

# Anaesthesiology Intensive Therapy

## Anestezjologia Intensywna Terapia



Official Journal  
of the Polish Society  
of Anaesthesiology  
and Intensive Therapy

Oral and poster abstracts  
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## Oral presentations

### O1. Abdominal compartment syndrome: deadly despite early recognition and open abdomen treatment

A. Seternes<sup>1</sup>, M. Björck<sup>2</sup>, L.C. Rekstad<sup>1</sup>, S. Mo<sup>3</sup>,  
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**Background:** Treatment for Abdominal Compartment Syndrome (ACS) and open abdomen (OA) are significant burdens for the patient and are associated with high mortality despite large efforts.

**Objective:** In this observational study we wanted to identify clinical background information, type of temporary abdominal closure (TAC) device used, resources allocated, in-hospital morbidity and mortality and independent predictors of mortality with the aim to improve patient care.

**Methods:** At Trondheim University hospital in Norway, 120 consecutive OA treatments in 118 patients from October 2006 until June 2014 were identified. Clinical data were obtained from two prospective clinical databases: a surgical department and an intensive care unit registry.

**Results:** Median age was 63 years (IQR 53 to 73), 69% were males. Eighty per-cent were treated for a vascular or gastrointestinal disease, 8% were trauma patients. To treat or prevent ACS was the indication for 82 OAs. Other indications were abdominal sepsis (n = 14), second look (n = 10), necrotizing fasciitis (n = 7), packing for hemorrhage (n = 4) and full thickness dehiscence (n = 3). Vacuum assisted wound closure (VAWC) with mesh mediated traction (VAWCM) was used as TAC in 79%, the remaining (27) had VAWC only due to early death (n = 11), closed at next planned visit at operating room (n = 10), surgeons' preference (n = 3) or unknown (n = 3). The mean number of OA changes before closure or death was 6 (IQR 3.25 to 8).

Seventy-seven of the 118 patients (65%) survived their hospital stay. The median length of hospital stay was 29 days (IQR 16.75 to 57.25). Intensive care was required in 113 patients

(97%) in median 15 days (IQR 8 to 26). Patients treated for ACS needed ventilatory support longer than when OA was used for other reasons, mean 18.9 vs 13.2 days, mean difference 5.6 ( $P = 0.006$ ). Delayed primary fascial closure was achieved in 78 (84%) of the patients surviving OA treatment. Nine patients had a reconstruction with Permacol™, three with skin or fascia flaps and two ended with a planned incisional hernia. Out of 60 patients undergoing intestinal surgery prior to or during OA treatment, 11 (18%) developed an enteroatmospheric fistula, all survived. Of the 53 patients treated for ACS only 46% survived, compared to 80% for patients with OA for other reasons ( $P = 0.0001$ ). Renal failure with the need of dialysis (OR: 5.240, 95%CI: 1.291 to 21.266,  $P = 0.020$ ) and ACS (OR: 3.516, 95%CI: 1.210 to 10.218,  $P = 0.021$ ) were independent predictors for death in a multivariable logistic regression model.

**Conclusions:** Patients treated with OA have long hospital and ICU length of stay, need a number of procedures and have a high mortality. Survival was lower when OA treatment was motivated by ACS, compared to other indications. Delayed primary fascial closure was achieved in 84% of the surviving patients in this experience using VAWC with and without mesh mediated fascial traction. Renal failure and ACS were predictors for death.

### O2. Patients with alcohol induced severe acute pancreatitis are at higher risk for development of abdominal compartment syndrome

Kaspars Zeiza, Nadezda Drozdova, Raivis Gailums,  
Kaspars Silins, Guntars Pupelis

Riga East University Hospital, Riga Stradins University, Latvia

**Background:** Systemic inflammatory response in the early phase of severe acute pancreatitis (SAP) may lead to intra-abdominal hypertension and development of the abdominal compartment syndrome (ACS) a serious complication which is associated with development of early MODS and increased mortality.

**Objective:** The aim of the study was to define groups of higher risk for the development of the ACS considering etiology, magnitude of exudation, distribution of the acute necrotic collections (ANC) and expansion of the necrotic process.



**Methods:** Patients with SAP treated in our institution during the period from 2003 to 2013 were included. Acute pancreatitis was classified according to the revised Atlanta classification. Necrotizing pancreatitis was proved by contrast enhanced computer tomography (CECT) in a 7–10 day period after admission. Patients were stratified according to etiology in alcohol induced pancreatitis (A group) and biliary origin pancreatitis (B group). Groups were compared according to distribution of the ANC, incidence of organ dysfunction according to the sequential organ failure assessment score ( $\geq$  grade 3), grade of intra-abdominal hypertension, incidence of ACS and need for renal replacement therapy (continuous veno-venous haemofiltration (CVVH)). Complication rate and main outcomes were compared in groups.

**Results:** From total of 143 patients who developed IAH in the acute phase of disease 103 had alcohol induced SAP and 40 patients had biliary origin. Higher rate of necrotizing SAP was observed in group A, 67% vs 52.5% in group B. 28.2% patients from group A had focal necrosis vs 27.5% in group B. Incidence of the renal, pulmonary and central nervous system dysfunctions was significantly higher in group A compared to group B, 49.5% vs 20%,  $P = 0.001$ ; 35% vs 15%,  $P = 0.031$ ; 29.1% vs 10%,  $P = 0.012$ , respectively. Incidence of grade III intra-abdominal hypertension and ACS also was significantly higher in group A: 32% vs 15%,  $P = 0.040$  and 39.8% vs 20.0%,  $P = 0.025$ , respectively. Need for CVVH and percutaneous drainage of the large ANC again was higher in group A compared to group B, 89.3% vs 57.5%,  $P = < 0.001$ ; 42.2% vs 17.5%,  $P = 0.011$ , respectively. Surgical decompression of the abdominal cavity due to ACS was required in 4.8% of patients from group A compared to 2.5% from group B. Significantly longer median ICU stay was observed in patients from group A 10 days vs 5 days in group B,  $P = 0.041$ . Mortality rate was similar in both groups 10.7% and 10%.

**Conclusions:** Patients with alcohol induced SAP are at higher risk for development of ACS and more active strategy to diagnose and treat intra-abdominal hypertension, and ACS is required in this category of patients.

### O3. Abdominal compartment syndrome after surgery for abdominal aortic aneurysm, a contemporary nationwide population-based study

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**Background:** More than 95% of operations for abdominal aortic aneurysm (AAA) in Sweden are registered in the Swedvasc registry. In May 2008 the variables postoperative

abdominal compartment syndrome (ACS), and relaparotomy for ACS were introduced.

**Objective:** To study the prevalence of ACS after open (OR) and endovascular repair (EVAR) for ruptured and non-ruptured AAA, and the clinical consequences of ACS.

**Methods:** Prospectively entered data was retrieved from the registry in November 2014. Data validation is underway, in particular regarding the use of prophylactic open abdomen (OA) therapy, and will be completed in time for the Ghent meeting. One hospital practicing prophylactic OA therapy was excluded.

**Results:** In all 6,612 operations were analysed, 1,341 (20.3%) for ruptured and 5,271 for non-ruptured AAA. Among those operated on for rupture 965 had OR, 6.8% developed ACS, 376 had EVAR, and 6.9% developed ACS,  $P = 1.0$ . Among those operated on for non-ruptured AAA 2,206 had OR and 1.6% developed ACS, compared to 0.5% among the 3,065 who had EVAR,  $P < 0.001$ .

Risk factors to develop ACS after surgery for ruptured AAA included preoperative low blood-pressure ( $P = 0.004$ ), preoperative unconsciousness ( $P = 0.004$ ), perioperative bleeding  $> 5$  litres ( $P < 0.001$ ) and using aortic occlusion balloon ( $P < 0.001$ ).

Risk factors to develop ACS after surgery for non-ruptured AAA included perioperative bleeding  $> 5$  litres ( $P < 0.001$ ), reimplantation of renal artery ( $P = 0.009$ ) and aortobifemoral reconstruction ( $P = 0.032$ ).

When patients developed ACS after surgery for ruptured AAA they had the following complications more often (all  $P$ -values  $< 0.001$ ): myocardial infarction (14.6 vs 4.4%), renal failure (73.1% vs 15.6%), multiple organ failure (63.4 vs 11.5%), ICU care  $> 5$  days (79.8 vs 20%), intestinal ischaemia (38.5 vs 7.1%), bowel resection (28.7 vs 3.6%), relaparotomy for bleeding (28.7 vs 5%). Death at 30 days was 42.4% with ACS vs 23.5% without ACS,  $P < 0.001$ , at one year 50.7 vs 31.8%,  $P < 0.001$ . When patients developed ACS after surgery for non-ruptured AAA they had the following complications more often (all  $P$ -values  $< 0.001$ ): myocardial infarction (5.9 vs 1.6%), renal failure (48.1 vs 3.5%), multiple organ failure (34.6 vs 1.0%), ICU care  $> 5$  days (61.5 vs 3.4%), intestinal ischaemia (28.8 vs 1.2%), bowel resection (25 vs 0.7%), relaparotomy for bleeding (19.2 vs 2.2%). Death at 30 days was 11.5% with ACS vs 1.8% without ACS,  $P < 0.001$ , at one year 27.5 vs 6.3%,  $P < 0.001$ .

If the patient developed ACS after ruptured AAA there were no differences in complication-rates or outcomes if the operation was performed with OR or EVAR. After non-ruptured AAA a higher proportion needed ICU care  $> 5$  days after OR (74.3 vs 31.3% after EVAR,  $P = 0.005$ ), and there was a trend towards more needing bowel resection after EVAR (43.8 vs 17.1%,  $P = 0.08$ ).

**Conclusions:** The devastating impact of ACS after AAA surgery on complications and survival was verified in this first large population based study. The main difference in outcomes depended on if the operation was performed for ruptured or non-ruptured AAA, but there were also thought provoking differences depending on surgical techniques.

