**(1): 98-100.

The abdominal compartment syndrome is a well-known complication after abdominal trauma and is increasingly recognized as a potential risk factor for renal failure and mortality after adult orthotopic liver transplantation (OLT). We present a case report of a young patient who presented with acute liver failure complicated by an acute pancreatitis. The patient developed an acute abdominal compartment syndrome after OLT. Transurethral measurement of intraabdominal pressure indicated an abdominal compartment syndrome associated with impaired

abdominal vascular perfusion, including liver perfusion. Renal insufficiency was immediately reversed after decompressive bedside laparotomy. The abdominal compartment syndrome is a potential source of posttransplant renal insufficiency and liver necrosis in OLT. It remains, however, a rarely described complication after liver transplantation, despite the presence of significant factors that contribute to elevated intraabdominal pressure.

Hasukic, S., D. Kosuta, et al. (2005). "Comparison of postoperative hepatic function between laparoscopic and open cholecystectomy." Med Princ Pract **14**(3): 147-50.

**OBJECTIVE:** In this prospective study, we evaluated the effects of pneumoperitoneum on hepatic function during laparoscopic (LC) and open cholecystectomy (OC). **SUBJECTS AND METHODS:** One hundred patients who underwent LC (n = 50) or OC (n = 50) were included in the study. The groups were similar in age, sex, weight and height. Following liver function tests (total bilirubin; gamma-glutamyltransferase, GGT; alkaline phosphatase, ALP), aspartate aminotransferase (AST), alanine aminotransferase (ALT) and lactate dehydrogenase (LDH) were obtained preoperatively and at 24 and 48 h postoperatively. Similar anesthesiologic protocol was used for both LC and OC. During LC, the intra-abdominal pressure was maintained within the conventional range of 12-14 mm Hg. **RESULTS:** Total bilirubin, ALP, GGT and LDH levels remained unchanged from baseline in both groups without significant difference between them. A higher number of patients had increased values of ALT (26/50 vs. 5/50) and AST (23/50 vs. 6/50) in LC compared to OC group. Although the difference was statistically significant ( $p < 0.000$  for ALT and  $p = 0.0004$  for AST) the increased level decreased at 48 compared to 24 h. **CONCLUSION:** The results indicate that LC is associated with transient elevation of ALT and AST. The disturbances in the function of the liver after LC are self-limited and not associated with any morbidity in patients with a normal liver function.

Hernandez, G., R. Cornejo, et al. (2005). "High volume hemofiltration in the management of severe hyperdynamic septic shock." Intensive Care Medicine **31**, **Supplement 1**(134): S185, Abstract 711.

Hernandez, G., T. Requeira, et al. (2005). "Intra-abdominal hypertension in septic shock patients." Intensive Care Medicine **31**, **Supplement 1**(134): S91, Abstract 339.

**INTRODUCTION.** Intra-abdominal hypertension (IAH) may contribute to splanchnic hypoperfusion and multiple organ failure in critically ill patients. Nevertheless, limited information exists about IAH in septic shock patients, where severe distributive and microcirculatory abnormalities are present. Even moderate increases in intra-abdominal pressure may worsen hypoperfusion during septic shock. Our aim was to evaluate in septic shock patients compared to postoperative control patients with known risk factors for IAH: (a) the incidence and time course of IAH during early ICU stay; and (b) the consequences of IAH in lactate levels, maximum SOFA and norepinephrine requirements. **METHODS.** 27 septic shock patients and 19 abdominal surgery patients with > 2 risk factors for IAH admitted consecutively were included. Intra-abdominal pressure was measured

every 6 h during the first 48 h. IAH was diagnosed with 2 consecutive measurements > 20 mm Hg. Clinical data and risk factors for IAH were registered. During follow-up SOFA, peak norepinephrine doses and lactate levels were registered daily. IAH incidence was established in both groups. Lactate levels, norepinephrine requirements and SOFA scores in patients with and without IAH in both groups were statistically compared. RESULTS. 51% of septic shock and 31% of control patients developed IAH. Septic shock patients with and without IAH were comparable in peak norepinephrine dose, SOFA and mortality. However, peak lactate levels were significantly higher in septic shock patients with IAH compared with those without IAH (3.5 vs. 1.9 mmol/L,  $p < 0.04$ ). There was a significant positive temporal correlation between intra-abdominal pressure and lactate in septic shock patients with IAH. Peak levels of both occurred early and decreased progressively over time. Control patients with and without IAH exhibited comparable normal lactate levels. CONCLUSION. We demonstrated a very high incidence of IAH in septic shock. Lactate levels were significantly higher in septic shock patients with IAH compared to those patients without IAH or to control patients with IAH. There was a close temporal correlation between lactate and intra-abdominal pressure values over time.

Hultman, C. S., B. Pratt, et al. (2005). "Multidisciplinary approach to abdominal wall reconstruction after decompressive laparotomy for abdominal compartment syndrome." *Ann Plast Surg* **54**(3): 269-75; discussion 275.

INTRODUCTION: Decompressive laparotomy for abdominal compartment syndrome has been shown to reduce mortality in critically ill patients, but little is known about the outcome of abdominal wall reconstruction. This study investigates the role of plastic surgeons in the management and reconstruction of these abdominal wall defects. METHODS: We performed a retrospective review of 82 consecutive critically ill patients who underwent decompressive laparotomy for abdominal compartment syndrome, at a university level 1 trauma center, from April 2000 to May 2004. Patients reconstructed by trauma surgeons alone ( $n = 15$ ) were compared with patients reconstructed jointly with plastic surgeons ( $n = 12$ ), using Student t test and chi analysis. RESULTS: Eighty-two patients underwent decompressive laparotomy for abdominal compartment syndrome, yielding 50 survivors (61%). Of the 27 patients who underwent abdominal wall reconstruction, 6 had early primary fascial repair, and 21 had staged reconstruction with primary fascial closure ( $n = 4$ ), components separation alone ( $n = 3$ ), components separation with mesh ( $n = 10$ ), or permanent mesh only ( $n = 4$ ). Compared with patients whose reconstruction was performed by trauma surgeons, patients who underwent a combined approach with plastic surgeons were older (50.5 versus 31.7 years,  $P < 0.05$ ), had more comorbidities ( $P < 0.001$ ), were less likely to have a traumatic etiology ( $P < 0.001$ ), had a longer delay to reconstruction (407 versus 119 days,  $P < 0.05$ ), and were more likely to undergo components separation ( $P < 0.05$ ). Mean follow-up of 11.5 months revealed 2 recurrent hernias in the combined reconstruction group, both of which were successfully repaired. CONCLUSIONS: A multidisciplinary approach is essential to the successful management of abdominal wall defects after decompressive

laparotomy for abdominal compartment syndrome. Although carefully selected patients can undergo early primary fascial repair, most of reconstructed patients had staged closure of the abdominal wall via components separation, with a low rate of recurrent hernia. High-risk patients with large defects and comorbidities appear to benefit from the involvement of a plastic surgeon.

Janik, Sutiak, et al. (2005). "The significance of clinical markers in the prediction of hemodynamic and cardiac complications of capnoperitoneum in patients at risk." Bratisl Lek Listy **106**(4-5): 155-62.

**OBJECTIVES:** The aim of this prospective study was to find out the predictive value of concomitant diseases of cardiovascular system (CVS), lungs and kidneys as well as metabolic diseases to be able to anticipate the potential origin of hemodynamic and cardiopulmonary complications as a result of insufflated CO<sub>2</sub> peritoneum. **METHODS:** The study investigated eleven patients at the anaesthetic risk of ASA III-IV and cardiac risk of NYHA II-III in whom elective laparoscopic surgical intervention had been indicated. **RESULTS:** We have found out that the significance of the increase in biologic ANP markers, catecholamines and PRA was not sufficient to signal the deepening of cardiac dysfunction, latent cardiac failure or hemodynamic disorder ( $p > 0.01$ ). The courses of regression lines have shown the dependence on the increased IAP (intra-abdominal pressure) of capnoperitoneum in PRA and adrenaline. The reactions of biologic markers correlated with reactions of clinical hemodynamic markers of BP and HR. We have proved that the increased level of IAP causes a significant increase in CVP ( $p < 0.01$ ) being one of the factors determining the preload of right ventricle (RV) and in coincidence with intact transpulmonary circulation also the optimal function of left ventricle (LV). **CONCLUSION:** Our investigation of perioperative clinical and biologic markers of hemodynamics and neuroendocrine response to operative stress and development of CO<sub>2</sub> peritoneum has proved that the course of laparoscopic operations in patients in the risk group of ASA III-IV and NYHA III does not necessarily have to be deteriorated by complications. It can be assumed that increased values of biologic markers regulate the neurohumoral response in the physiologic range and do not predict a severe CVS dysfunction within its course. (Tab. 2, Fig. 3, Ref. 22.)

Kaplan, M. (2005). "Negative pressure wound therapy in the management of abdominal compartment syndrome." Ostomy Wound Manage **51**(2A Suppl): 29-35.

Kimball, E. J., G. K. Baraghoshi, et al. (2005). "A comparison of infusion volumes in the measurement of intra-abdominal pressure." Critical Care Medicine **33**(12 supplement): A37, Abstract 139-S.

**Introduction:** Bladder pressure measurement through a Foley catheter is the current gold standard in monitoring for intra-abdominal hypertension (IAH) and abdominal compartment syndrome. Accurate pressure transduction requires a continuous fluid column with a small volume of transducing medium at the tip of the catheter. However, infusing excessive fluid volume can falsely elevated IAP due to bladder over-distention and can lead to intrinsic muscular contraction.

This effect can be seen with infusion volumes as low as 60 ml to 100 ml. Recent expert consensus has recommended 50 ml as a standard infusion volume, however lower volumes have not been rigorously evaluated. Hypothesis: There will be a non-significant variance between IAP measurement values using a range of bladder volume infusions between 10ml and 60ml. Methods: A total of 18 surgical ICU patients undergoing IAP measurement for suspected IAH were entered into this Institutional Review Board approved study. Ten ml increments of saline (range 10 ml to 60 ml) were infused into the bladder and IAP was recorded for each volume (one measurement event). Results: After analysis accounting for data correlation within patients, means and standard deviations were generated for differences between 50 ml versus 10, 20, 30, 40, and 60 ml bladder infusion volumes. There was a mean variance of = 1.35 mm Hg in IAP between these volume comparisons. Conclusion: In surgical ICU patients with a clinical indication for IAP monitoring, bladder infusion volumes between 10 ml and 60 ml provide consistent IAP measurements.

Volume	No. of Events	Mean dif.	Standard Dev	95% CI
10 ml	188	1.35	2.27	1.0-1.7
20 ml	188	1.00	2.27	0.7-1.3
30 ml	188	0.62	1.7	0.4-0.8
40 ml	188	0.39	0.82	0.3-0.5
60 ml	121	-0.35	0.85	-0.5-0.2

Kimball, E. J., D. Kinikini, et al. (2005). "Delayed Abdominal closure in the management of ruptured abdominal aortic aneurysm." Crit Care Med **33**(12 (suppl.)): A38, Abstract 144-S.

Kimball, E. J. and M. Mone (2005). "Influence of neuromuscular blockade on intra-abdominal pressure." Critical Care Medicine **33**(12 supplement): A38, Abstract 142-S.