#### **O4. Intra-abdominal pressures in the intensive care unit: who should we be monitoring?**

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**Background:** Intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS) are common entities in critically ill patients that are associated with multiple organ dysfunction, morbidity and mortality [1–3]. Given that evidence-based, non-operative treatment modalities exist to prevent the elevation of intra-abdominal pressure (IAP), the development of ACS and the need for surgical decompression, early detection of patients at risk of IAH and ACS is of premium value. The risk factors defined by the World Society of Abdominal Compartment Syndrome (WSACS) IAH assessment algorithm describe almost every ICU patient and increased specificity is desirable to assist clinicians in identifying which patients require close monitoring of their IAP.

**Objective:** To develop a sensitive and specific screening tool, applicable to a heterogeneous, critically ill population, to aid the early identification of patients that require IAP monitoring.

**Methods:** Prospective, observational study of 403 consecutively enrolled patients with an indwelling catheter, admitted to a mixed medical-surgical ICU in a tertiary referral, university hospital. Intra-abdominal pressure was measured at least twice daily and IAH and ACS defined as per consensus definitions. Physiologic, biochemical and haematological measurements as well as treatments instituted were recorded daily for all patients.

**Results:** Thirty-nine percent of patients developed IAH and 2% developed ACS. Abdominal distension, hemoperitoneum/ pneumoperitoneum/intra-peritoneal fluid collection, obesity, intravenous fluid received > 2.3 L, abbreviated Sequential Organ Failure Assessment score > 4 points and lactate > 1.4 mmol L<sup>-1</sup> were identified as independent predictors of IAH upon admission to ICU. The presence of three or more of these risk factors at admission identified patients

that would develop IAH with a sensitivity of 75% and a specificity of 76%, the development of grades II, III and IV IAH with a sensitivity of 91% and a specificity of 62%. Applying the WSACS IAH assessment algorithm to the studied population predicted the development of IAH with a sensitivity and specificity of 97 and 21% respectively.

**Conclusions:** This study found that IAH is a common manifestation in critically ill patients. A proposed screening tool, applicable to all patients upon admission to the ICU and using a pragmatic compromise between sensitivity and specificity, demonstrated superior specificity compared with the WSACS IAH assessment algorithm.

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#### **O5. Mortality in children with abdominal compartment syndrome: does time in hospital before laparotomy influence outcomes?**

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**Background:** Pediatric abdominal compartment syndrome has a high mortality rate. Recognition of intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS) requires a high index of clinician suspicion combined with bedside monitoring. Bedside monitoring can be easily done and consists of a combination of physical examination; intra-abdominal pressure monitoring; surveillance for secondary organ dysfunction, increasing serum lactate, and persistent acidemia [1]. The progression of IAH to ACS thus can be monitored closely especially for hospitalized patients. It has been shown that pediatric patients with IAH can progress to ACS requiring decompression laparotomy (DL) quickly, often within 8 hours [2]. Strategies to decrease mortality rate from ACS have focused on increasing awareness in physicians and nurses of IAH and ACS and early abdominal DL when ACS is recognized.

**Objective:** To ascertain if mortality from ACS in patients who have undergone DL is higher in patients who present acutely upon admission (within 2 days) compared to those hospitalized for more than 2 days.

**Methods:** We retrospectively reviewed consecutive pediatric patients who underwent emergent exploratory laparotomy between January 2013 and December 2014 at a tertiary care children’s hospital and collected data regarding demographics, mortality before discharge, evidence of secondary organ dysfunction, development of ACS, and length of hospital stay prior to exploratory laparotomy. Patients met criteria for ACS if this was directly noted in the operative report or the patient had clinical evidence of secondary organ damage prior to surgery along with physical findings consistent with ACS. Laparotomies in patients who met criteria for ACS were assumed to be DL. Patients were grouped by length of admission prior to DL (within two days of admission or after two days of admission). Patients who required DL within two days of admission were assumed to have been admitted with ongoing IAH. Statistical analysis was performed using Pearson Chi-Square and Fisher’s Exact Test.

**Results:** 117 patients required emergent exploratory laparotomy between January 2013 and December 2014. Of the patients who underwent exploratory laparotomy 33 (28.2%) were noted to have ACS. Mortality before discharge for patients with ACS was 63.6%. The mortality rate of patients with ACS who underwent surgery within two days of hospital admission was similar to patients who underwent surgery two or more days after hospital admission (Table 1).

**Conclusions:** Pediatric mortality in patients who develop ACS continues to be high despite advances in knowledge, clinician recognition, and treatment of ACS. Our study shows that in-hospital status at the time of ACS development does not change the mortality rate in patients in ACS. Additional research is needed to develop more sensitive clinical indicators of ACS that will lead to early detection and treatment.

**Table 1**

		ACS		P-value
		Yes	No	
Mortality before discharge	Yes	63.6%	2.4%	< 0.001
	No	36.4%	97.6%	
<b>Time from Admission to Surgery</b>				
<b>&lt; 2 days</b> <b>&gt; 2 days</b>				
Mortality before discharge in patients with ACS	Yes	66.7%	61.1%	1.00
	No	33.3%	38.9%	

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**06. Abdominal compartment syndrome in open abdomen after penetrating abdominal trauma: an independent mortality predictor**

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**Background:** Abdominal compartment syndrome (ACS) in trauma is an established entity that can be avoided in most cases with an Open Abdomen (OA) technique, which accommodates considerable expansion of the intra-abdominal contents after abdominal trauma. Despite this approach, some patients will progress on to develop intra-abdominal hypertension (IAH) and subsequent ACS.

**Objective:** The aim of our study was to determine the incidence and mortality of ACS in patients with penetrating abdominal trauma (PAT) who required an OA as part of their initial damage control surgery (DCS) management.

**Methods:** An observational study at a Level I trauma center from April, 2002 to November, 2013 was performed. All adult patients (≥ 16 years old) with a PAT that required DCS and an OA were included. Patients were divided into two groups according to their intensive care unit (ICU) recorded intra-abdominal pressure (IAP): Group 1 = IAP < 20 mm Hg, Group 2 = IAP > 20 mm Hg. Analyzed mortality predictors included: admission systolic blood pressure [(SBP) (≤ 90 mm Hg)], INR (≥ 1.5), pH (≤ 7.2), base excess (≤ -8), lactic acid (≥ 2 mmol L<sup>-1</sup>), body temperature (≤ 36 C°), injury severity score (ISS > 25), new injury severity score (NISS > 35), and ACS. The outcome variable measured was mortality. Patients were diagnosed with ACS when they presented a sustained IAP of > 20 mm Hg and an associated end organ failure (EOF) onset. Continuous variables were expressed as mean and + SD. Qualitative variables were expressed as percentages and were compared using Chi-square. A logistic regression was performed to determine predictors of mortality in both groups.

**Table 1.** Mortality predictors according to IAP

Mortality Predictors	Group 1		Group 2		Total n = 188	P-value	
	IAP < 20 mm Hg n = 137		IAP > 20 mm Hg n = 51				
SBP ( $\leq$ 90 mm Hg)	51	37.23	23	45.10	74	39.36	0.41
INR (1.5)	25	18.25	22	43.14	47	25.00	< 0.01
pH ( $\leq$ 7.2)	6	4.38	8	15.69	14	7.45	0.02
Base excess ( $\leq$ -8)	23	16.79	25	49.02	48	25.53	0.01
Lactic acid ( $\geq$ 2 mmol L <sup>-1</sup> )	45	32.85	17	33.33	62	32.98	0.99
Body temperature ( $\leq$ 36 C°)	10	7.30	8	15.69	18	9.57	0.14
ISS (> 25)	43	31.39	17	33.33	60	31.91	0.94
NISS (> 35)	61	44.53	33	64.70	94	50.00	0.02
End Organ Failure ( $\geq$ 1)	34	24.82	30	58.82	64	34.04	0.03
Mortality	11	8.03	10	19.61	21	11.17	0.05

**Results:** A total of 188 patients were included, mean age was 30.91 (+10.99) and 171 were male (90.96%). The most frequent trauma mechanism was gunshot wounds (86.7%). Abdominal packing was performed in 82.98% of the cases. Mean IAP was 14 mm Hg. Mean measured outcome variables for each group are shown in Table 1. IAH was present in 177 patients (94.15%). EOF developed in 64 (34.04%) patients and ACS in 30 (15.96%). Mean severity scores were: ISS 24.2 (+9.78) and NISS 36.8 (+14.2). Mean total ICU/hospital days were 12.5 (+11.3) and 23.9 (+35.2) respectively. Overall mortality was 21 (11.17%). Group 1 mortality was 11/137 (8.03%) versus 10/51 (19.61%) in Group 2 ( $P = 0.04$ ). Mortality in patients with ACS was 9/30 (30%) versus 12/158 (7.6%) in patients without ACS ( $P = 0.001$ ). In the multivariate analysis ACS (OR = 5.18, CI 95%[1.89–14.00]) constituted an independent risk factor for increased mortality.

**Conclusions:** Patients with PAT that require DCS and OA have an approximate 16% overall chance of developing ACS, which can climb up to a staggering 59% chance if their IAP is greater than 20 mm Hg. We found that mortality increases by a factor of 2.5 times in patients with an IAP > 20 mm Hg as compared to those who had an IAP < 20 mm Hg. Furthermore, we discovered that when ACS is present mortality rate is four times greater than those without ACS. With these findings we were able to conclude that ACS is an independent mortality risk factor in this type of patients, therefore close IAP surveillance should be considered in all PAT patients who require DCS/OA.

## 07. Grade I–II IAH — is it important?

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**Background:** There is still a ‘grey zone’ in IAP, ranging from 12 mm Hg to 18 mm Hg, where the clinical consequences of IAH are not clearly evident and treatment recommendations are inconsistent. This is in contrast to ACS, the clinical course of which is unequivocally detectable and where early causative treatment is directly connected with a positive outcome. The deterioration of tissue metabolism in the abdominal area may occur well before the clinical signs of organ dysfunction related to IAH are evident.

**Objective:** The main aim of the present work was to test the hypothesis that elevated IAP is associated with tissue hypoperfusion and the prevalence of anaerobic metabolism.

**Methods:** Four subsequent studies were conducted. Two studies focused on microcirculatory changes and two on abdominal rectus muscle tissue metabolism (short-term IAH vs prolonged IAH; laparoscopic surgery vs intensive care (ICU) patients). Altogether 37 patients were included. In 31 patients the sublingual microcirculation was visualized using an SDF imaging device, in 16 patients tissue metabolism was studied with microdialysis. Data are presented in medians (IQR) and  $P$  was considered significant  $\leq 0.05$ .

**Results:** Median IAP during the surgery was 12.5 (12–13) mm Hg. Baseline IAP in ICU patients was 14.5 (12.5–17.8)

mm Hg and it decreased significantly during the study ( $P \leq 0.0001$ ). MAP and APP were in all studies over the minimally sufficient levels.

Median age in ICU patients was 67 (from 19 to 89) and in surgery patients 52 (from 27 to 81) years. Median APACHE II score was 28 (13–36).

In microcirculatory parameters no significant changes were observed between the time points, neither in laparoscopic surgery nor in ICU patients. However, the overall density of microvessels (TVD), if measured before laparoscopy was significantly higher than in critically ill patients at inclusion in the study ( $P \leq 0.0001$ ). In contrast, the proportion of perfused sublingual microvessels (PPV) was significantly better ( $P \leq 0.0001$ ) in critically ill patients, which may reflect their relatively better fluid status. The correlation analysis revealed weak positive correlations between TVD and IAP, microvascular flow index (MFI) and MAP and between MFI and APP in critically ill patients. The heterogeneity index was negatively correlated with both MAP and APP.

Tissue metabolism markers, lactate and lactate-to-pyruvate (L/P) ratio elevated significantly during laparoscopic surgery. In intensive care patients lactate, L/P ratio and glutamate concentrations were significantly elevated at the beginning of study.

The correlation analysis revealed an association between higher MAP and APP levels and lower tissue pyruvate concentrations. There was also an association between elevated IAP levels and higher tissue glutamate concentrations.

**Conclusions:** IAH grades I and II (IAP 12 to 18 mm Hg) cause mild microcirculatory changes in laparoscopic surgery patients and in previously resuscitated ICU patients. The correlation analysis indicates better microvascular blood-flow at higher MAP and APP levels.

IAH grades I and II lead to RAM tissue anaerobic metabolism suggestive of hypoperfusion in critically ill patients and during laparoscopic surgery. The correlation analysis supports the concept of using APP as a primary endpoint of resuscitation in addition to MAP and IAP.

## 08. Intra-abdominal hypertension after cardiac surgery: time to pay attention?

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**Background:** Intra-abdominal hypertension (IAH) is associated with multi-organ failure and mortality in critically ill patients [1, 2]. Whilst the incidence and relevance of IAH has

been extensively investigated in general surgical patients [3, 4], few studies have investigated patients in the perioperative period of cardiac surgery [5–7]. Thus, many of the risk factors identified in the consensus guidelines for IAH do not directly apply to the postoperative cardiac surgery population.

**Objective:** To investigate the incidence, severity and evolution of IAH after cardiac surgery, with particular emphasis on identifying independent predictors of IAH in this cohort.

**Methods:** Prospective, observational study of 103 consecutively enrolled post-operative cardiac surgery patients admitted to the intensive care unit (ICU). Demographic data, risk factors for developing IAH (according to consensus guidelines) and the duration of cardiopulmonary bypass (CPB) and aortic cross-clamp times were collected upon admission. Intra-abdominal pressures (IAP) were measured at least twice daily on all patients. Physiologic, biochemical and haematological measurements as well as treatments instituted were recorded daily for all patients.

**Results:** Fifty patients (46%) developed IAH at any time during their ICU stay. No patients developed abdominal compartment syndrome. The incidence of IAH was highest on Day 2 and Day 3 of the ICU admission. Patients that developed IAH had significantly longer CPB and aortic cross-clamp times. Within the first 24 hours of ICU admission, patients in the IAH group had significantly higher IAPs, central venous pressures, peak airway pressures and significantly lower pH, PaO<sub>2</sub> and PaO<sub>2</sub>/FiO<sub>2</sub> ratios. Patients in the IAH group required a longer duration of mechanical ventilation and one more day of ICU care as compared with patients that did not develop IAH. Six independent predictors of IAH were identified; these included the presence of abdominal distension, albumin < 33 g L<sup>-1</sup>, abdominal perfusion pressure < 62 mm Hg, CPB time > 121 minutes, aortic cross-clamp time > 75 minutes and central venous pressure > 15 mm Hg. A logistic regression model using these variables correctly identified 85% of patients who developed IAH.

**Conclusions:** This study found that IAH developed in almost half the patients admitted to the ICU after cardiac surgery. These patients required a longer duration of mechanical ventilation and ICU care. A set of screening criteria routinely available within the first 24 hours of admission to the ICU after cardiac surgery correctly identified most patients at risk of IAH.

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## O9. Five-year follow up after open abdomen therapy with vacuum-assisted wound closure and mesh-mediated fascial traction — results from a prospective multicenter study

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**Background:** Vacuum assisted wound closure and mesh mediated fascial traction (VAWCM) enables delayed primary fascial closure in most patients, even after prolonged open abdomen (OA) treatment. The aim was to evaluate mortality, as well as incidence of hernia and abdominal wall discomfort five year after abdominal closure.

**Methods:** A prospective multicenter study of 111 patients undergoing prolonged OA with the VAWCM method was performed 2006–2009. Survivors underwent clinical examination and CT scan at one year and clinical examination at five years. A modified version of the validated Ventral Hernia Pain Questionnaire was used for evaluation of abdominal wall discomfort at five years.

**Results:** The in-hospital survival rate was 70% (78/111) and the fascial closure rate per protocol (among survivors) was 89% (85/95). No patient was left with a giant planned ventral hernia. At one-year 70 patients were alive (70/111 = 63%). In total 42 of those (66%) had developed incisional hernias: 28 (40%) were asymptomatic, 14 (20%) were symptomatic. Seven had hernia repair. Another five patients developed an incisional hernia and ten underwent hernia repair between 1 and 5 years of follow-up. The five-year survival rate was 49% (54/111). Among those, 49 were reexamined and five underwent follow-up through case records and/or telephone contact. In those 54 surviving individuals, median age at study entrance was 64 years, 78% were male. The indications for OA were visceral pathology (n = 30), vascular pathology (n = 16) or trauma (n = 8). The median length of OA therapy was 14 days and the number of mesh-mediated fascial traction was four. At five years, 26 individuals had an incisional hernia and 23 had not (five were not examined). According

to the questionnaire, there were no differences in patients' experience of pain, cosmetics, bowel function or social domain between those with hernia and those without.

**Conclusions:** The VAWCM method for long-term treatment of OA provides a high primary delayed fascial closure rate in these predominantly elderly non-trauma patients. The incisional hernia rate was high during follow up and develops often within the first year, but most hernias were asymptomatic. The presence of incisional hernia among long-term survivors appeared not to be associated with impairment in quality of life. In view of the underlying acute fatal condition leading to a long-term treatment period of OA, long-term morbidity due to incisional hernia is considered acceptable.

## O10. Rate of incisional hernias 1 year after open abdomen management with negative pressure therapy combined with mesh-mediated fascial traction

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**Background:** Temporary management of an open abdomen (OA) is still a surgical challenge. Negative pressure therapy (NPT) in combination with mesh-mediated fascial traction (MMFT) in severely ill and ICU-treated patients is our treatment of choice. We present a 3-year period evaluation of using this technique including a 1-year follow-up evaluating incisional hernia rate and Quality of Life (QoL).

**Methods:** A single center retrospective analysis from a prospective database was performed of all patients treated for OA at the Ghent University Hospital, Belgium between 2011 and 2013. Indications for open abdomen treatment, basic characteristics and details of surgical treatment progression were prospectively documented. Patients alive, at least 1 year after discharge, were invited to visit the outpatient clinic for clinical examination, CT scanning and questionnaires regarding QoL.

**Results:** A total of 43 patients were treated with this technique of which 20 died on the ICU due to disease severity, not related to NPT and MMFT. In the other 23 patients abdominal wall was closed after 13 days (3–45) mean of 3 dressing changes (1–17). Open abdomen was present for a period of 10 days (0–46 days); skin closure could be achieved after 14 days (0–84 days). One patient developed an entero-atmospheric fistula. One patient developed an intra-abdominal bleeding and 1 developed an intra-abdominal abscess, easily removed during the Abthera removal. One subcutaneous hematoma occurred after closure. All patients with mesh-mediated fascial traction were closed after three

shortenings of the marlex mesh. Five patients were lost to follow-up, so a total of 18 patients were evaluated in the out-patient clinic. Eleven out of 18 patients (61%) showed an intact abdominal wall both at clinical and CT examination, while 39% (7/18) had a clear hernia on clinical exam, which was confirmed on CT scan. Two hernias were repaired using the Rives-Stoppa technique using a light-weight mesh, with hernia sizes of 12 × 8 cm and 10 × 8 cm respectively. Comparing these 2 subgroups the only significant factor influencing incisional hernia development was weight gain: 8.6% weight gain in the non hernia group compared to 24% weight gain in the hernia group.

**Conclusions:** Using NPT and MMFT fascial closure can be achieved in 100% of patients but with a rather high incidence of incisional hernia during follow-up. Weight gain seems to have a negative impact on the development of these hernias. Question remains whether fascial traction has to be already diminished further by component separation techniques during secondary closure.

### O11. Outcomes in pediatric patients with abdominal compartment syndrome following urgent exploratory laparotomy

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**Background:** Abdominal compartment syndrome (ACS) is a serious clinical entity seen in critically ill children. Even

after prompt decompressive laparotomy, mortality remains high [1, 2].

**Objective:** To characterize the incidence of ACS in pediatric patients who underwent urgent exploratory laparotomy. To analyze outcomes of patients with ACS compared to patients without ACS.

**Methods:** This was a retrospective review of patients (ages 0–18 years) who underwent urgent exploratory laparotomy between January 1, 2013 and December 25, 2014. 117 patients were included of which 68 (58.1%) were male. For this study we define ACS as: tense abdominal distension with invasive mechanical ventilation, and vasopressor/inotropic support as a sign of new organ dysfunction, or if indication for surgery was ACS or decompression as documented by the surgeon.