Introduction: Elevated intraabdominal pressure (IAP) leads to reduced organ perfusion, elevated peak airway pressures and may be a precursor or cause of multiple organ failure and death. Medical interventions to reduce IAP may be useful in preventing these complications. Hypothesis: This study sought to determine whether neuromuscular blockade (NMB) was useful for reducing IAP in patients suffering from clinically significant intraabdominal hypertension (IAH) (defined as IAP > 15 mm Hg). Methods: A retrospective chart review of 28 records was reviewed. Patients with IAP measurements taken within 2 hours prior to NMB and 1 hour following NMB bolus or infusion were eligible for analysis in this Institutional Review Board approved study. Sixteen events on 10 patient cases met eligibility criteria. IAP reductions of greater than 4 mm Hg were considered clinically significant. Results: In all patients with IAP over 20 mm Hg there was a clinically significant pressure reduction following NMB administration (mean reduction of 9.2 mm Hg). Patients with lower IAP rarely had clinically significant reductions in IAP following NMB administration. Conclusions: NMB administration leads to a clinically significant reduction in IAP in all patients with intraabdominal hypertension greater than 20 mm Hg.

This medical therapy may be useful in improving abdominal perfusion in selected patient suffering from IAH.

Group	Pre-NMB IAP mmHg	Post-NMB IAP mmHg	Pre/Post-NMB IAP diff
IAP > 20	22.4 (21-24)	13.2 (10-18)	-9.2 (-6 to -12)
IAP 15-19	16.8 (15-19)	14.6 (10-18)	-2.1 (+1 to -9)
IAP < 15	11.7 (10-13)	10.2 (6-12)	-1.5 (0 to -4)

Kopelman, T. R. and P. J. O'Neill (2005). "Adrenal Insufficiency in patients undergoing the open abdomen technique." Crit Care Med **33**(12 (suppl.)): A37, Abstract 138-S.

Kozar, R. A., J. B. Moore, et al. (2005). "Complications of Nonoperative Management of High-Grade Blunt Hepatic Injuries." J Trauma **59**(5): 1066-1071.

**BACKGROUND::** Nonoperative management of blunt hepatic injuries is highly successful. Complications associated with high-grade injuries, however, have not been well characterized. The purpose of the present study was therefore to define hepatic-related complications and associated treatment modalities in patients undergoing nonoperative management of high-grade blunt hepatic injuries.

**METHODS::** Three hundred thirty-seven patients from two regional Level I trauma centers with grade 3 to 5 blunt hepatic injuries during a 40-month period were reviewed. Complications and treatment of hepatic-related complications in patients not requiring laparotomy in the first 24 hours were identified.

**RESULTS::** Of 337 patients with a grade 3 to 5 injury, 230 (68%) were managed nonoperatively. There were 37 hepatic-related complications in 25 patients (11%); 63% (5 of 8) of patients with grade 5 injuries developed complications, 21% (19 of 92) of patients with grade 4 injuries, but only 1% (1 of 130) of patients with grade 3 injuries. Complications included bleeding in 13 patients managed by angioembolization (n = 12) and laparotomy (n = 1), liver abscesses in 2 patients managed with computed tomography-guided drainage (n = 2) and subsequent laparotomy (n = 1). In one patient with bleeding, hepatic necrosis followed surgical ligation of the right hepatic artery and required delayed hepatic lobectomy. Sixteen biliary complications were managed with endoscopic retrograde cholangiopancreatography and stenting (n = 7), drainage (n = 5), and laparoscopy (n = 4). Three patients had suspected abdominal sepsis and underwent a negative laparotomy, whereas an additional three patients underwent laparotomy for abdominal compartment syndrome. **CONCLUSION::** Nonoperative management of high-grade liver injuries can be safely accomplished. Mortality is low; however, complications in grade 4 and 5 injuries should be anticipated and may require a combination of operative and nonoperative management strategies.

Kural, T., M. Brabec, et al. (2005). "[The importance of measuring intraabdominal pressure in cases of severe acute pancreatitis]." Zentralbl Chir **130**(2): 128-31.

**AIM:** Evaluating the importance of intraabdominal pressure measurement in cases of severe acute pancreatitis and its use in determining indication for surgery.

**METHODS:** A retrospective evaluation of the treatment of patients with severe

acute pancreatitis hospitalised at the Department of Surgery or the Department of Anaesthesiology and Resuscitation of the Charles University hospital in Pilsen during the last two years (from January 1 (st), 2002 to December 31 (st), 2003) was performed. RESULTS: During this period, 63 patients with severe acute pancreatitis were hospitalised at both departments, among which 18 patients underwent an operation (28.6 %), eight of them died (12.7 %). In four of the 18 patients who underwent an operation the surgery was indicated due to progression of abdominal compartment syndrome (ACS) and all of these patients survived. CONCLUSIONS: At present, basic treatment of severe acute pancreatitis is considered to be conservative. The only generally accepted indication for surgery is an established infection of the necrotic tissue. In our presentation, we draw attention to those cases where the general condition of the patient deteriorates combined with a progression of ACS and where a decompressive laparotomy can improve the prognosis of the disease.

Lambert, D. M., S. Marceau, et al. (2005). "Intra-abdominal pressure in the morbidly obese." *Obes Surg* **15**(9): 1225-32.

BACKGROUND: Recent data suggests that increased intra-abdominal pressure (IAP) is one factor associated with the morbidity of morbidly obese patients, who have a BMI > 35 kg/m<sup>2</sup>. IAP has been proposed to be an abdominal compartment syndrome (ACS). This study investigated the characteristics of IAP in morbidly obese patients. METHODS: 45 morbidly obese patients (mean BMI 55 ± 2 kg/m<sup>2</sup>) had IAP measured using urinary bladder pressure. RESULTS: The mean IAP for the morbidly obese group was 12 ± 0.8 cmH<sub>2</sub>O, increased when compared to controls (IAP = 0 ± 2 cmH<sub>2</sub>O). The IAP correlated to the sagittal abdominal diameter, an index of the degree of central obesity (r = +0.83, P < 0.02); however, it did not correlate to basal insulin, body weight, or BMI. The end-expiratory IAP did not change when measured after the laparotomy incision was made, but IAP measured in the last 15 patients increased during the first 2 postoperative days. The IAP for patients with pressure-related morbidity (gastroesophageal reflux disease, hernia, stress incontinence, diabetes, hypertension, and venous insufficiency) was 12 ± 1 cmH<sub>2</sub>O, while those without these morbidities had an IAP of 9 ± 0.8 cmH<sub>2</sub>O. CONCLUSION: We conclude that IAP is increased in morbid obesity. This increased IAP is a function of central obesity and is associated with increased morbidity. The degree of IAP elevation correlates with increased co-morbidities. We also conclude that elevation in IAP in morbid obesity is not a true ACS but represents a direct mass effect of the visceral obesity.

Leblanc, M., J. A. Kellum, et al. (2005). "Risk factors for acute renal failure: inherent and modifiable risks." *Curr Opin Crit Care* **11**(6): 533-536.

PURPOSE OF REVIEW: Our purpose is to discuss established risk factors in the development of acute renal failure and briefly overview clinical markers and preventive measures. RECENT FINDINGS: Findings from the literature support the role of older age, diabetes, underlying renal insufficiency, and heart failure as predisposing factors for acute renal failure. Diabetics with baseline renal

insufficiency represent the highest risk subgroup. An association between sepsis, hypovolemia, and acute renal failure is clear. Liver failure, rhabdomyolysis, and open-heart surgery (especially valve replacement) are clinical conditions potentially leading to acute renal failure. Increasing evidence shows that intraabdominal hypertension may contribute to the development of acute renal failure. Radiocontrast and antimicrobial agents are the most common causes of nephrotoxic acute renal failure. In terms of prevention, avoiding nephrotoxins when possible is certainly desirable; fluid therapy is an effective prevention measure in certain clinical circumstances. Supporting cardiac output, mean arterial pressure, and renal perfusion pressure are indicated to reduce the risk for acute renal failure. Nonionic, isoosmolar intravenous contrast should be used in high-risk patients. Although urine output and serum creatinine lack sensitivity and specificity in acute renal failure, they remain the most used parameters in clinical practice. SUMMARY: There are identified risk factors of acute renal failure. Because acute renal failure is associated with a worsening outcome, particularly if occurring in critical illness and if severe enough to require renal replacement therapy, preventive measures should be part of appropriate management.

Leppaniemi, A. and E. Kemppainen (2005). "Recent advances in the surgical management of necrotizing pancreatitis." Curr Opin Crit Care **11**(4): 349-52.

PURPOSE OF REVIEW: To summarize advances and new concepts in the surgical management of necrotizing pancreatitis published within the past year with emphasis on the evolving importance of the recognition of abdominal compartment syndrome as a significant contributor to early development of organ failure. RECENT FINDINGS: Underdiagnosed and untreated, abdominal compartment syndrome is a potential contributing factor to the development of early organ failure in patients with severe acute pancreatitis and warrants routine measurement of intra-abdominal pressure in patients treated for severe pancreatitis. The current estimate of the prevalence of intra-abdominal hypertension in severe acute pancreatitis is about 40%, with about 10% overall developing abdominal compartment syndrome, associated with increased hospital mortality rates. Early surgical decompression without exploring the pancreas further seems to be the most effective treatment. Primary fascial closure of the abdominal wall following abdominal decompression can be attempted, but in most cases the prolonged inflammatory process in the abdomen and the risk of recurrent abdominal compartment syndrome favors use of gradual closure or delayed reconstruction of the abdominal wall. SUMMARY: Recent studies confirm the overall validity of the established surgical principles for necrotizing pancreatitis: delayed necrosectomy in patients with infected peripancreatic necrosis, mostly nonoperative management of sterile necrosis, and delayed cholecystectomy in severe gallstone-associated pancreatitis. The role of abdominal compartment syndrome as an important contributing factor to early development of multiple organ failure and the potential benefit of surgical decompression are gaining support from recent reports and should be carefully assessed in future studies.

Letoublon, C., N. Cardin, et al. (2005). "[Laparostomy with vacuum pack technique.]" Ann Chir.

The technique of abdominal wall closure by vacuum pack is described. Indications are essentially the abbreviated laparotomy or damage control (especially with abdominal packing), and the post traumatic abdominal compartment syndrome (in the treatment and prevention).

Li, J. S., D. F. Zhang, et al. (2005). "[Medical therapy for abdominal compartment syndrome: 3 cases report and literature review.]" Zhongguo Wei Zhong Bing Ji Jiu Yi Xue **17**(6): 379-81.

Lonardo and Piazza (2005). "Incidence of intraabdominal hypertension in the intensive care unit." Crit Care Med **33**(9): 2150; author reply 2150-3.

Losken, A., G. W. Carlson, et al. (2005). "The significance of intraabdominal compartment pressure after free versus pedicled TRAM flap breast reconstruction." Plast Reconstr Surg **115**(1): 261-3.

Ma, Y. M., C. Qian, et al. (2005). "[Acute renal failure due to abdominal compartment syndrome]." Zhonghua Yi Xue Za Zhi **85**(31): 2218-20.