**Results:** In total, 33 (28.7%) had ACS. 27 (23.5%) had primary ACS and 6 (5.2%) had secondary ACS. Of patients reviewed, 57% required ICU admission, 7.8% required cardiopulmonary resuscitation within 48 hours of surgery, 22.2% required mechanical ventilation, 5.2% required hemodialysis, and 27.7% required vasopressor/inotropic support (Table 1).

**Conclusions:** Nearly 30% of urgent laparotomies performed during the study period met criteria for ACS. This population presents a significant challenge in management. The mortality rate in our patients with ACS was similar to other studies. There was no difference in mortality in either group with length of time in hospital prior to surgery. Perhaps this is because the need for urgent laparotomy was variable and independent of a particular time course. Bowel resection was more common in the ACS group (but did not reach statistical significance), likely due to the high risk of bowel necrosis. As expected, the abdomen was left open more often in the ACS group for decompression. Gastrointestinal failure may be demonstrated by patients who required parental nutrition at 30 days or at hospital discharge. Approximately half of patients dependent on parental nutrition

**Table 1.** Outcomes of patients following urgent laparotomy comparing ACS and non ACS groups

	ACS	Non ACS	P-value
Hospital mortality	63.60%	2.40%	< 0.001*
28 day mortality	51.50%	0	< 0.001**
Hospital mortality: in hospital < 2 days prior to surgery	66.70%	33.30%	1**
Hospital mortality: in hospital ≥ 2 days prior to surgery	61.10%	38.90%	
28 day mortality: in hospital < 2 days prior to surgery	60%	40%	0.373*
28 day mortality: in hospital ≥ 2 days prior to surgery	44.40%	55.60%	
Bowel resected	61%	39%	0.068*
Primary fascial closure	45.50%	97.50%	< 0.001*
Parental nutrition dependent at 30 days or hospital discharge	47.10%	52.90%	0.004**

\*Pearson Chi-Square; \*\*Fisher's Exact Test

had ACS. Further studies are needed to examine the long term outcomes of this patient population.

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## O12. Abdominal compartment syndrome screening following repair of ruptured abdominal aortic aneurysm — review of 12 years of experience

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**Background:** Abdominal Compartment Syndrome (ACS) is often an unrecognised and undertreated condition, which can result in increased morbidity and mortality following repair of ruptured Abdominal Aortic Aneurysm (rAAA) [1–4]. Following AAA surgery, raised IAP is recognised as a major contributor to post-operative organ dysfunction with incidence rates in published series between 6 and 30% [1–9]. ACS is also reported as a major cause of death, associated with a mortality of up to 70% in those patients with ACS following rAAA repair [1–4].

**Objective:** The objective of this study was to compare the mortality and morbidity of patients screened for postoperative abdominal compartment syndrome in the context of ruptured AAA.

**Methods:** A retrospective review was performed of all patients with ruptured AAA presenting to an Australian metropolitan tertiary referral centre between 1999 and 2011. Consensus definitions from the World Society of Abdominal Compartment Syndrome (WSACS) were used for diagnosis of ACS. Physiological and clinical variables were analysed between the patient cohorts that were screened and not screened for IAH/ACS.

**Results:** Over 12 years, 86 patients underwent urgent repair of rAAA and 47 (55%) of these patients were screened for IAH/ACS. Of screened patients, 19 (40%) were diagnosed with ACS. Seven of these 19 patients were surgically decompressed. Year-by-year analysis using Cochran-Armitage test for trends showed a significant improvement in the screening rate from 2000 to 2010 ( $P=0.0042$ ). Furthermore, higher IAP ( $P=0.011$ ) and lower APP ( $P=0.002$ ) were significantly associated with higher rates of death in rAAA patients.

**Conclusions:** ACS is a common complication of rAAA repair. Although screening rates in this population have improved there are significant gaps and the true incidence of IAH/ACS in our rAAA population are still unknown. Although less than 50% of the population diagnosed with ACS went on to surgical decompression it is unclear how successful and to what extent non-operative interventions were. Enhanced screening protocols and further data collection might improve these gaps in knowledge.

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## O13. Prognostic profile of intra-abdominal pressure in SICU patients

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**Background:** The prognostic impact of intra-abdominal pressure (IAP) in Surgical Intensive Care Unit (SICU) patients is not well known.

**Objective:** To determine the prognostic impact of IAP and its derivative variables (Abdominal perfusion pressure — APP, Filtration gradient — FG) on overall SICU survival.

**Patients and methods:** In a prospective observational study, we investigated 463 SICU patients, admitted after major abdominal surgery. To assess overall discriminative ability of IAP, APP and FG we analyzed receiver operating characteristic curves (ROC curves) constructed for average values of investigated variables measured for the whole SICU stay. To find cut-off values for investigated variables we calculated sensitivity, specificity, positive and negative



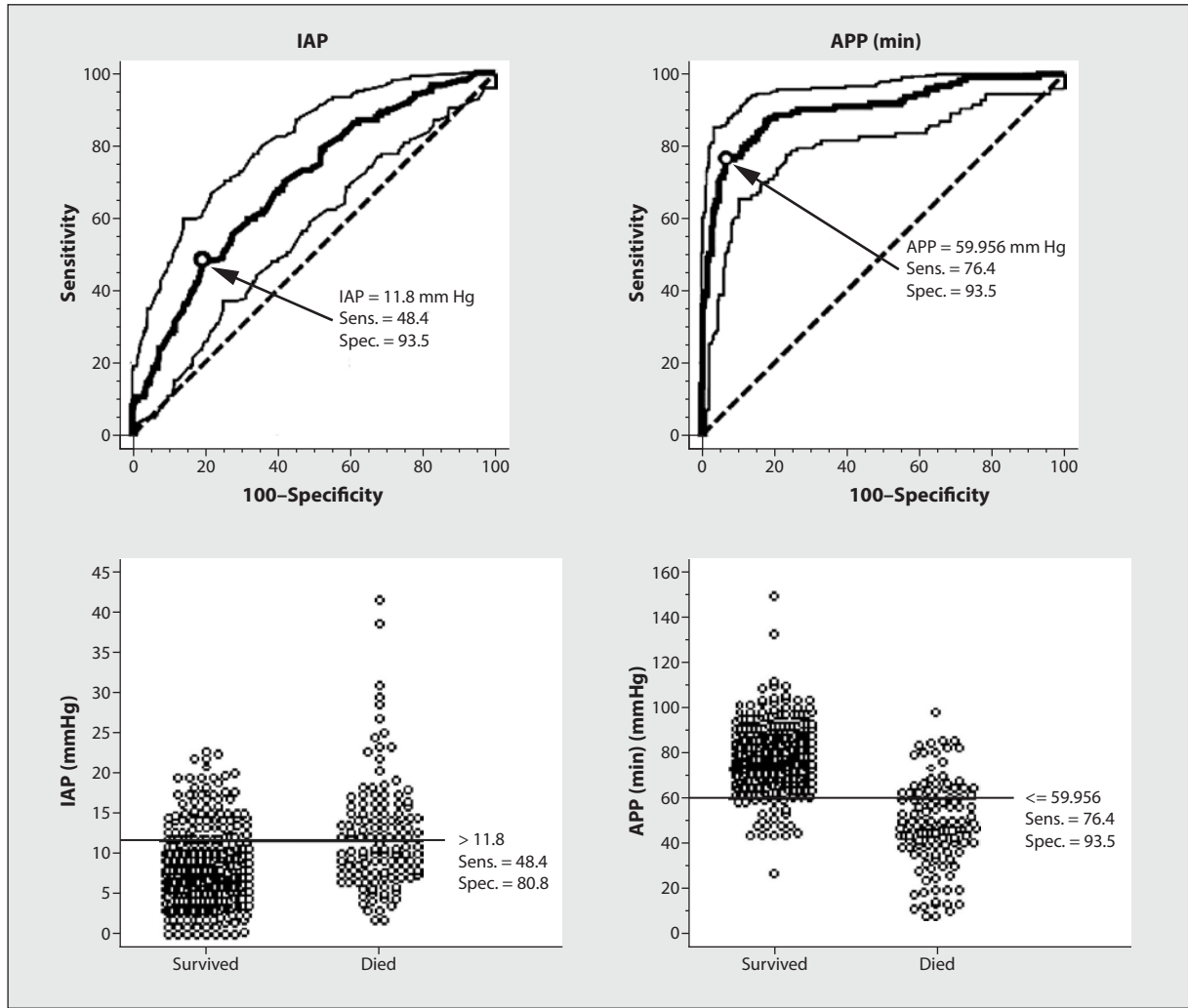


Figure 1.

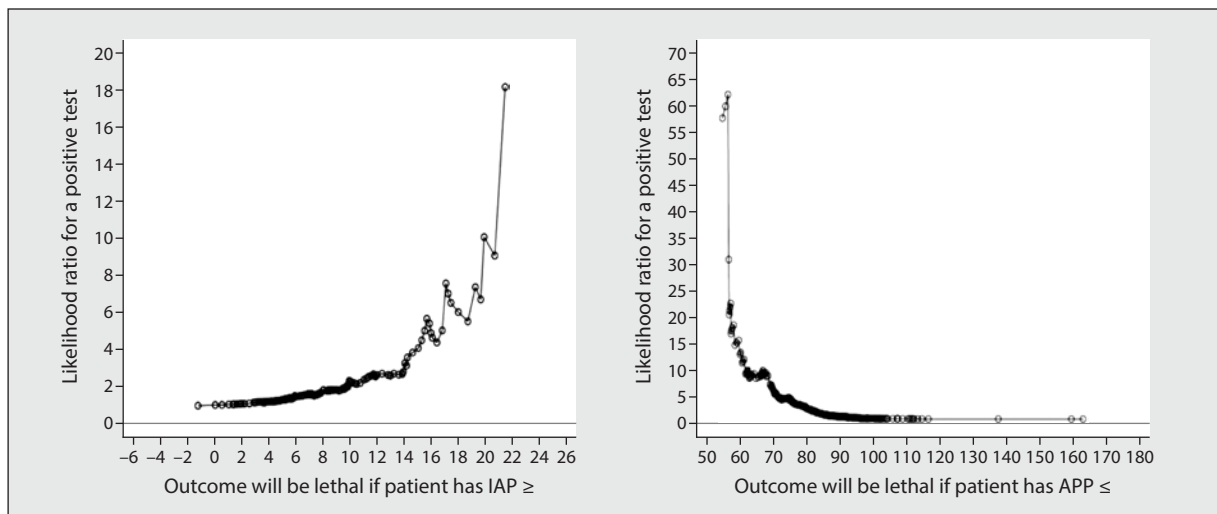


Figure 2.

**Table 1.**

	Sens	95% CI	Spec	95% CI	+LR	95% CI	-LR	95% CI	+PV	95% CI	-PV	95% CI
IAP = 11.8	48.39	39.3–57.5	80.83	76.2–84.9	2.52	2.1–3.0	0.64	0.5–0.8	48	39.0–57.1	81.1	76.5–85.1
APP = 59.9	76.42	67.9–83.6	93.47	90.3–95.9	11.71	10.6–13.0	0.25	0.2–0.4	81	72.7–87.7	91.6	88.1–94.3

predictive values and likelihood ratios for positive and negative results of possible cut-off values. IAP was measured transvesically after instillation of 25 mL saline every 6 hours during the whole SICU stay. APP was calculated for each IAP measurement as  $APP = MAP - IAP$ . Statistical analysis was carried out with SPSS 20.

**Results:** The areas under the ROC curves of IAP, APP and FG were 0.693, 0.868 and 0.861 respectively; (all values were significantly higher than 0.5;  $P < 0.05$  for all). The optimal cut-off values for IAP and APP were 12 and 60 mm Hg respectively (Fig. 1).

Increase in IAP or decrease in APP corresponds to an increase in likelihood ratios for patient death. Likelihood ratios approaches to indefinite at  $IAP \geq 21$  mm Hg or  $APP \leq 50$  mm Hg, indicating that probability of poor outcome approaches to one (Fig. 2).

**Conclusions:** IAP and its derivatives are useful prognostic tests with APP having the maximum prognostic potential. Values of  $IAP \geq 21$  mm Hg or  $APP \leq 50$  mm Hg are predictive of poor outcome (Table 1).

#### O14. Quality of life and cosmetic outcome following component separation for open ventral hernia repair for large hernias

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**Background:** Component separation (CS) has become a frequently used alternative to repair large ventral defects when mesh augmentation can not be achieved. However, the impact of transecting the external oblique aponeurosis to facilitate closure of the abdomen on quality of life (QOL) and Body Image has yet to be investigated. The study goal was to investigate QOL and outcomes after open incisional hernia repair (OIHR) using CS for large ventral hernias.

**Methods:** All patients included in this study suffered an incisional hernia and were treated without or with mesh using a retromuscular or intraperitoneal mesh repair. Prospective data for all CSs were reviewed and analysed using SPSS Statistical software. All defects were 100 to 1000 cm<sup>2</sup> in size and repaired with mesh. Comorbidities, operi-operative complications and outcomes were analysed. To evaluate QOL pain was evaluated using the VAS scale analysis, the Carolinas

Comfort Scale score was used to evaluate Hernia specific QOL outcome, while the European Quality of Life scale was used to evaluate overall improvement after surgery. The validated Body Image Questionnaire was performed in all patients to analyze cosmetic outcomes.

**Results:** In total 34 patients were treated, 19 females and 15 men with a mean age of 56.8 years and a BMI of  $28.7 \pm 5.6$ . Thirty-two patients had a anterior component separation, of which 13 were unilaterally performed, 17 bilaterally and in 1 patient one side was treated with anterior CS and the other side by posterior CS. One patient got a bilateral posterior CS. Two patients had no mesh used, while a retromuscular mesh repair was done in 20 patients, 1 onlay repair and 11 had an intraperitoneal onlay mesh repair.

The main postoperative sequelae were seroma (23.5%), superficial (11.7%) and deep (5.8%) wound infections and recurrence (11.7%) after a follow-up ranging from 12–36 months. Mean hospital stay was 12 days. Pain scores as well as QOL-scores after this follow-up were significantly higher in unilaterally treated patients, while regarding the body image questionnaire there was a significantly better score in the bilaterally treated patients.

**Conclusions:** All patient undergoing CS with mesh reinforcement had improvement of their QOL both using CCS and EQ-5D evaluation. Whereas wound breakdown and seroma formation are high, the overall outcome after intermediate follow-up time is excellent. When bilateral CS is not necessary unilateral CS should be preferred because of improved pain sensation and QOL, although cosmetic results might a little bit inferior in unilaterally treated patients.

#### O15. Modified component separation for early closure of the open abdomen

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**Background:** A component separation technique is described for repairing ventral hernias with a large separation between the aponeurotic margins. Use of the technique for early closure of the open abdomen (OA) is not widely accepted. Furthermore, the absence of posterior fascia of

the rectus muscles caudally to the Douglas line mean that unfolding at this level is complex. Therefore, we modified the technique to unfold the anterior fascia, placing polypropylene fascial reinforcement meshes.

**Objective:** To discover the short and mid/long term results of modified component separation (MCS) for early closure of OA.

**Methods:** Observational analytical study performed on a prospective database in the Trauma and Emergency Surgery Unit of a tertiary hospital. A telephone interview was conducted to ascertain the health status of subjects during February 2015. Inclusion criteria: patients subjected to early definitive abdominal closure via MCS following a temporary closure procedure using negative pressure wound therapy (TAC NPWT) (ABThera™, KCI) between October 2011 and February 2015. Exclusion criteria: patients who received the same procedure in later phases. Surgical technique: MCS was indicated once the success of direct fascial closure was considered to be improbable due to the aponeurotic separation and intra-abdominal condition. We modified the typical technique so that the anterior fascia of the rectus muscles occurred longitudinally as far to the laterals as possible and the median line was sutured with long-lasting resorbable sutures. Finally, the musculature was reinforced with a polypropylene mesh. The statistical program SPSS 15 was used.

**Results:** 45 patients received TAC NPWT during the study period. Definitive closure was achieved in 13 patients by employing MCS, but one was excluded. There were 9 men and 3 women, with an average age of 52.5 years (15–79 years). All were subjected to the TAC NPWT technique as part of damage control surgery to treat a septic abdomen. The MCS technique was practiced on 1 patient during the first revision, on 4 in the second revision, on 2 in the third, fourth and fifth revisions, and on 1 patient in the sixth revision. Seven patients experienced complications: 1 intestinal fistula, 1 organ and space infection, 1 tertiary peritonitis, 1 hepatic failure, 1 pressure sore and 2 cases of cutaneous necrosis. Three patients died, 2 due to multi-organ failure and 1 because of intracranial hemorrhage.

We obtained interviews with 8 of the 9 patients who were discharged from hospital (follow-up over a period ranging from 7 to 20 months after abdominal closure). One patient presented a peristomal hernia and another a chronic seroma. None of them presented functional modifications derived from the repair surgery. According to hospital records, the only patient who could not be interviewed had not presented a hernia within 7 months after the operation.

**Conclusions:** MCS as an early closure method in TAC NPWT is a technique that facilitates abdominal closure in difficult conditions, presenting neither severe abdominal wall complications nor functional sequelae over short and mid-term periods.

## O16. A novel minimally invasive device for preemptive direct peritoneal resuscitation to reduce ACS incidence

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**Background:** Intra-abdominal Hypertension (IAH), defined as intra-abdominal pressure (IAP) > 12 cm H<sub>2</sub>O, is found in > 60% of hospitalized patients, and is associated with triple the mortality of patients without IAH. Systemic inflammatory response syndrome (SIRS) and massive fluid resuscitation can drive the progression of IAH into the abdominal compartment syndrome (ACS) defined as a sustained IAP > 20 cm H<sub>2</sub>O with concomitant multiple organ dysfunction syndrome. Current treatment algorithms target ACS only after it develops and includes paralysis, diuretics if tolerated, and percutaneous removal of ascites. Untreated ACS is universally fatal, and the mainstay of treatment is still decompressive laparotomy, however mortality is unacceptably high at 25–100% even after decompressive laparotomy. Currently judicious fluid administration is the only indirect therapy to prevent IAH from progressing into ACS, which is only moderately effective. Our lab previously demonstrated that abdominal negative pressure therapy attenuates the SIRS by reducing cytokine concentrations in peritoneal ascites [1]. Recent rat studies suggest that direct peritoneal resuscitation (DPR) with intraperitoneal injection and removal of dialysate increased intestinal blood flow and reduced organ edema [2]. We hypothesize that the dual therapy of preemptive DPR combined with removal of inflammatory cytokines, if applied preemptively, would reduce the incidence of ACS.

**Objective:** Develop a novel device to prophylactically treat patients with DPR plus ascites removal to reduce the incidence of IAH/ACS.

**Methods:** We have developed a Minimally Invasive Suction and Treatment (MIST) device that can be inserted into the abdominal cavity preemptively using laparoscopic surgical techniques to remove toxic ascites and perform DPR to block the progression from IAH/ACS. It contains a four-catheter manifold to which suction drains are attached for negative pressure therapy, as well as a single infusion catheter for peritoneal dialysis fluid (Fig. 1). The entire device can be inserted into the peritoneal cavity through a 15 mm trocar. The drains are placed in the paracolic gutters bilaterally, pelvis, and subdiaphragmatic regions, while the infusion catheter remains affixed to the abdominal wall. In a single pilot experiment a female Yorkshire pig was anesthetized and instrumented. Laparotomy was performed and the superior mesenteric artery clamped for 30 minutes, which we have shown to cause ACS if untreated. The device was

placed into the peritoneal cavity as outlined above. Peritoneal dialysate was continuously infused at 500 cc hr<sup>-1</sup>, and the drains were maintained on low wall suction.