OBJECTIVE: To observe the effect of intra-abdominal hypertension on renal function. METHODS: 30 intra-abdominal hypertension patients, 26 mals and 4 femals, age 42 +/- 17, were observed. Intra-abdominal pressure, mean arterial pressure, central venous pressure and serum creatinine were recorded and tested at the same time every day. RESULTS: When the intra-abdominal pressure increased, the urine output decreased (from 78 ml/h +/- 26 ml/h to 31 ml/h +/- 11 ml/h,  $P < 0.01$ ), serum creatinine increased (from 110 mmol/L +/- 98 mmol/L to 224 mmol/L +/- 147 mmol/L,  $P < 0.01$ ) with high central venous pressure (6.0 mm Hg +/- 2.1 mm Hg to 8.8 mm Hg +/- 2.5 mm Hg, 1 mm Hg = 0.133 kPa,  $P < 0.01$ ) and high mean arterial pressure (from 79 mm Hg +/- 8 mm Hg to 86 mm Hg +/- 10 mm Hg,  $P < 0.01$ ). There is a significant negative correlation between the intra-abdominal hypertension and urine output ( $r = -0.747$ ,  $P < 0.01$ ), and a significant positive correlation between the intra-abdominal hypertension and serum creatinine ( $r = 0.816$ ,  $P < 0.01$ ). During the ICU stay, 12 patients died, among which 8 died from multiple organ dysfunction due to septicemia and 4 died from abdominal hemorrhage. CONCLUSION: Intra-abdominal hypertension is correlated with lower urine output and increased blood creatinine significantly, and these results can be inverted when the intra-abdominal pressure decreases.

Malbrain, M. L. N. G., D. Chiumello, et al. (2005). "Incidence and prognosis of intraabdominal hypertension in a mixed population of critically ill patients: a multiple-center epidemiological study." Crit Care Med **33**(2): 315-22.

OBJECTIVE: Intraabdominal hypertension is associated with significant morbidity and mortality in surgical and trauma patients. The aim of this study was to assess, in a mixed population of critically ill patients, whether intraabdominal pressure at admission was an independent predictor for mortality and to evaluate

the effects of intraabdominal hypertension on organ functions. DESIGN: Multiple-center, prospective epidemiologic study. SETTING: Fourteen intensive care units in six countries. PATIENTS: A total of 265 consecutive patients admitted for >24 hrs during the 4-wk study period. INTERVENTIONS: None. MEASUREMENTS AND MAIN RESULTS: Intraabdominal pressure was measured twice daily via the bladder. Data recorded on admission were the patient demographics with Simplified Acute Physiology Score II, Acute Physiology and Chronic Health Evaluation II score, and type of admission; during intensive care stay, Sepsis-Related Organ Failure Assessment score and intraabdominal pressure were measured daily together with fluid balance. Nonsurvivors had a significantly higher mean intraabdominal pressure on admission than survivors: 11.4 +/- 4.8 vs. 9.5 +/- 4.8 mm Hg. Independent predictors for mortality were age (odds ratio, 1.04; 95% confidence interval, 1.01-1.06; p = .003), Acute Physiology and Chronic Health Evaluation II score (odds ratio, 1.1; 95% confidence interval, 1.05-1.15; p < .0001), type of intensive care unit admission (odds ratio, 2.5 medical vs. surgical; 95% confidence interval, 1.24-5.16; p = .01), and the presence of liver dysfunction (odds ratio, 2.5; 95% confidence interval, 1.06-5.8; p = .04). The occurrence of intraabdominal hypertension during the intensive care unit stay was also an independent predictor of mortality (relative risk, 1.85; 95% confidence interval, 1.12-3.06; p = .01). Patients with intraabdominal hypertension at admission had significantly higher Sepsis-Related Organ Failure Assessment scores during the intensive care unit stay than patients without intraabdominal hypertension. CONCLUSIONS: Intraabdominal hypertension on admission was associated with severe organ dysfunction during the intensive care unit stay. The mean intraabdominal pressure on admission was not an independent risk factor for mortality; however, the occurrence of intraabdominal hypertension during the intensive care unit stay was an independent outcome predictor.

Malbrain, M. L. N. G., D. Deeren, et al. (2005). "Intra-abdominal hypertension in the critically ill: it is time to pay attention." *Curr Opin Crit Care* **11**(2): 156-171.

PURPOSE OF THE REVIEW: There has been an exponentially increasing interest in intra-abdominal hypertension (IAH). Comparison of the published data however is difficult due to the lack of consensus definitions. This review will focus on the available literature from the last 2 years. A Medline and PubMed search was performed using 'intra-abdominal pressure' (IAP), 'intra-abdominal hypertension' (IAH), and 'abdominal compartment syndrome' (ACS) as search items. The aim was to find an answer to the question 'Isn't it time to pay attention to intra-abdominal pressure in the critically ill?' RECENT FINDINGS: Although the number of studies published on this topic is steadily increasing and confirms the pathophysiologic implications of IAH on end-organ function within and outside the abdominal cavity it remains difficult to compare the literature data because the measurement methods and definitions used are not uniform. Provocative data have been published regarding the interactions between the abdominal and thoracic compartments especially in patients with capillary leak and fluid overload; most of this data raises even more questions than it gives

answers and may therefore strengthen the nonbelievers who consider IAP, IAH and ACS as epiphenomena in critically ill patients. Unless the international scientific community does not come forward with clear-cut definitions we will keep comparing 'apples with oranges.' SUMMARY: It is time to pay attention to intra-abdominal pressure in the critically ill. It is also time for standardized IAP measurement methods, good consensus definitions and randomized interventional studies.

Malbrain, M. N. L. G., K. Schoonheydt, et al. (2005). "Effect of abdominal perfusion pressure on outcome in mechanically ventilated patients." Intensive Care Medicine **31**, Supplement 1(134): S5 - Abstract 003.

Maslovsky, O. P. and V. V. Zagorujko (2005). "Acute pancreatitis with multiple organ dysfunction syndrome - is high volume hemofiltration helpful?" Intensive Care Medicine **31**, Supplement 1(134): S185, Abstract 710.

Mehta, M., R. C. Darling, 3rd, et al. (2005). "Factors associated with abdominal compartment syndrome complicating endovascular repair of ruptured abdominal aortic aneurysms." J Vasc Surg **42**(6): 1047-51.

BACKGROUND: Endovascular treatment of ruptured abdominal aortic aneurysms (r-AAAs) has the potential to offer improved outcomes. As our experience with endovascular repair of r-AAA evolved, we recognized that the development of abdominal compartment syndrome (ACS) led to an increase in morbidity and mortality. We therefore reviewed our experience to identify risk factors associated with the development of ACS. METHODS: From January 2002 to December 2004, 30 patients underwent emergent endovascular repair of r-AAA by using commercially available stent grafts. All patients who developed ACS underwent emergent laparotomy. Physiological and clinical parameters were analyzed between patients with and without ACS after endovascular r-AAA repair. RESULTS: Over the past 3 years, 30 patients underwent endovascular r-AAA repair, and 6 (20%) patients developed ACS. Patients with ACS had a higher incidence of the need for aortic occlusion balloon (67% vs 12%;  $P = .01$ ), a markedly longer activated partial thromboplastin time (128 +/- 84 seconds vs 49 +/- 31 seconds;  $P = .01$ ), a greater need for blood transfusion (8 +/- 2.5 units vs 1.8 +/- 1.7 units;  $P = .08$ ), and a higher incidence of conversion to aortouni-iliac devices because of ongoing hemodynamic instability and an inability to expeditiously cannulate the contralateral gate (67% vs 8%) when compared with patients without ACS. The mortality was significantly higher in the patients with ACS (67%; 4 of 6) compared with patients without ACS (13%; 3 of 24;  $P = .01$ ). CONCLUSIONS: ACS is a potential complication of endovascular repair of r-AAA and negatively affects survival. Factors associated with the development of ACS include (1) use of an aortic occlusion balloon, (2) coagulopathy, (3) massive transfusion requirements, and (4) conversion of bifurcated stent grafts into aortouni-iliac devices. We recommend that, after endovascular repair of r-AAA, these patients undergo vigilant monitoring for the development of ACS.

Meierhenrich, Gauss, et al. (2005). "The effects of intraabdominally insufflated carbon dioxide on hepatic blood flow during laparoscopic surgery assessed by transesophageal echocardiography." *Anesth Analg* **100**(2): 340-7.

Conflicting results have been published about the effects of carbon dioxide (CO<sub>2</sub>) pneumoperitoneum on splanchnic and liver perfusion. Several experimental studies described a pressure-related reduction in hepatic blood flow, whereas other investigators reported an increase as long as the intraabdominal pressure (IAP) remained less than 16 mm Hg. Our goal in the present study was to investigate the effects of insufflated CO<sub>2</sub> on hepatic blood flow during laparoscopic surgery in healthy adults. Blood flow in the right and middle hepatic veins was assessed in 24 patients undergoing laparoscopic surgery by use of transesophageal Doppler echocardiography. Hepatic venous blood flow was recorded before and after 5, 10, 20, 30, and 40 min of pneumoperitoneum, as well as 1 and 5 min after deflation. Twelve patients undergoing conventional hernia repair served as the control group. The induction of pneumoperitoneum produced a significant increase in blood flow of the right and middle hepatic veins. Five minutes after insufflation of CO<sub>2</sub> the median right hepatic blood flow index increased from 196 mL/min/m<sup>2</sup> (95% confidence interval (CI), 140-261 mL/min/m<sup>2</sup>) to 392 mL/min/m<sup>2</sup> (CI, 263-551 mL/min/m<sup>2</sup>) (P < 0.05) and persisted during maintenance of pneumoperitoneum. In the middle hepatic vein the blood flow index increased from 105 mL/min/m<sup>2</sup> (CI, 71-136 mL/min/m<sup>2</sup>) to 159 mL/min/m<sup>2</sup> (CI, 103-236 mL/min/m<sup>2</sup>) 20 min after insufflation of CO<sub>2</sub>. After deflation blood flow returned to baseline values in both hepatic veins. Conversely, in the control group hepatic blood flow remained unchanged over the entire study period. We conclude that induction of CO<sub>2</sub> pneumoperitoneum with an IAP of 12 mm Hg is associated with an increase in hepatic perfusion in healthy adults.

Meininger, D., C. Byhahn, et al. (2005). "Positive end-expiratory pressure improves arterial oxygenation during prolonged pneumoperitoneum." *Acta Anaesthesiol Scand* **49**(6): 778-83.

**BACKGROUND:** Laparoscopic surgery usually requires the use of a pneumoperitoneum by insufflating gas in the peritoneal space. The gas most commonly used for insufflation is carbon dioxide. Increased intra-abdominal pressure causes cephalad displacement of the diaphragm resulting in compressed lung areas, which leads to formation of atelectasis, especially during mechanical ventilation. The aim of this prospective study was to investigate the effect of prolonged intraperitoneal gas insufflation on arterial oxygenation and hemodynamics during mechanical ventilation with and without positive end-expiratory pressure (PEEP). **METHODS:** Twenty patients undergoing totally endoscopic robot-assisted radical prostatectomy were randomly allocated to one of two groups. In the PEEP group (n = 10) a constant PEEP of 5 cmH<sub>2</sub>O was used, whereas in the ZPEEP group (n = 10) no PEEP was used. **RESULTS:** Application of PEEP (5 cmH<sub>2</sub>O) resulted in significantly higher P(a)O<sub>2</sub> levels after 3 h (182 +/- 49 vs. 224 +/- 35 mmHg) and 4 h (179 +/- 48 vs. 229 +/- 29 mmHg) of pneumoperitoneum; after desufflation, P(a)O<sub>2</sub> values decreased

significantly below preinsufflation values. While there were no significant differences in heart rate, central venous pressure (CVP) and mean arterial blood pressure (MAP) during pneumoperitoneum between both groups, baseline values in CVP and MAP differed significantly between both groups with higher levels in the ZPEEP group. CONCLUSION: The application of a constant positive airway pressure of 5 cmH<sub>2</sub>O preserves arterial oxygenation during prolonged pneumoperitoneum.