**Results:** In this pilot study to establish the technically feasibility of preemptive MIST we found the device easy to apply and the dialysis infusion and ascites removal worked smoothly for 32 hours.

**Conclusion:** Prophylactic placement of our MIST device is technically feasible and well tolerated. Previous studies support our hypothesis that application of MIST before the development of ACS in patients at high risk with it's dual action therapy has the potential of reducing the incidence, morbidity and mortality associated with ACS. Experiments are currently being conducted to demonstrate the efficacy of MIST at reducing ACS incidence in our translational porcine ACS model.

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**O17. Increased intra-abdominal pressure and depleted citrulline level are indicators of intestinal dysfunction and failure during acute necrotizing pancreatitis**

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**Background:** Single and multiple organ dysfunction with subsequent failure are key steps in pathogenesis of acute

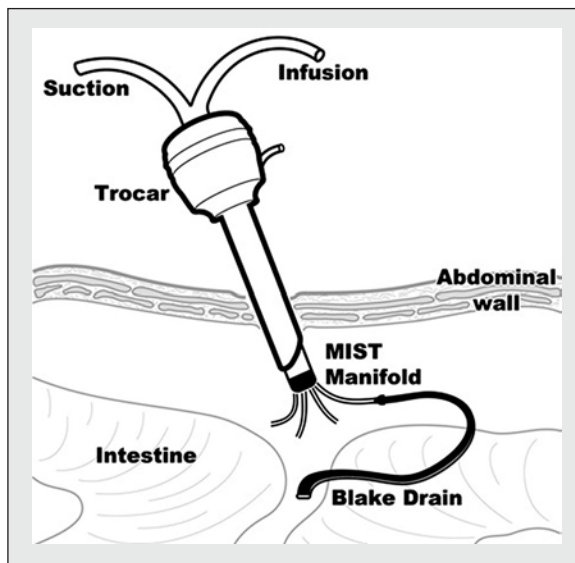


Figure 1.

necrotizing pancreatitis (ANP) [1]. Opposite to kidney or liver identified markers of the enterocyte function are still lacking. Plasma citrulline, an amino acid, produced exclusively by enterocytes from glutamine and level of intra-abdominal pressure (IAP) might be the candidates [2].

**Objective:** The aim of our study was to determine correlation of IAP and changes of citrulline level with signs of intestinal dysfunction and failure.

**Methods:** Prospective study of 113 consequence patients with ANP in a single intensive care department of regional hospital have been performed. There were 88 male and 25 female with avarage age of 46 ± 3.4 years old. In every patient intraabdominal pressure by indirect transvesical method, and citrulline level in peripheral blood were measured from

**Table 1.** Influence of intraabdominal hypertension and citrulline concentration on intestinal failure, infection and mortality rate in patients with acute necrotizing pancreatitis (M ± m)

Measurements	Control group, n-10	APACHEII score					
		I (0–9) n-30	II (10–14) n-20	III (15–19) n-20	IV (20–24) n-17	V (25–29) n-16	VI (> 30) n-10
IAH 12–15 mm Hg	0	6 (20)	5 (25)	4 (20)	8 (45)	2 (12)	0
15–25 mm Hg	0	0	7 (35)	10 (50)	7 (41)	11 (63)	6 (60)
> 30 mm Hg	0	0	0	0	2 (17.5)	4 (25)	4 (40)
Citrulline, μmol L <sup>-1</sup>	36.8 ± 0.86	23.2 ± 0.19*	18.81 ± 0.48*	13.63 ± 0.86*	11.03 ± 0.19*	10.54 ± 0.86*	9.58 ± 0.39*
Lactulose/mannitol ratio	0.014 ± 0.005	0.022 ± 0.0031*	0.035 ± 0.003*	0.041 ± 0.0027*	0.066 ± 0.0038*	0.071 ± 0.0031*	0.077 ± 0.0036*
Paralitic ileus, n (%)	0	2 (10)	4 (20)	10 (50)*	17 (100)*	16 (100)*	10 (100)*
Infection, n (%)	0	4 (13)	5 (25)*	7 (35)*	8 (47)*	7 (44)*	8 (90)*
Mortality, n (%)	0	0	0	4 (25)*	8 (47)*	9 (56)*	10 (100)*

\*P < 0.05 in comparison with control-operated group

1<sup>st</sup> till 5<sup>th</sup> admission days and compared with both clinical (intolerance of oral feeding, distention of abdomen, disorders of peristaltics, ileus) and laboratorial (lactulose/mannitol permeability) signs of intestinal dysfunction and failure as well as APACHE II score, infection complication and mortality rates.

**Results:** Infections was diagnosed in 46 (41%) patients, mortality rate reached 27,4% mostly due to late (after 4 weeks) septic complications. According to ANOVA analyse main factors of mortality and infection development was presence and amount of organs failure ( $P < 0.01$ ). Intestinal failure was diagnosed in 60%, but disorders of digestive function of intestine with signs of oral feeding intolerance with suppression of intestinal peristalsis were presented in 96.7% of patients with ANP. In all unsurvive patients IAH was over 15 mm Hg (9 cases were presented as abdominal compartment syndrome) and in 77% of them citrulline level failed less 10.6  $\mu\text{mol L}^{-1}$  (control —  $36.8 \pm 0.86 \mu\text{mol L}^{-1}$ ). There were statistically significant correlation between clinical signs of intestinal failure IAH ( $r = 0.711, P < 0.05$ ) and citrulline ( $r = -0.643, P < 0.05$ ), between lactulose/mannitol permeability ratio IAH ( $r = 0.88, P < 0.01$ ) and citrulline ( $r = 0.081, P < 0.01$ ) and between severity of APACHEII score and them ( $r = 0.644$  and  $r = -0.573, P < 0.05$ , accordingly). There were intestinal dysfunction signs in all patients with IAH over 12 mm Hg and citrulline below  $18,81 \pm 0,48 \mu\text{mol L}^{-1}$  and failure — with IAH above 15 mm Hg and citrulline below  $13.63 \pm 0.86 \mu\text{mol L}^{-1}$  (Table 1).

**Conclusions:** IAH and citrulline level are simple but objective criteria for intestinal dysfunction and failure determination in patients with ANP. IAH over 15 mm Hg and citrulline below  $10,6 \mu\text{mol L}^{-1}$  are significant ( $P < 0.05$ ) independent factors of mortality of such patients.

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### O18. New laboratory markers of increased intra-abdominal pressure

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**Background:** Increased intra-abdominal pressure (IAP), intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS) are severe complications of surgical interventions with a high rate of mortality. The technique of IAP measurement is accurate, precise, reproducible and cost-effective. However, laboratory measures for monitoring of IAH have not been defined.

**Objective:** In our study we investigated the linkage between the serum levels of adenosine and interleukin 10 (IL-10) with IAP.

**Methods:** The serum of 25 surgical patients with IAP < 12 mm Hg and of 45 surgical patients with IAP > 12 mm Hg were tested. IAP were measured by the continuous IAP monitoring (CIAPM) technique. Serum adenosine concentration was measured by HPLC. Serum IL-1B, IL-2, IL-4, IL-10, TNF $\alpha$  and IFN $\gamma$  were determined by enzyme linked immunosorbent assay (ELISA). CRP was measured by nephelometry.

**Results:** Significant correlations of IAP were found only with serum levels of adenosine and IL-10. In the sera of patients with IAP > 12 mm Hg the levels of both adenosine (1.61 versus 0.06  $\mu\text{mol L}^{-1}$ ,  $P < 0.01$ ) and IL-10 (63.23 vs 27.27  $\text{pg mL}^{-1}$ ,  $P < 0.01$ ) were significantly higher than those in patients with IAP < 12 mm Hg. Moreover, significant correlations were found between individual patient IAP-adenosine values ( $r = 0.766, P < 0.001$ ) and IAP-IL-10 values ( $r = 0.888, P < 0.001$ ). A direct linear correlation between IAP-adenosine and IAP-IL-10 values was only observed with IAP > 15 mm Hg.

**Conclusions:** We report associations between IAP and the serum adenosine and IL-10 levels providing new tools for the laboratory monitoring of IAH as well as further understanding of the pathomechanisms contributing to ACS.

### O19. Assessment of peritoneal cytokines in patients with severe intra-abdominal sepsis managed with laparostomy and vacuum-assisted closure

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**Objective:** The aim of this study is to evaluate pro-inflammatory and anti-inflammatory cytokine levels in peritoneal fluid in patients with severe intra-abdominal sepsis and Vacuum Assisted Closure (VAC) and to correlate them with mortality.

**Methods:** Fifteen patients with severe intra-abdominal sepsis (SOFA score > 6, Mannheim Peritonitis Index > 29) treated with VAC. The onset of peritonitis was > 24h in all patients. VAC changes were made every 48h. Peritoneal fluid and blood samples were obtained for cytokines assessment at initial operation and subsequently in every VAC dressing change until permanent abdominal closure or death. Tumor necrosis factor (TNF $\alpha$ ), Interleukins 6 (IL-6), 8 (IL-8) and 10 (IL-10) were measured at operation (count 1), at first

VAC change (count 2) and at abdominal closure or patient's death (count 3).

**Results:** The levels of peritoneal IL-6 and IL-8 were extremely high ( $>400$  pg mL<sup>-1</sup>,  $>4500$  pg mL<sup>-1</sup> respectively). TNF $\alpha$  levels were maintained steadily during measurements (28 pg mL<sup>-1</sup>, 25 pg mL<sup>-1</sup>, 33 pg mL<sup>-1</sup>). IL-10 levels were high at operation and subsequently decreased (97.3 pg mL<sup>-1</sup>, 58.2 pg mL<sup>-1</sup>, 16.6 pg mL<sup>-1</sup>). Statistic analysis with non-parametric tests showed that levels of IL-8 at 48h were significant higher in survivors ( $P = 0.049$ ).

**Conclusions:** Peritoneal cytokine production is extremely high in patients with severe intra-abdominal sepsis even after the closure of laparostomy. Low IL-8 peritoneal levels at 1<sup>st</sup> VAC change are correlated with mortality.