Michelet, P., A. Roch, et al. (2005). "Influence of support on intra-abdominal pressure, hepatic kinetics of indocyanine green and extravascular lung water during prone positioning in patients with ARDS: a randomized crossover study." *Crit Care* 9(3): R251-7.

INTRODUCTION: Prone positioning (PP) on an air-cushioned mattress is associated with a limited increase in intra-abdominal pressure (IAP) and an absence of organ dysfunction. The respective influence of posture by itself and the type of mattress on these limited modifications during the PP procedure remains unclear. The aim of this study was to evaluate whether the type of support modifies IAP, extravascular lung water (EVLW) and the plasma disappearance rate of indocyanine green (PDRICG) during PP. METHODS: A prospective, randomized, crossover study of 20 patients with acute respiratory distress syndrome (ARDS) was conducted in a medical intensive care unit in a teaching hospital. Measurements were made at baseline and repeated after 1 and 6 hours of two randomized periods of 6 hours of PP with one of two support types: conventional foam mattress or air-cushioned mattress. RESULTS: After logarithmic transformation of the data, an analysis of variance (ANOVA) showed that IAP and PDRICG were significantly influenced by the type of support during PP with an increase in IAP ( $P < 0.05$  by ANOVA) and a decrease in PDRICG on the foam mattress ( $P < 0.05$  by ANOVA). Conversely, the measurements of EVLW did not show significant modification between the two supports whatever the posture. The ratio of the arterial oxygen tension to the fraction of inspired oxygen significantly increased in PP ( $P < 0.0001$  by ANOVA) without any influence of the support. CONCLUSION: In comparison with a conventional foam mattress, the use of an air-cushioned mattress limited the increase in IAP and prevented the decrease in PDRICG related to PP in patients with ARDS. Conversely, the type of support did not influence EVLW or oxygenation.

Montalvo, J. A., J. A. Acosta, et al. (2005). "Surgical complications and causes of death in trauma patients that require temporary abdominal closure." *Am Surg* 71(3): 219-24.

Temporary abdominal closure (TAC) has increasingly been employed in the management of severely injured patients to avoid abdominal compartment syndrome (ACS) and as part of damage control surgery (DCS). Although the use of TAC has received great interest, few data exist describing the morbidity and mortality associated with its use in trauma victims. The main goal of this study is to describe the incidence of surgical complications following the use of TAC as well as to define the mortality associated with this procedure. A retrospective review of patients admitted to a state-designated level 1 trauma center from April

2000 to February 2003 was performed. Inclusion criteria were age >18 years, traumatic injury, and need for exploratory laparotomy and use of TAC. A total of 120 patients were included in the study. The overall mortality of trauma patients requiring TAC was 59.2 per cent. The most common causes of death were acute inflammatory process (50.7%), followed by hypovolemic shock (43.7%). The incidence of surgical complications was 26.6 per cent. Intra-abdominal abscesses were the most frequent surgical complication (10%). After multiple logistic regression analysis, increasing age and a numerically greater initial base deficit were found to be independent predictors of mortality in trauma patients that require TAC.

Moore-Olufemi, S. D., H. Xue, et al. (2005). "Effects of Primary and Secondary Intra-Abdominal Hypertension on Mesenteric Lymph Flow: Implications for the Abdominal Compartment Syndrome." *Shock* **23**(6): 571-575.

Intra-abdominal hypertension leading to abdominal compartment syndrome complicates trauma resuscitation. The purpose of this study was to determine the effect of primary (1 degrees ) and secondary (2 degrees ) intra-abdominal hypertension (IAH) on hemodynamics, intestinal fluid balance, and mesenteric lymph flow. Anesthetized dogs were instrumented with vascular catheters, intra-abdominal manometer, and mesenteric lymphatic fistulae. 1 degrees IAH was created by infusing 0.9% saline into the peritoneal cavity to increase abdominal pressure. 2 degrees IAH was created by elevating the inferior vena cava (IVC) pressure between 20 and 25 mmHg and crystalloid resuscitation to create intestinal edema to induce IAH. At baseline and at 30-min intervals, hemodynamics, lymph flow (QL), IVC, and intra-abdominal pressures were measured. Tissue water was determined using microgravimetry to assess gut edema. Results are reported as mean +/- SEM, with n = 7-8 dogs per group. 1 degrees IAH significantly increased CVP and decreased QL. 1 degrees IAH stopped mesenteric QL, thus transvascular fluid flux necessarily exceeded QL, contributing to gut edema formation. 2 degrees IAH significantly increased CVP and QL. 2 degrees IAH increased QL despite elevated IAP. Interstitial protein washdown maintained the plasma-to-interstitial oncotic gradient, thus increased transvascular fluid flux was due principally to increased capillary pressure. Transvascular fluid flux exceeded QL as manifested by increasing gut tissue water as QL plateaued. Modest elevations in IAP significantly affect mesenteric QL and the development of gut edema. The principle of early abdominal decompression to reduce mesenteric/IVC venous hypertension and capillary pressure is supported by these data.

Moore-Olufemi, S. D., H. Xue, et al. (2005). "Resuscitation-induced gut edema and intestinal dysfunction." *J Trauma* **58**(2): 264-70.

BACKGROUND: Mesenteric venous hypertension and subsequent gut edema play a pivotal role in the development of intra-abdominal hypertension. Although gut edema is one cause of intra-abdominal hypertension, its impact on gut function is unknown. The purpose of this study was to create a model of acute hydrostatic gut edema and to evaluate its effect on gut motility and barrier

function. **METHODS:** The first study, group A, evaluated the effect of gut edema on transit over time using 20 mL/kg 0.9% saline. The second study, group B, focused on the 12-hour time period using 80 mL/kg 0.9% saline. Rats were randomized to superior mesenteric vein partial occlusion (venous hypertension) or sham surgery. At 6, 12, and 24 hours, group A underwent intestinal transit and tissue water weight measurements. At 12 hours, group B underwent tissue water, transit, ileal permeability and resistance, lactate and myeloperoxidase activity, and mucosal injury measurements. **RESULTS:** Venous hypertension with fluid resuscitation caused acute hydrostatic gut edema, delayed intestinal transit, increased mucosal permeability to macromolecules, and decreased tissue resistance over time. Mucosal injury was minimal in mesenteric venous hypertension. **CONCLUSION:** Acute mesenteric venous hypertension and resuscitation-induced gut edema, in the absence of ischemia/reperfusion injury, is associated with delayed intestinal transit and altered gut barrier function.

Nacev, T. V. (2005). "[Abdominal compartment syndrome in politrauma patients with concomitant abdominal and head lesions --mechanisms and terapeutical aspects]." Chirurgia (Bucur) **100**(5): 507-14.

The acute and persistent increase of the intra-abdominal pressure (IAP) above 25 cm H<sub>2</sub>O represents a pathologic entity called the abdominal compartment syndrome (ACS). This intra-abdominal high pression is responsible of dysfunctions in cardiovascular, respiratory and renal systems and also dysfunctions in brain and abdomen. In polytrauma patients with combined head and abdominal lesions, increases of IAP are transmitted via thorax and superior venous caval system to brain generating intracranial hypertension, reducing cerebral blood flow (CBF) and cerebral perfusion pressure (CPP) thus worsening neurological status and increasing mortality. A better prognosis for this polytrauma patients is possible only by elucidating the mechanisms which produces the dysfunctions in ACS and by promoting an aggressive therapeutical surgical approach.

Nast-Kolb, Bail, et al. (2005). "[Current diagnostics for intra-abdominal trauma.]" Chirurg **76**(10): 919-26.

In case of suspected intra-abdominal injury, fast transport of the patient to a suitable hospital is of high priority. The initial clinical examination aims at identifying patients with potentially life-threatening bleeding that require emergency surgery. In patients with penetrating trauma, laparoscopy is favoured to exclude suspected perforation of the peritoneum. If a peritoneal perforation is identified, exploratory laparotomy is recommended to exclude or treat lacerations of the hollow viscus. Although clinical examination should be performed its sensitivity and specificity of up to 82% and 45%, respectively, are not sufficient as the sole screening method. For the further diagnostic workup, diagnostic peritoneal lavage has been completely replaced by abdominal ultrasound examination in Germany and many other countries. Focussing not only on the detection of free abdominal fluid but also searching for parenchymal organ lesions and performing repeated examinations increases accuracy up to 96%, with

specificity of 99.8% and sensitivity of 72.1%. Computed abdominal tomography with a helical scanner with and without intravenous contrast media is currently the gold standard of imaging techniques to identify traumatic abdominal injuries. A sensitivity of 97.2% and specificity of 94.7% can be achieved. False negative findings must be expected with hollow organ injuries. Serial clinical and ultrasound examinations as well as lab testing in conjunction with repeated CT may help to identify such lesions. Increased intra-abdominal pressure (IAP) with consecutive abdominal compartment syndrome and multiple organ dysfunction is a delayed complication from conditions such as severe intra-abdominal bleeding, major bleeding from pelvic ring fractures, and profuse fluid resuscitation. The IAP should be measured routinely in patients at risk, and decompression laparotomy may be indicated with pressures of higher than 20 mmHg.

Nguyen, Nt, et al. (2005). "The physiologic effects of pneumoperitoneum in the morbidly obese." *Ann Surg* **241**(2): 219-26.

**OBJECTIVE:** To review the physiologic effects of carbon dioxide (CO<sub>2</sub>) pneumoperitoneum in the morbidly obese. **SUMMARY BACKGROUND DATA:** The number of laparoscopic bariatric operations performed in the United States has increased dramatically over the past several years. Laparoscopic bariatric surgery requires abdominal insufflation with CO<sub>2</sub> and an increase in the intraabdominal pressure up to 15 mm Hg. Many studies have demonstrated the adverse consequences of pneumoperitoneum; however, few studies have examined the physiologic effects of pneumoperitoneum in the morbidly obese. **METHODS:** A MEDLINE search from 1994 to 2003 was performed using the key words morbid obesity, laparoscopy, bariatric surgery, pneumoperitoneum, and gastric bypass. The authors reviewed papers evaluating the physiologic effects of pneumoperitoneum in morbidly obese subjects undergoing laparoscopy. The topics examined included alteration in acid-base balance, hemodynamics, femoral venous flow, and hepatic, renal, and cardiorespiratory function. **RESULTS:** Physiologically, morbidly obese patients have a higher intraabdominal pressure at 2 to 3 times that of nonobese patients. The adverse consequences of pneumoperitoneum in morbidly obese patients are similar to those observed in nonobese patients. Laparoscopy in the obese can lead to systemic absorption of CO<sub>2</sub> and increased requirements for CO<sub>2</sub> elimination. The increased intraabdominal pressure enhances venous stasis, reduces intraoperative portal venous blood flow, decreases intraoperative urinary output, lowers respiratory compliance, increases airway pressure, and impairs cardiac function. Intraoperative management to minimize the adverse changes include appropriate ventilatory adjustments to avoid hypercapnia and acidosis, the use of sequential compression devices to minimize venous stasis, and optimize intravascular volume to minimize the effects of increased intraabdominal pressure on renal and cardiac function. **CONCLUSIONS:** Morbidly obese patients undergoing laparoscopic bariatric surgery are at risk for intraoperative complications relating to the use of CO<sub>2</sub> pneumoperitoneum. Surgeons performing laparoscopic bariatric surgery should understand the physiologic effects of CO<sub>2</sub> pneumoperitoneum in

the morbidly obese and make appropriate intraoperative adjustments to minimize the adverse changes.

Nisanevich, Felsenstein, et al. (2005). "Effect of intraoperative fluid management on outcome after intraabdominal surgery." *Anesthesiology* **103**(1): 25-32.

**BACKGROUND:** The debate over the correct perioperative fluid management is unresolved. **METHODS:** The impact of two intraoperative fluid regimes on postoperative outcome was prospectively evaluated in 152 patients with an American Society of Anesthesiologists physical status of I-III who were undergoing elective intraabdominal surgery. Patients were randomly assigned to receive intraoperatively either liberal (liberal protocol group [LPG], n = 75; bolus of 10 ml/kg followed by 12 ml x kg(-1) x h(-1)) or restrictive (restrictive protocol group [RPG], n = 77; 4 ml x kg(-1) x h(-1)) amounts of lactated Ringer's solution. The primary endpoint was the number of patients who died or experienced complications. The secondary endpoints included time to initial passage of flatus and feces, duration of hospital stay, and changes in body weight, hematocrit, and albumin serum concentration in the first 3 postoperative days. **RESULTS:** The number of patients with complications was lower in the RPG (P = 0.046). Patients in the LPG passed flatus and feces significantly later (flatus, median [range]: 4 [3-7] days in the LPG vs. 3 [2-7] days in the RPG; P < 0.001; feces: 6 [4-9] days in the LPG vs. 4 [3-9] days in the RPG; P < 0.001), and their postoperative hospital stay was significantly longer (9 [7-24] days in the LPG vs. 8 [6-21] days in the RPG; P = 0.01). Significantly larger increases in body weight were observed in the LPG compared with the RPG (P < 0.01). In the first 3 postoperative days, hematocrit and albumin concentrations were significantly higher in the RPG compared with the LPG. **CONCLUSIONS:** In patients undergoing elective intraabdominal surgery, intraoperative use of restrictive fluid management may be advantageous because it reduces postoperative morbidity and shortens hospital stay.

Nowicka, M., L. Stoltny, et al. (2005). "[Abdominal compartment syndrome as an advanced stage of abdominal hypertension]." *Wiad Lek* **58**(1-2): 84-7.

The aim of the article is to present the definition and criteria of diagnosis of abdominal compartment syndrome (ACS) due to abdominal hypertension. Epidemiology of ACS is discussed. Secondary ACS is described. There is also an overview of clinical consequences and a scheme for ACS management.

Oda, J., M. Ueyama, et al. (2005). "Effects of escharotomy as abdominal decompression on cardiopulmonary function and visceral perfusion in abdominal compartment syndrome with burn patients." *J Trauma* **59**(2): 369-74.

**BACKGROUND:** Abdominal compartment syndrome (ACS) can become fatal; however, it has rarely been described as a complication of burn injury. This study clarified the physiologic results of abdominal decompression (AD) for ACS in patients with burn injury in detail. **METHODS:** Extensively burned patients admitted to our burn unit between January 2003 and February 2004 were prospectively monitored by pulmonary artery catheter. Physiologic parameters

from the catheter, blood gas analysis, intrabdominal pressure as a parameter of intra-abdominal pressure (IAP), peak inspiratory pressure, and urine output (UO) were compared before and after escharotomy as AD in patients with ACS. RESULTS: Eight of 36 patients who had sustained more than 30% total body surface area burn developed ACS requiring AD in 18.3 +/- 4.9 hours. AD significantly decreased IAP (52 +/- 9 cm H<sub>2</sub>O vs. 26 +/- 7 cm H<sub>2</sub>O), peak inspiratory pressure (53 +/- 13 cm H<sub>2</sub>O vs. 35 +/- 6 cm H<sub>2</sub>O), heart rate, and Paco<sub>2</sub>, and increased cardiac index (1.6 +/- 0.7 L/min/m<sup>2</sup> vs. 2.5 +/- 0.9 L/min/m<sup>2</sup>), abdominal perfusion pressure (50 +/- 11 mm Hg vs. 72 +/- 17 mm Hg), UO (0.45 +/- 0.46 mL/h/kg vs. 2.0 +/- 2.1 mL/h/kg), and oxygen delivery index (290 +/- 195 mL/m<sup>2</sup>/min vs. 455 +/- 218 mL/m<sup>2</sup>/min). Impaired oxygen consumption index increased (86 +/- 43 mL/m<sup>2</sup>/min vs. 153 +/- 58 mL/m<sup>2</sup>/min) after AD. CONCLUSION: In patients with severe burn injury, elevated IAP makes pulmonary artery wedge pressure and UO unreliable indices of preload or intravascular volume, and decreases abdominal perfusion in the resuscitation period. AD in these patients significantly improves the ventilation, hemodynamic parameters, and oxygen metabolism.

Oda, J., M. Ueyama, et al. (2005). "Hypertonic lactated saline resuscitation reduces the risk of abdominal compartment syndrome in severely burned patients." *J Trauma* **59**(2): 526, Abstract.

Oda, S., H. Hirasawa, et al. (2005). "Management of intra-abdominal hypertension in patients with severe acute pancreatitis with continuous hemodiafiltration using a polymethyl methacrylate membrane hemofilter." *Ther Apher Dial* **9**(4): 355-61.

To evaluate, with a prospective observational study, whether continuous hemodiafiltration using a polymethyl methacrylate membrane hemofilter (PMMA-CHDF) is effective for prevention and treatment of intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS) on patients with severe acute pancreatitis (SAP). The study was carried out in the general intensive care unit (ICU) of a university hospital. Seventeen consecutive patients with SAP were treated in the intensive care unit and underwent PMMA-CHDF whether or not they had renal failure. Blood level of interleukin (IL)-6, as an indicator of cytokine network activation, and intra-abdominal pressure (IAP) were measured daily to investigate their time-course of changes and the correlation between the two. The blood level of IL-6 was high at 1350 +/- 1540 pg/mL on admission to the ICU. However, it significantly decreased to 679 +/- 594 pg/mL 24 h after initiation of PMMA-CHDF (P<0.05), and thereafter decreased rapidly. Mean intra-abdominal pressure (IAP) on admission was high, at 14.6 +/- 5.3 mm Hg, with an IAP of 20 mm Hg or over in 2 of 17 patients, showing that they had already developed IAH. The IAP was significantly lower (P<0.05) 24 h after initiation of PMMA-CHDF, and subsequently decreased. There was a significant positive correlation between blood level of IL-6 and IAP, suggesting that PMMA-CHDF improved vascular permeability through elimination of cytokines, and that it thereby decreased interstitial edema to lower IAP. Sixteen of the 17 patients were discharged from the hospital in remission from SAP without development of

complications. Continuous hemodiafiltration using a polymethyl methacrylate membrane hemofilter appears to be effective for prevention and treatment of IAH in patients with SAP through the removal of causative cytokines of hyperpermeability.

Olesevich, M., F. Alexander, et al. (2005). "Gastroschisis revisited: role of intraoperative measurement of abdominal pressure." J Pediatr Surg **40**(5): 789-92.

**BACKGROUND:** Animal studies have shown that visceral circulation is well preserved when intraabdominal pressure does not exceed 20 mm Hg. Our aim was to analyze the outcomes of a series of infants with gastroschisis whose surgical management was directed by the intraoperative measurement of bladder pressure. **METHODS:** Forty-two neonates with gastroschisis were surgically managed using intraoperative measurement of bladder pressure at a tertiary care center between July 31, 1992, and March 20, 2004, and their outcome was evaluated. Primary closure with or without prosthetic material was performed when pressures measured 20 mm Hg or less. Delayed closure using a silon pouch was performed when pressures measured more than 20 mm Hg. Categorical variables were analyzed including mode of delivery, associated anomalies, type of closure, complications, and mortality. Continuous variables were analyzed including gestational age, birth weight, bladder pressure, time to full feeds, and length of hospital stay. Categorical and continuous variables for both groups were compared using Fisher's Exact and Wilcoxon's rank-sum tests, respectively, and a significance level of .05 was used. Preapproval of this study was obtained from the Institutional Review Board (No. 6690). **RESULTS:** Thirty-three (79%) neonates with a mean bladder pressure of 16 mm Hg underwent primary closure and 9 neonates with a mean bladder pressure of 27 mm Hg underwent delayed closure with a silon pouch that was not spring loaded ( $P < .03$ ). Patients treated with primary closure had faster return to full feeds and significantly shorter hospital length of stay compared with patients treated by delayed closure ( $P = .04$ ). Surgical morbidity and mortality was nil in patients after primary closure. One patient with total abdominal evisceration died during attempted delayed closure and another patient required reoperation for bowel necrosis after delayed closure. **CONCLUSION:** Primary closure was safely accomplished in 100% of neonates with gastroschisis whose bladder pressure measured 20 mm Hg or less. Further, this group of patients had a faster return to full feeds and a significantly shorter hospital length of stay compared with neonates who required delayed closure.

O'Mara, M. S., H. Slater, et al. (2005). "A prospective, randomized evaluation of intra-abdominal pressures with crystalloid and colloid resuscitation in burn patients." J Trauma **58**(5): 1011-8.

**BACKGROUND:** The volume of resuscitation in burn patients has been shown to correlate with intra-abdominal pressure (IAP). Limiting volume may reduce consequences of IAP and abdominal compartment syndrome. Colloid resuscitation has been previously shown to limit the volume required initially after burn. **METHODS:** Thirty-one patients were prospectively followed.

Inclusion criteria were a burn of 25% total body surface area with inhalation injury or 40% total body surface area without. Patients received crystalloid (Parkland formula) or plasma resuscitation. IAP was measured by means of urinary bladder transduction. RESULTS: Mean age, area of burn, and baseline IAP were not different. Urine output was maintained. There was a greater increase in IAP with crystalloid (26.5 vs. 10.6 mmHg,  $p < 0.0001$ ). Two patients in the plasma group developed IAP greater than 25 mmHg; only one patient in the crystalloid group maintained IAP less than 25 mmHg. More fluid volume was required with crystalloid resuscitation, 0.26 L/kg, versus 0.21 L/kg ( $p < 0.005$ ). Correlation was seen in both groups between volume of fluid and IAP (crystalloid,  $r = 0.351$ ; plasma,  $r = 0.657$ ; all patients,  $r = 0.621$ ). CONCLUSION: Plasma-resuscitated patients maintained an IAP below the threshold of complications of intra-abdominal hypertension. This appears to be a direct result of the decrease in volume required. Lower fluid volume regimens should be given consideration as the incidence and consequences of intra-abdominal hypertension in burn patients continue to be defined.