## O20. Temporary abdominal wall closure — experience from a level 1-trauma center

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**Background:** Resuscitation leads to visceral edema often precluding abdominal wall closure; similar is the case with damage control surgery. In such patients owing to massive transfusion and aggressive fluid resuscitation there is always a chance of development of IAH/ACS. To obviate this complication we have been practicing a staged approach encompassing acute management through definitive abdominal wall reconstruction. The purpose of this report is to analyze our experience with this technique applied to the treatment of patients with open abdomen and giant abdominal wall defects.

**Objective:** To study the time taken for management of celiotomy, length of stay, complication rates and outcome of patients undergoing temporary abdominal wall closure as apart of damage control laparotomy.

**Methods:** Data was collected from prospectively maintained computer record of patients, data pertinent to mechanism of injury, procedure performed, demography, outcome, length of stay etc. was collected and analyzed. Our management scheme consists of 3 stages: stage I, mesh laparostomy for temporary closure (if edema quickly resolves within 3–5 days, the mesh is gradually pleated, allowing delayed fascial closure); stage II, mesh removal in patients without edema resolution (2–3 weeks after insertion to allow for granulation and fixation of viscera) and formation of the planned ventral hernia with either split thickness skin graft or full thickness skin closure over the viscera; and stage III, definitive reconstruction after 6–12 months (allowing for inflammation and dense adhesion resolution) by using the modified components

separation technique. Consecutive patients from 2008 to 2013 at AIIMS were evaluated. Outcomes were analyzed by management stage, with emphasis on wound related morbidity and mortality, and fistula and recurrent hernia rates.

**Results:** Mesh Laparostomy two hundred seventy four patients (35 with sepsis, 239 with hemorrhagic shock) were managed. There were 212 males (77%), and mean age was 37 (range, 12–88). The average size of the defects was 20 × 22 cm. In the stage I group, 108 died (143 patients i.e, 52% of all deaths) because of shock. The remaining 166 had temporary closure with polypropylene mesh. In the stage II group, 9 died (8% of all deaths) from sepsis multiple organ failure and 96% of the remaining 120 had split-thickness skin graft placed over the viscera. No wound related mortality occurred. There were a total of 7 enteroatmospheric fistulae. In the stage III group, to date, 73 of the 120 have had definitive abdominal wall reconstruction using the modified components separation technique/mesh hernioplasty. Mean follow-up was 24 months, (range 2–60). Recurrent hernias developed in 4 of these patients (5%).

**Conclusions:** The staged abdominal wall closure is time consuming but it's a safe and effective way to prevent abdominal compartment syndrome as well as to restore the abdominal domain.

## O21. Negative pressure therapy in the management of the complicated intra-abdominal infection and abdominal compartment syndrome

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**Background:** Application of the abdominal negative pressure therapy (NPT) has proved to be lifesaving in the management of critically ill patients suffering abdominal compartment syndrome (ACS) and complicated intra-abdominal infection (CIAI) when source control cannot be achieved in a single operation.

**Objective:** To share our experience with the application of the abdominal NPT.

**Methods:** Patients treated with open abdomen using abdominal NPT were prospectively included from December 2010 till December 2014. Only KCI® ABThera™ NPT systems were used. Acute Physiology and Chronic Health Evaluation II (APACHE II) score on admission, daily sequential organ failure assessment (SOFA) score and Mannheim peritonitis index (MPI) were calculated for severity definition.

The frequency of the NPT system changes, daily amount of aspirated fluid effluent and the time of abdominal closure were assessed. The overall hospital and ICU stay, complication rate and outcomes were analysed.

**Results:** In total 54 patients were included. Negative pressure therapy were applied in the treatment of 45 (83.3%) patients with CIAI, in 7 (12.9%) patients with severe acute pancreatitis and in 2 (3.8%) polytrauma patients who developed ACS as a damage control procedure. The median age of the patients was 60.5 years (range, 26 to 89), median APACHE II score was 15.5 points (range, 7 to 40) and median MPI was 27.5 points (range, 15 to 40). Sepsis developed in all patients, in 39 it was severe and 11 suffered septic shock. Median of 2 NPT system changes were needed and abdominal closure was feasible median on eight postoperative day without necessity for repeated laparotomy. Median plasma C-reactive protein levels and SOFA points before application of NPT were 246 mg L<sup>-1</sup> and 6.7 points, dropped to 73 mg L<sup>-1</sup> and 3 points after abdominal closure, respectively. Bleeding from the retroperitoneal space during the NPT was observed in 4 patients, intestinal fistulas developed in 4, which were successfully managed conservatively with NPT. Wound infection after abdominal closure complicated clinical course in 7 patients. The overall ICU and hospital stay were 14 (range, 5 to 70) days and 23.5 (range, 9 to 101) days, respectively. 11 patients died, contributing to the overall mortality of 20.3%. In 9 (81.8%) patients death was associated with the development of septic shock.

**Conclusions:** Abdominal NPT could be a highly promising method in the management of patients with increased IAP and CIAI that is associated with severe sepsis and septic shock.

## O22. Negative pressure therapy combined with mesh-mediated fascial traction

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**Background:** Nowadays management of an OA demands a dual treatment strategy. Both the abdominal organs and the abdominal wall need attention and specialised treatment. The abdominal organs demand protection, removal of excessive oedema and drainage of potential collections. Equally important, the abdominal wall needs improvement of its compliance, systemic and regional perfusion needs to be optimized and delayed primary fascial closure needs to be achieved as soon as possible.

**Methods:** The technique we use was first described by Petersson et al. using the intra-abdominal negative pressure

device ABThera™ (KCI Vacuum Assisted Closure, San Antonio, TX, USA) combined with mesh-mediated fascial traction. We present our experience.

It consists of blue polyurethane foam, oval shaped and coated in fenestrated plastic, placed over the viscera generously into the paracolic gutters and into the pelvic space. We believe application of the Abthera™ may help to reduce the formation of adhesions between the bowel and the anterior peritoneum, preventing formation of frozen abdomen and allowing easy repeated access to the viscera. The device needs to be individualized at patients' size by cutting the foam in the fenestrated plastic. In our opinion it is important to remove only 1 cube, to make sure the protective device is large enough to cover the entire abdomen, the paracolic gutters and Douglas' space. By doing that, access to the entire abdomen can be safeguarded. Second tip, is to mobilize the small bowel at every revision to prevent adhesion formation and evolution to formation of stage IV (Bjork et al.) frozen abdomen

**Results:** We believe the mesh should be sewn in a soon as possible, when OA is mandatory for a longer time than 1 week. It is important to make the mesh very tight and use a heavy weight, non-rigid mesh. Last, is to make the opening in the plastic fold for the suction cap, large enough to prevent obstruction. A total of 43 patients were treated with this technique of which 20 died on the ICU due to disease severity. In the other 23 patients abdominal wall was closed after 13 days (3–45) mean of 3 dressing changes (1–17). OA was present for a period of 10 days (0–46 days); skin closure could be achieved after 14 days (0–84 days). All patients with mesh-mediated fascial traction were closed after three shortenings of the mesh.

**Conclusions:** A 100% closing rate could be achieved in surviving patients using intra-abdominal NPT with MMFT. It should be the treatment of choice in management of the OA. Standardization of the technique is a key to success.

## O23. Relation between intra-abdominal pressure and early intestinal ischemia in rats

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**Background:** Abdominal compartment syndrome (ACS) is associated with high morbidity and mortality. These poor outcomes may be the result of intestinal ischemia. Development

of this complication could be prevented by early surgical decompression of the abdomen. The timing of this treatment can be challenging, since little is known on early irreversible effects of increased intra-abdominal pressure (IAP). The aim of this study was to determine the early effects of increasing IAP on respiratory parameters, hemodynamic parameters and the development of intestinal ischemia in rats.

**Methods:** Twenty-five anesthetized and ventilated male adult Sprague-Dawley rats were randomly assigned to five groups and exposed to an IAP of 0, 5, 10, 15, or 20 mm Hg for three hours. IAP was induced by intraperitoneal catheter infusion of Gelafundin 4%. Blood pressure, blood samples for arterial blood gas analysis, and serum samples were collected at baseline, 90, and 180 minutes. Serum albumin-cobalt binding (ACB) capacity was determined as measure for systemic ischemia. Intestines were processed for histopathology. Spearman rank correlation was used to test the association between IAP and these variables.

**Results:** IAP was negatively associated with mean arterial pressure at 90 (Spearman correlation coefficient;  $R_s = -0.446$ ,  $P = 0.025$ ) and 180 minutes ( $R_s = -0.466$ ,  $P = 0.019$ ), oxygen saturation and partial oxygen pressure ( $pO_2$ ) at 90 minutes ( $R_s = -0.673$ ,  $P < 0.001$ ;  $R_s = -0.561$ ,  $P = 0.004$ ) and 180 minutes ( $R_s = -0.882$ ,  $P < 0.001$ ;  $R_s = -0.752$ ,  $P < 0.001$ ), pH-value at 90 ( $R_s = -0.819$ ,  $P < 0.001$ ) and 180 minutes ( $R_s = -0.934$ ,  $P < 0.001$ ). IAP was positively associated with central venous pressure ( $R_s = 0.581$ ,  $P = 0.002$ ) at 180 minutes. There was no association between IAP and lactate level or ACB capacity at 90 and 180 minutes. No ischemic damage was found in the intestines of rats in any of the groups.

**Conclusions:** Although increasing IAP was associated with respiratory and hemodynamic difficulties, no signs for early intestinal ischemia were found.

## O24. The ultrasound “pop-up sign” reliably predicts correct nasogastric tube position in ICU patients

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**Background:** Complications due to a malpositioned nasogastric tube (NGT) may have disastrous consequences leading to prolonged length of stay or ultimately death. Therefore the correct position must be confirmed before usage of the NGT. Although several methods have been investigated (e.g. pH-metry, aspiration of gastric content, auscultation of air, ...) the chest X-ray remains the golden

standard to confirm correct position. However, a chest X-ray in an ICU patient has disadvantages including radiation exposure and cost and is labor intensive.

**Objective:** The aim of this study is to investigate the diagnostic accuracy of the ultrasound “pop-up sign” to confirm correct position of a nasogastric tube in ICU patients compared with chest X-ray.