Perks, D. H. and H. Grewal (2005). "Abdominal compartment syndrome in the pediatric patient with blunt trauma." *J Trauma Nurs* **12**(2): 50-4.

Abdominal compartment syndrome in the trauma patient is usually associated as a post surgical complication or as a consequence of full thickness burns to the trunk and abdomen. It is not widely recognized in patients who have received massive fluid resuscitation in the absence of abdominal pathology. This paper will present a case study of a pediatric patient who was the victim of a motor vehicle collision. This 4-year-old boy was hemodynamically unstable initially and received massive fluid resuscitation in the emergency department and pediatric intensive care unit. An emergency laparotomy revealed massive bowel edema but no significant abdominal injury or bleeding. The patient underwent abdominal decompression and returned to the pediatric intensive care unit with an open abdomen covered with a temporary dressing. Differences in pediatric anatomy and physiology which can predispose children to this condition will be explained. In addition pathophysiologic responses to trauma that contribute to abdominal compartment syndrome and nursing care of this condition will be explored.

Prince, R. A., C. J. Hoffman, et al. (2005). "The distinct and secondary harmful effect of pelvic and extremity injury on the outcome of laparotomy for trauma." *J Surg Res* **124**(1): 3-8.

HYPOTHESIS: Extra-abdominal injury negatively affects the outcome of abdominal injury following trauma laparotomy. DESIGN: Retrospective review of 920 consecutive patients receiving laparotomy for trauma who survived more than 24 h between January 1989 and May 1998 at a Level 1 trauma center. Major abdominal complications (MAC) were defined as: abdominal compartment syndrome (ACS), abscess/peritonitis, enterocutaneous fistula, necrotizing fasciitis, and necrotizing pancreatitis. METHODS: Univariate and multivariate logistic regression were used to identify predictors of MAC. RESULTS: Sixty-nine patients (7.5%) developed one or more MAC. Patients who developed MAC had

higher injury severity scores (ISS), abdominal trauma indices (ATI), and blood transfusions in the first 24 h (PRCs) than patients who did not develop MAC. Patients with MAC were more likely to have suffered a thoracic or pelvic injury with an abbreviated injury scale (AIS)  $\geq 3$  and were more likely to have received an extremity injury (AIS  $\geq 3$ ) operation than patients without MAC. Independent predictors of MAC in multivariate analysis included colon injury (AIS  $\geq 3$ ) [odds ratio (OR) = 3.1, 95% confidence interval (CI) 1.5- 6.3], pelvic injury (AIS  $\geq 3$ ) or operation for extremity injury (AIS  $\geq 3$ ) [OR 2.9, 95% CI 1.5-5.3], and ATI (OR = 1.03 for each 10 unit increase in ATI, 95% CI 1.02-1.05). PRCs did not independently predict MAC. CONCLUSION: The outcome of laparotomy for trauma (both blunt and penetrating) is negatively affected by a severe pelvic injury or a severe extremity injury operation independent of initial hemorrhage and abdominal injury severity.

Putensen, C. (2005). "Prone position in mechanically ventilated patients -- the hard or the soft way?" *Crit Care* 9(3): 253-4.

Prone positioning may even in patients without abdominal hypertension result in an increased intra-abdominal pressure (IAP). Previous research could not demonstrate a marked increase in IAP associated with cardiovascular, renal, or hepato-splanchnic dysfunction when patients were prone in air-cushioned beds. Michelet and colleagues in this issue of Critical Care report that the increase in IAP in the prone position depends on the used mattress type. Compared with air-cushion beds, conventional foam mattresses resulted in a greater increase in IAP which was associated with a decrease in the plasma disappearance rate of indocyanin green (PDRICG) indicating inadequate hepato-splanchnic function.

Ratanarat, Brendolan, et al. (2005). "Pulse high-volume haemofiltration for treatment of severe sepsis: effects on hemodynamics and survival." *Crit Care* 9(4): R294-302.

INTRODUCTION: Severe sepsis is the leading cause of mortality in critically ill patients. Abnormal concentrations of inflammatory mediators appear to be involved in the pathogenesis of sepsis. Based on the humoral theory of sepsis, a potential therapeutic approach involves high-volume haemofiltration (HVHF), which has exhibited beneficial effects in severe sepsis, improving haemodynamics and unselectively removing proinflammatory and anti-inflammatory mediators. However, concerns have been expressed about the feasibility and costs of continuous HVHF. Here we evaluate a new modality, namely pulse HVHF (PHVHF; 24-hour schedule: HVHF 85 ml/kg per hour for 6-8 hours followed by continuous venovenous haemofiltration 35 ml/kg per hour for 16-18 hours). METHOD : Fifteen critically ill patients (seven male; mean Acute Physiology and Chronic Health Evaluation [APACHE] II score 31.2, mean Simplified Acute Physiology Score [SAPS] II 62, and mean Sequential Organ Failure Assessment 14.2) with severe sepsis underwent daily PHVHF. We measured changes in haemodynamic variables and evaluated the dose of noradrenaline required to maintain mean arterial pressure above 70 mmHg during and after pulse therapy at 6 and 12 hours. PHVHF was performed with 250 ml/min blood flow rate. The bicarbonate-based replacement fluid was used at a 1:1 ratio in simultaneous pre-

dilution and post-dilution. RESULTS : No treatment was prematurely discontinued. Haemodynamics were improved by PHVHF, allowing a significant reduction in noradrenaline dose during and at the end of the PHVHF session; this reduction was maintained at 6 and 12 hours after pulse treatment (P = 0.001). There was also an improvement in systolic blood pressure (P = 0.04). There were no changes in temperature, cardiac index, oxygenation, arterial pH or urine output during the period of observation. The mean daily Kt/V was 1.92. Predicted mortality rates were 72% (based on APACHE II score) and 68% (based on SAPS II score), and the observed 28-day mortality was 47%. CONCLUSION : PHVHF is a feasible modality and improves haemodynamics both during and after therapy. It may be a beneficial adjuvant treatment for severe sepsis/septic shock in terms of patient survival, and it represents a compromise between continuous renal replacement therapy and HVHF.

Ravishankar, N. and J. Hunter (2005). "Measurement of intra-abdominal pressure in intensive care units in the United Kingdom: a national postal questionnaire study." Br J Anaesth **94**(6): 763-6.

BACKGROUND: To explore the attitudes of intensivists in the UK to intra-abdominal pressure (IAP) measurement and abdominal compartment syndrome (ACS) and to determine current practice. METHODS: A postal questionnaire study addressed to the lead clinician in the intensive care unit was sent to hospitals in the UK with a general surgical service. RESULTS: Completed questionnaires were received from 137 of the 207 hospitals surveyed (66.2% response rate). Only 1.5% of the respondents (n=2) had no prior knowledge of intra-abdominal hypertension and ACS. IAP had been measured on some occasion by 75.9% (n=104) of the respondents, always by the intravesical route. Among those intensive care units that measured IAP, in 93.2% (n=97) it was only measured when there was a suspicion of the development of ACS; 3.8% of units (n=4) measured IAP on all patients who had undergone an emergency laparotomy, and 2.9% (n=3) measured IAP only in those who had undergone emergency laparotomy associated with massive fluid resuscitation. There was major disparity in the frequency of IAP measurement and when to recommend abdominal decompression. CONCLUSIONS: Despite widespread awareness of IAH and the ACS, many intensive care units never measure the IAP. When it is measured, the intravesical route is used exclusively. No consensus exists on optimal timing of measurement or when decompressive laparotomy should be performed.

Reckard, J. M., M. H. Chung, et al. (2005). "Management of intraabdominal hypertension by percutaneous catheter drainage." J Vasc Interv Radiol **16**(7): 1019-21.

The authors report a case of an 18-year-old man with T-cell acute lymphocytic leukemia who developed hemorrhagic pancreatitis after chemotherapy. He subsequently developed abdominal compartment syndrome (ACS). Computed tomography showed a large fluid-filled mass in the area of the pancreas. As a result of the instability of his condition, surgical decompression, the standard therapy for ACS, was believed to carry significant morbidity and potential

mortality. The patient underwent ultrasound-guided drainage of the peripancreatic fluid, which decreased his abdominal pressures and improved his clinical status. Without this procedure, the patient may not have tolerated subsequent surgery.

Reed, S. F., R. C. Britt, et al. (2005). "Aggressive surveillance and early catheter directed therapy in the prevention of abdominal compartment syndrome." J Trauma **59**(2): 522, Abstract.

Background: Trauma patients are at risk for abdominal compartment syndrome (ACS). Our study aims at identifying these individuals early and placing an intra-abdominal catheter to reduce abdominal compartment pressure (ACP) before severe consequences of ACS occur. Methods: During a 5 month period we identified 8 patients who developed ACS. Patients who received 12 liters or more of IVF in the first 24 hours of their resuscitation or received 500cc/hr of IVF for more than 4 consecutive hours were considered at-risk and had intra-abdominal pressure readings via bladder catheter every 4 hours. After resuscitation, patients were followed clinically and ACP readings were taken as necessary. When ACP exceeded 20 mmHg or the abdominal perfusion pressure (APP=mean arterial pressure (MAP) - ACP) fell below 50 mm Hg a diagnostic peritoneal lavage catheter was placed. Fluid volume and type, ACP, heart rate, MAP and pulmonary compliance were recorded. If adequate control of ACP was not achieved, the patients were managed with decompressive laparotomy. Results: Reading taken 30 minutes after placement of the peritoneal catheter showed an average decrease in ACP of 6.1 mmHg (p value 0.029), and increase in APP of 16.2 mmHg (p value 0.041) and an increase in MAP of 10.1 mmHg (p-value NS at 0.064). Six of eight patients were managed non-operatively. Four patients failed to have their APP improve >50 mmHg with the catheter. Two of these patients underwent laparotomy with one survivor, and two did not, dying of cerebral herniation and care withdrawal. Three of four patients requiring catheters in the first 32 hours of admission survived. All patients needing catheters after day 4 died, three within 24 hours. Conclusions: Intra-abdominal catheter placement is a reasonable first step in the management of ACS. Patients may be spared from progressing to significant ACS and the complication of an open abdomen. Late ACS may be prognostic of impending clinical deterioration. A prospective investigation at this institution is currently underway to determine if this method reduces overall morbidity and mortality.

Reintam, A., P. Parm, et al. (2005). "Impact of abdominal pressure on ICU mortality." Intensive Care Medicine **31, Supplement 1**(134): S8-Abstract 014.

INTRODUCTION. This prospective clinical study was designed to establish the incidence of intraabdominal hypertension (IAH) in critically ill patients and to evaluate the impact of intraabdominal pressure (IAP) on ICU mortality. METHODS. IAP assessment protocol was used in 113 adult ICU patients (41 of medical and 72 of surgical profile), who were mechanically ventilated due to polytrauma, abdominal surgery, pancreatitis or post-CPR status and/or were receiving fluid resuscitation above 5 litres/24h, vasoactive or inotropic support or renal replacement therapy. IAP was measured via bladder

every 6 hours in patients with IAP >12 mm Hg or every 12 hours with IAP <12 mm Hg; with revised closed system repeated measurement technique. Daily mean and maximum values were recorded. IAP-mean represents the average of daily means, while IAP-max is average of maximum levels. Abdominal perfusion pressure (APP) was calculated as the difference between mean arterial pressure (MAP) and IAP. RESULTS. IAP was measured all together in 957 monitoring days, mean 8.8 (1-32) days per patient. IAP and APP differed significantly between survivors and non-survivors (Table). Mortality of patients (n=52) who had IAP mean >12 mm Hg (proposed cut-off value of IAH) was significantly higher compared to patients with IAP mean < 12 mm Hg 50% vs. 18%; p<.001). Using regression analysis IAP could correctly predict mortality in 86.5% of medical patients and 71.6% of surgical patients. Odds ratio of death in medical patients with IAH was 9.2 (95% CI 2.4-36.0) p<0.001; compared to OR 1.4 (95%CI 0.9-2.1), p=0.121, in surgical patients with IAH.

	Survivors	Nonsurvivors	p-value (t-test)
IAP mean±SD	10.3±4.6	14.0±4.6	<0.001
IAP max±SD	15.0±8.0	18.2±6.5	0.040
APP mean±SD	75.4±9.5	66.6±10.9	<0.001
APP min±SD	58.6±13.4	52.5±10.7	0.038

**CONCLUSION.** Mean IAP during ICU stay might be looked at as a predictor of mortality. Development of intraabdominal hypertension (IAP>12) during ICU stay in patients of medical profile increases the risk of death remarkably.

Richards, Sk, et al. (2005). "Porcine dermal collagen graft in pediatric renal transplantation." Pediatr Transplant 9(5): 627-9.

Successful closure of the anterior abdominal wall in infants following renal transplantation of adult organs may present a challenging dilemma to the transplant surgeon. Restricted volume of the recipient abdominal cavity and size discrepancy of donor adult kidney may lead to graft compromise. Pressure on the graft may be exacerbated further in the postoperative period by oedema that may lead to abdominal compartment syndrome. Donor/recipient size disparity remains the major obstacle in infant renal transplantation. We describe the use of a porcine collagen graft to facilitate closure of the abdominal wall following intra-peritoneal transplantation of an adult cadaveric kidney.

Rigamonti, Gemma, et al. (2005). "Prone versus knee-chest position for microdiscectomy: a prospective randomized study of intra-abdominal pressure and intraoperative bleeding." Spine 30(17): 1918-23.

STUDY DESIGN: Prospective randomized study. OBJECTIVES: To compare two support systems for positioning patients during microdiscectomy (i.e., prone on a modified Relton-Hall spine support vs. knee-chest position on an Andrews-type table) regarding their effects on intra-abdominal pressure and surgical bleeding. SUMMARY OF BACKGROUND DATA: Intra-abdominal pressure is an indicator of epidural venous pressure, which affects bleeding during microdiscectomy. The ideal patient's position during surgery reduces bleeding by

minimizing abdominal compression and vertebral venous engorgement. The results of previous studies on the relationship between intra-abdominal pressure and blood loss during spinal surgery are not consistent, and hardly comparable because they used different measurement systems and support frames.

**METHODS:** A total of 30 patients with the American Society of Anesthesiologists physical status I or II undergoing elective, single-space lumbar microdiscectomy had their intra-abdominal pressure measured through a urinary bladder catheter, together with airway pressure: (1) supine after anesthesia induction; (2) in prone position (group P) or knee-chest position (group K), according to randomization; or (3) at the end of surgery before repositioning the patient supine. **RESULTS:** Baseline intra-abdominal pressure did not differ between groups, and intra-abdominal pressure did not vary significantly from baseline in both groups throughout the study. Baseline airway pressure did not differ between groups. Airway pressure was significantly increased from baseline at the recording before incision in group K and at the end of surgery in both groups. Recordings before incision and at the end of surgery differed significantly from one another in both groups. Such airway pressure variations did not differ between groups. Bleeding was significantly more prominent in group K ( $P = 0.007$ ). No correlation between bleeding and intra-abdominal pressure or airway pressure was found. **CONCLUSIONS:** Intra-abdominal pressure did not differ between prone position on a modified Relton-Hall frame and knee-chest position on an Andrew-type table. Both positions provide good conditions for lumbar microdiscectomy.

Rizvi, K., B. P. Deboisblanc, et al. (2005). "Effect of airway pressure display on interobserver agreement in the assessment of vascular pressures in patients with acute lung injury and acute respiratory distress syndrome." *Crit Care Med* **33**(1): 98-103.

**BACKGROUND::** Previous investigations have identified significant interobserver variability in the measurements of central venous pressure and pulmonary artery occlusion pressure in critically ill patients. Large interobserver variability in the measurement of vascular pressures could potentially lead to inappropriate treatment decisions. **OBJECTIVE::** We postulated that adding an airway pressure signal ( $P_{aw}$ ) to pressure tracings of central venous pressure and pulmonary artery occlusion pressure would improve interobserver agreement by facilitating identification of end-expiration. **DESIGN::** To test this hypothesis, six independent experts used a standard protocol to interpret strip-chart recordings of central venous pressure and pulmonary artery occlusion pressure with or without  $P_{aw}$ . Two observers were said to agree if their measurements were within 2 mm Hg of each other. **SETTING/SUBJECTS/INTERVENTIONS::** A total of 459 strip-chart recordings (303 without  $P_{aw}$  and 156 with  $P_{aw}$ ) were obtained from 121 patients enrolled in the ARDSnet Fluids and Catheters Treatment Trial (FACTT) in 16 different hospitals. **RESULTS::** Agreement within 2 mm Hg between two measurements was 79% for central venous pressure strips without  $P_{aw}$  vs. 86% with  $P_{aw}$ . For pulmonary artery occlusion pressure, agreement increased from 71% without  $P_{aw}$  to 83% with  $P_{aw}$ . The increase in agreement with the addition of  $P_{aw}$  was greater for strips demonstrating  $>8$  mm Hg phasic

respiratory variation compared with strips demonstrating less phasic respiratory variation. CONCLUSION:: Paw display is a simple, inexpensive method to facilitate the identification of end-expiration that can significantly improve interobserver agreement.

Rodas, E. B., A. K. Malhotra, et al. (2005). "Hyperacute abdominal compartment syndrome: an unrecognized complication of massive intraoperative resuscitation for extra-abdominal injuries." *Am Surg* **71**(11): 977-81.

Primary and secondary abdominal compartment syndrome (ACS) are well-recognized entities after trauma. The current study describes a "hyperacute" form of secondary ACS (HACS) that develops intraoperatively while repair of extra-abdominal injuries is being carried out simultaneous with massive resuscitation for shock caused by those injuries. The charts of patients requiring abdominal decompression (AD) for HACS at time of extra-abdominal surgery at our level I trauma center were reviewed. The following data was gathered: age, Injury Severity Score (ISS), mechanism, resuscitation details, time to AD, time to abdominal closure, and outcome. All continuous data are presented as mean +/- standard error of mean. Hemodynamic and ventilatory data pre- and post-AD was compared using paired t test with significance set at  $P < 0.05$ . Five (0.13%) of 3,750 trauma admissions developed HACS during the 15-month study period ending February 2004. Mean age was 32 +/- 7 years, and mean ISS was 19 +/- 2. Four of five patients arrived in hemorrhagic shock (blunt subclavian artery injury, 1; chest gunshot, 1; gunshot to brachial artery, 1; stab transection of femoral vessels, 1) and were immediately operated upon. One of five patients (70% burn) developed HACS during burn wound excision on day 2. HACS developed after massive crystalloid (15 +/- 1.7 L) and blood (11 +/- 0.4 units) resuscitation during prolonged surgery (4.8 +/- 0.8 hours). Pre- versus post-AD comparisons revealed significant ( $P < 0.05$ ) improvements in mean arterial pressure (55 +/- 6 vs 88 +/- 3 mm Hg), peak airway pressure (44 +/- 5 vs 31 +/- 2 mm Hg), tidal volume (432 +/- 96 vs 758 +/- 93 mL), arterial pH (7.16 +/- 0.0 vs 7.26 +/- 0.04), and PaCO<sub>2</sub> (52 +/- 6 vs 45 +/- 6 mm Hg). There was no mortality among the group, and all patients underwent abdominal closure by fascial reapproximation in 2-5 days. Two (40%) of the five patients required extremity fasciotomy for compartment syndrome. HACS is a rare complication of massive resuscitation for extra-abdominal injuries. It should be considered in such patients in the face of unexplained hemodynamic and/or ventilatory decompensation. Prompt AD is life saving. Early abdominal closure is usually possible. Vigilance for compartment syndromes elsewhere in the body is warranted in any patient with HACS.)

Rosch, Stumpf, et al. (2005). "Influence of pneumoperitoneum on small bowel anastomoses: a histological analysis in the rat model." *J Invest Surg* **18**(2): 63-9.

Laparoscopic techniques are increasingly applied for the treatment of diverse gastrointestinal diseases. With regard to reports of a pronounced decrease of intra-abdominal blood flow with increasing intra-abdominal pressure, the present study investigates the impact of pressure and gas type on ischemia in small bowel anastomoses in the rat model. Laparotomy and ileoileal anastomosis were

performed in 39 male Sprague-Dawley rats. A CO<sub>2</sub> or helium pneumoperitoneum of 3 mm Hg or of 6 mm Hg was maintained before and after anastomoses. Rats in the control group received no pneumoperitoneum. Animals were sacrificed after 5 d, and the anastomotic region was explanted for subsequent histopathological examinations. In hematoxylin and eosin (HE)-stained sections, the Chiu score, villi configuration, and number of goblet cells were analyzed. Proliferation (Ki67) and expression of a matrix metalloproteinase (MMP-8) were examined by immunohistochemistry. Mucosal damage according to the scoring system by Chiu, the number of goblet cells, the villus length, the proliferation (Ki67), and the submucosal expression of MMP-8 was similar in all groups. Our results suggest that within a certain range of pressures and time, laparoscopic assisted surgery using CO<sub>2</sub> pneumoperitoneum can be performed safely. Helium gas offers no advantages over CO<sub>2</sub>.

Rozeboom, A. L., B. Havekes, et al. (2005). "[The abdominal compartment syndrome]." Ned Tijdschr Geneesk **149**(24): 1309-13.

In two patients, a man aged 67 and a woman aged 80, an abdominal compartment syndrome was diagnosed. The man had been treated surgically for an abdominal aortic aneurysm; he recovered after re-operation. The woman had been treated by sigmoidectomy because of ileus. A Bogota bag and a vacuum-assisted wound-closure system were applied to the abdominal wound. Her condition deteriorated, an intestinal perforation became apparent, of which she did not recover and died. An abdominal compartment syndrome should always be kept in mind when a patient at risk presents with increased intra-abdominal pressure and at least one of the following symptoms: oliguria, decreased cardiac output, increased pulmonary-artery pressure, hypotension and acidosis. Measurement of the bladder pressure remains the method of choice to establish the abdominal pressure level. However, there is a lack of correlation between the measured pressure and the clinical condition of the patient. Therefore, the combination of clinical findings and the observed trend in serial measurements of the bladder pressure is preferred to a single pressure measurement.

Scalea, T., G. Bochicchio, et al. (2005). "Increased intra-abdominal, intrathoracic and intracranial pressure after severe brain injury: Multiple compartment syndrome." J Trauma **59**(2): 523, Abstract.

Schachtrupp, A., G. Lawong, et al. (2005). "Fluid Resuscitation Preserves Cardiac Output but Cannot Prevent Organ Damage in a Porcine Model During 24 H of Intraabdominal Hypertension." Shock **24**(2): 153-158.

According to a previous study, a pathologically increased intraabdominal pressure (IAP) reduces cardiac output (CO) and results in medium- to high-grade organ damage in a porcine model of the abdominal compartment syndrome (ACS). The purpose of this study was to evaluate whether fluid resuscitation can preserve organ integrity together with CO. We examined 12 domestic pigs with a mean body weight of 48 kg. We used a CO<sub>2</sub> pneumoperitoneum to increase the IAP to 30 mmHg in 6 animals, and the others served as control group. The investigation

period was 24 h. In addition to a standard infusion regimen, Ringer's solution was infused to maintain CO at the level of control animals. Hemodynamic parameters (ITBV, EVLW, MAP, CVP), urine output, inspiratory pressure, as well as serum parameters (e.g., ALT, lipase, AP, lactate, creatinine) were recorded. In the end histological examination of liver, bowel, kidney, and lung was performed. CO, ITBV, EVLW, and urine output did not change when compared with control. Fluid intake was increased ( $P < 0.01$ ) when compared with control (10,570 +/- 1,928 vs. 3,918 +/- 1,042 mL). CVP, MAP, and inspiratory pressure were increased. Serum parameters did not change. Acidosis occurred in the study group. Liver, bowel, kidney, and lung displayed mean- to high-grade damage ( $P < 0.01$ ). Although extensive fluid resuscitation preserved CO, diuresis, and serum parameters in this previously described model of the ACS, organ damage occurred. In the clinical regard, these results support decompressive treatment in the presence of pathologically high IAP despite "normalized" parameters.

Serpytis, M. and J. Ivaskevicius (2005). "[Intra-abdominal hypertension and multiple organ dysfunction syndrome]." Medicina (Kaunas) **41**(11): 903-9.

In clinical practice, intra-abdominal pressure is usually measured indirectly via the urinary bladder using Foley catheter. This technique is minimally invasive, safe, simple and accurate. Intra-abdominal hypertension is defined as an intra-abdominal pressure above 12 mmHg. Rapid progression of intra-abdominal hypertension will lead to abdominal compartment syndrome, which is defined as an intra-abdominal pressure greater than 20 mmHg with at least one organ failure. The incidence of intra-abdominal hypertension is variable and depends on the values used to define it and on the study population. However, the mortality rate of intra-abdominal hypertension and abdominal compartment syndrome is high. Increase in intra-abdominal pressure causes significant impairment of almost all organ systems. Even slight increase in intra-abdominal pressure has negative influence on the respiratory, cardiovascular, cerebral, gastrointestinal, hepatic, and renal functions. Intra-abdominal hypertension causes visceral organ hypoperfusion, intestinal ischemia and may also lead to bacterial translocation, release of cytokines and production of free oxygen radicals. All these factors may contribute to the development of multiple organ failure in the critically ill patients. Intravascular fluid replacement and abdominal decompression are the standards of treatment for abdominal compartment syndrome.

Shiia, N., K. Matsuzaki, et al. (2005). "Abdominal compartment syndrome causing respiratory failure during surgery for a ruptured descending thoracic aneurysm: report of a case." Surg Today **35**(4): 320-2.

Elevated intra-abdominal pressure causing widespread organ dysfunction is known as abdominal compartment syndrome (ACS). The subject of our case report is a 64-year-old man who underwent repair of a ruptured descending thoracic aortic aneurysm (TAA) under deep hypothermic circulatory arrest. During the operation, decompression laparotomy was required to relieve intra-abdominal hypertension causing respiratory failure, before the patient could be weaned off cardiopulmonary bypass. We report this case to alert surgeons to the

fact that ACS can occur during surgery on the thoracic aorta, especially if massive fluid resuscitation is required and venous drainage for extracorporeal circulation is less than optimal. Early recognition and prompt decompression by laparotomy is essential to save the life of the patient.

Stipancic, Zarkovic, et al. (2005). "Oxidative stress markers after laparoscopic and open cholecystectomy." *J Laparoendosc Adv Surg Tech A* **15**(4): 347-52.

Background: Surgical injury is associated with oxidative stress, often due to ischemia/reperfusion injury. During laparoscopy, increased intra-abdominal pressure caused by pneumoperitoneum may cause splanchnic ischemia followed by reperfusion due to deflation. We measured several markers of oxidative stress in patients undergoing laparoscopic cholecystectomy (LC) versus open cholecystectomy (OC) to find if these surgical procedures result in different patterns of oxidative stress. Methods: This prospective study enrolled 43 patients with symptomatic cholelithiasis, of whom 21 underwent open, and 22 laparoscopic, cholecystectomy. Twenty healthy adults comprised the control group. Total antioxidant status (TAS), superoxide dismutase (SOD), endogenous peroxide level (POX), oxidized low density lipoprotein (oLDL) autoantibodies (oLAb), and neopterin were measured preoperatively and on postoperative days 1, 3, and 7. Results: POX values decreased significantly on postoperative day 1 in the OC ( $P < 0.01$ ), but not in the LC, group. On postoperative day 7, POX values were higher than preoperatively in both groups ( $P < 0.01$ ) with no difference between the LC and OC groups. Significant postoperative elevations of oLAb and neopterin levels were observed only on postoperative day 7 in the OC group. There were no changes of oLAb and neopterin levels in the LC group. TAS and SOD levels did not change after either LC or OC. Conclusion: Cholecystectomy, either open or laparoscopic, caused only moderate oxidative stress. Open cholecystectomy caused changes of oLAb and neopterin, suggesting more severe oxidative stress, and a possible role of reactive oxygen species in the healing of the laparotomic wound.

Sugrue, M. (2005). "Abdominal compartment syndrome." *Curr Opin Crit Care* **11**(4): 333-8.

**PURPOSE OF REVIEW:** This review will set forth the new consensus definitions for intra-abdominal pressure, intra-abdominal hypertension, and the abdominal compartment syndrome from the World Congress on the Abdominal Compartment Syndrome in December 2004. The review will explore the challenges in diagnosis, pathophysiology, and recent concepts in the treatment of abdominal compartment syndrome. **RECENT FINDINGS:** Intra-abdominal pressure greater than 12 mm Hg may exert adverse physiologic sequelae, progressing to intra-abdominal hypertension and full-blown abdominal compartment syndrome as intra-abdominal pressure increases. The first challenge is to recognize that abdominal compartment syndrome may be a potential problem in critically ill patients. Intra-abdominal pressure monitoring is essential for this. Continuous monitoring of intra-abdominal pressure and abdominal perfusion pressure adds real-time measurements and can be performed by way of the

stomach or bladder. Intra-abdominal hypertension occurs in approximately 35% of patients in the intensive care unit, and abdominal compartment syndrome in approximately 5%. SUMMARY: Massive resuscitation is increasingly recognized as a major contributor to abdominal compartment syndrome. Prophylactic decompression and temporary abdominal closure have important roles in preventing tertiary or recurrent abdominal compartment syndrome. Failure to recognize and treat intra-abdominal hypertension will result in increased risk of renal impairment, visceral and intestinal ischemia, respiratory failure and death.

Syndrom, W. S. o. A. C. (2005). Consensus Definitions and Recommendations, WSACS web site. **2005**.

Tschopp, S., M. Keel, et al. (2005). "Abdominal compartment syndrome after scuba diving." Intensive Care Med.

Verzilli, D., S. Jaber, et al. (2005). "Does the adjustment of the positive end-expiratory pressure (PEEP) influence the value of intra-abdominal pressure?" Intensive Care Medicine **31, Supplement 1**(134): S42- Abstract 148.

Wong, K. and C. F. Summerhays (2005). "Abdominal compartment syndrome: a new indication for operative intervention in severe acute pancreatitis." Int J Clin Pract **59**(12): 1479-81.

The current management of severe acute pancreatitis (SAP) is maximal conservative therapy within an intensive care environment. The only commonly accepted indication for operative intervention is the presence of infected pancreatic necrosis. We present a case wherein a laparotomy performed for treatment of abdominal compartment syndrome (ACS) arising in the setting of SAP in the absence of pancreatic necrosis prevented early mortality and discuss the diagnosis and treatment of ACS as a new indication for operative intervention in SAP.

Yagci, G., N. Zeybek, et al. (2005). "Increased intra-abdominal pressure causes bacterial translocation in rabbits." J Chin Med Assoc **68**(4): 172-7.

BACKGROUND: Abdominal compartment syndrome (ACS) is defined as intra-abdominal hypertension associated with organ dysfunction. Subsequently, increased intra-abdominal pressure (IAP) adversely affects the pulmonary, cardiovascular, renal, musculoskeletal/integumentary and central nervous systems. Bacterial translocation (BT), which is defined as the movement of viable enteric bacteria to the mesenteric lymph nodes, liver and spleen, occurs after various types of stress and results in splanchnic ischemia. In this experimental study, we aimed to investigate the effects of various levels of increased IAP on BT in rabbits; IAP was increased by the intra-abdominal balloon-insufflation method, thus simulating noncompliant abdominal-wall closure under tension. METHODS: Fifty rabbits were randomly assigned to 1 of 5 groups, with each group comprising 10 animals. In group I (control group), an intra-abdominal balloon was placed without inflation. In groups II, III, IV and V, IAPs of 10, 15,

20 and 25 mmHg, respectively, were established via inflation of the intra-abdominal balloon. All groups underwent laparotomy after 12 hours. Multiple biopsies were taken from ileocecal lymph nodes, the spleen and liver. RESULTS: BT was observed to some degree in all 4 experimental groups. A gradual increase in the phenomenon was noted as IAP increased from 10 to 15 mmHg; and BT was overt at 20 mmHg, and significant at 25 mmHg. Klebsiella pneumoniae, Serratia marcescens, and Escherichia coli were the predominant pathogens identified by culture. CONCLUSION: We propose that an intravesical pressure (IVP) of 15 mmHg is the critical point for BT in patients with increased IAP. In this experimental study, BT occurred when IVP reached 20 mmHg. We suggest that IVP monitoring is desirable in the management of patients with ACS, and that decompressive laparotomy should be performed in patients with IVP >20 mmHg.

Ziakas, P. D., M. Voulgarelis, et al. (2005). "Myelofibrosis-associated massive splenomegaly: A cause of increased intra-abdominal pressure, pulmonary hypertension, and positional dyspnea." *Am J Hematol* **80**(2): 128-32.

We describe a patient with myelofibrosis, giant splenomegaly, and pulmonary hypertension related to increased intra-abdominal pressure. Focusing on alterations in hemodynamic studies, we conclude that in patients with myelofibrosis, dyspnea, and hypoxemia, the measurement of intra-abdominal pressure should be included in the initial evaluation. It is an inexpensive, non-invasive diagnostic tool that can provide crucial information about the cause of dyspnea and disclose the pathogenetic link between massive splenomegaly and pulmonary compromise in myelofibrosis. *Am. J. Hematol.* 80:128-132, 2005. (c) 2005 Wiley-Liss, Inc.