**Methods:** In this single center prospective study, adult patients with no history of surgery to the stomach or esophagus, admitted to our mixed surgical and medical ICU were included if a NGT was placed. After placement of the NGT (either blind or with the laryngoscope/Magill forceps), the correct position was tested by ultrasound. The patient remained in the dorsal decubitus position with the head of the bed elevated 30°. The antrum of the stomach was visualized by ultrasound with a curvilinear abdominal probe (Philips CX50 — probe C5-). A nurse or second investigator was asked to rapidly insufflate the NGT with 60 mL of air. If a sudden pop-up of air (see Fig. 1), also known as dynamic fogging, was identified in the stomach in maximum 4 attempts, the sign was considered positive. The investigator was asked to only identify the pop-up sign as positive if he was absolutely certain of visualization of the sign. A chest X-ray was subsequently taken to confirm position.

**Results:** Eighty patients were included. The mean patient age was  $66 \pm 14.6$  years. The mean Body Mass Index was  $24.7 \pm 5.5$ . Sixty patients (75%) were invasively ventilated. In 63/80 patients (79%) the pop-up sign could be identified. The pop-up sign was identified after a single insufflation in 24/63 (38%) patients, two insufflations in 15/63 (24%) patients, three insufflations in 9/63 (14%) and four insufflations in 5/63 (8%) patients. In the remaining 10 patients (16%), the data of the number of attempts are missing. In all these 63 patients correct position of the NGT was confirmed by chest X-ray (positive predictive value 100%). On chest X-ray, the NGT was identified in the corpus in 49/63 (78%), in the cardia in 4/63 (6%), in the fundus in 7/63 (11%) and in the



Figure 1.



antrum in 3/63 (5%). In 17 patients the pop-up sign could not be identified. Of these the nasogastric tube was correctly placed in the stomach in 15 patients (88%), while two (12%) were midesophageal. The sensitivity of the method is thus  $63/78 (= 0.81)$ .

**Conclusions:** The ultrasound "pop-up sign" is a very reliable predictor of correct nasogastric tube position and is present in 81% of correctly positioned nasogastric tubes. We believe a confirmatory chest X-ray can be omitted after visualization of the pop-up sign (Fig. 1).

## Poster presentations

### P1. Correlation between different methods of intra-abdominal pressure monitoring in varying models of intra-abdominal hypertension

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**Background:** Advancement in clinical therapies and equipment has enabled better monitoring and physiological manipulation of patients developing intra-abdominal hypertension or abdominal compartment syndrome. Central to this is the ability to accurately measure the intra-abdominal pressure. The aim of this study was to determine if there was correlation between different methods of intra-abdominal pressure monitoring in varying porcine IAH models.

**Objective:** To assess the statistical agreement between trans-vesical (TV), trans-gastric (TG), and direct trans-peritoneal (TP) pressure monitoring in 2 models of intra-abdominal hypertension, namely a pneumoperitoneum model and an intestinal obstruction model at different pressures.

**Methods:** Fifty-nine pigs were divided into 6 groups; a control group (Cr) (n = 5), pneumoperitoneum groups with IAP of 20 mm Hg, 30 mm Hg, and 40 mm Hg (Pn20, Pn30, Pn40) (n = 40), and intestinal occlusion group at pressures of 20 mm Hg and 30 mm Hg (Oc20, Oc30) (n = 14). Intra-abdominal pressure was then measured in each pig using the 3 methods simultaneously at different times. Multiple measurements were achieved for each animal. The control group did not have any intervention to increase the intra-abdominal pressure.

Intra-class correlation was used to assess agreement between the three pressure measurement methods.

**Results:** The first comparison between all 3 methods of pressure measurement (TP vs TG vs TV) showed very poor agreement in the control group (variance fraction = 0.0).

There was good agreement in the other groups (Pn20 = 0.87; Pn30 = 0.96; Pn40 = 0.88; Oc20 = 0.69; Oc30 = 0.86). A comparison between TP and TG had similar results (Cr = 0.0; Pn20 = 0.85; Pn30 = 0.94; Pn40 = 0.90; Oc20 = 0.78; Oc30 = 0.78), as did a comparison between TP and TV (Cr = 0.0; Pn20 = 0.83; Pn30 = 0.95; Pn40 = 0.86; Oc20 = 0.59; Oc30 = 0.88). Of importance, there was also good correlation between TV and TG methods (Cr = 0.0; Pn20 = 0.95; Pn30 = 0.98; Pn40 = 0.88; Oc20 = 0.69; Oc30 = 0.91).

**Conclusions:** All three measurement methods showed poor agreement at low intra-abdominal pressures, but at higher pressures agreement improved dramatically. Agreement did not differ according to the intra-abdominal pressure model used. From this study it appears as though either intra-vesical or transgastric pressure measurements can be used for IAP measurement, however, these have better agreement with trans-peritoneal pressures greater than 20 mm Hg.

### P2. Treatment of abdominal hypertension in obese patients needs a new vacuum chamber

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**Background:** ABDOPRE is a noninvasive device to lower intra-abdominal pressure (IAP), which includes a bell to be put on the patient's abdomen. Negative pressure is created by an external pump. Application to an obese patient was counter productive, as higher pressure was induced due to lack of firm anatomical footholds. A new design of the bell was defined and tested in two 19 patients series. Transparent metacrilate (PMMA) was selected for the design for 2 bell models 250 & 370 g and 14 & 20 L capacity.

Abdominal Hypertension (AHT) is a complex condition which can be anticipated by lowering intraabdominal pressure (IAP) by surgical procedures. We have developed ABDOPRE to achieve the same goal non invasively. ABDOPRE applies a controlled negative pressure onto the abdomen, to lower IAP. Preliminary use has suggested a new design of the externally applied bell. ABDOPRE includes a special skin gasket and a bladder catheter to measure the control variable: IAP. ABDOPRE is not applied continuously but follows alternating pressure protocols set by software.

**Table 1.** Bell fit for a and b to bell sizes T1 AND T2

Patients	a	T1:27	T2:33	b	T1:19	T2:24	Size
1	27.9	-0.9	5.1	18.4	0.6	5.6	T1
2	34.8	-7.8	-1.8	25.9	-6.9	-1.9	T2
3	35.7	-8.7	-2.7	25.3	-6.3	-1.3	T2
4	28.0	-1.0	5.0	18.1	0.9	5.9	T1
5	32.4	-5.4	0.6	23.1	-4.1	0.9	T2

**Objective:** To design a bell that would not cave into the abdomen.

**Methods:** The bell must be resistant to negative pressures necessary to lower IAP. It should be light enough to be easily handled in clinical settings, hypoallergenic and resistant to disinfection. It should be transparent so as to see the skin of the patient. To avoid the bell to cave into the abdomen (Fig. 1), it must be applied onto solid bone footholds: iliac crests, sternum, pelvic bone and ribs.

Two 19 patients series were measured in the intensive care unit, the first to define the bell size and the second to evaluate fitting. Every measure was displayed as a histogram. The second group of patients was measured and fitted to either size 1 or size 2 of the bell, by minimum distance differences. Several variables were defined, such as patient height, thoracic width, "sternal notch to pubis" a and "iliac crest to 10<sup>th</sup> coastal-axillary median" b. The distribution of such parametres was obtained to enhance groupings around standard values. Every grouping would suggest a bell of a given size.

**Results:** Amongst all measures, it was found that patient height is dominant to discriminate sizes, because the distributions of its related variables, a and b, have two marked peaks. Hip width is non critical due to the spread of values found. This turned out to be useful and can be explained by the fact that there is an ample supporting base around the

**Table 2.** Bell characteristics

	Bell [1]	T1	T2	
Air volume	161480	13692.0	20344.1	cm <sup>3</sup>
Bell volume	252.1	212.3	314.9	cm <sup>3</sup>
Weight	302.5	254.7	377.8	g

iliac crest. This discards gender specific bells. Table 1 shows measurements a and b of 5 patients to whom we assigned size T1 or T2.

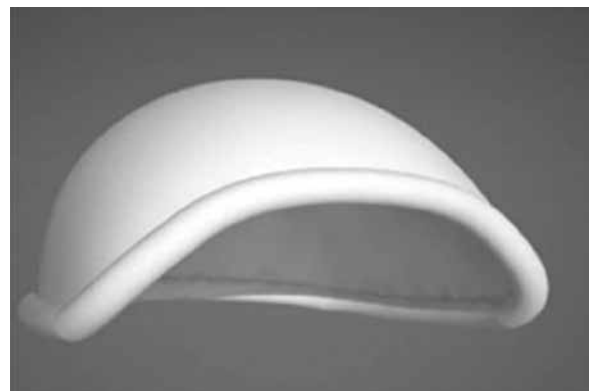
The two peaks of the histogram suggest two bell sizes. Dimension a has peaks at 27 and 33 cm. Each patient has a distance between its "a-value" and the center of both peaks. We assign the size (T1 or T2) to the shorter distance. As in Table 1, patient 1 has a distance of -0.9 to peak T1 and a distance of 5.1 to peak T2 and therefore is assigned to size T1.

Table 2 shows the dimensions of the two bells, as they were designed, based on patients measurements, and further virtual check with the second group of patients. Figure 2 shows the bell in its projected shape.

**Conclusions** Use of the original bell led to results opposite to the desired lowering of IAP. This was due to lack of firm points on which the bell would rest. Measurements in 19 patients allowed to separate the population in two sizes, and to design a new shape of bell, as shown in Figure 2.



**Figure 1.** Application of ABDOPRE original bell onto the abdomen of an obese patient (BMI = 34.9): similar to a hernia, the bell caves into the abdomen



**Figure 2.** Design of a revised bell, with supporting points on anatomical footholds: iliac crests, sternum, pelvic bone and ribs

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## P3. Influence of intra-abdominal hypertension on blood coagulation system

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**Background:** Most of the complications of intraabdominal hypertension and compartment syndrome (myocardial infarction, ischemia, phlebothrombosis, pulmonary embolism) is undoubtedly related to the changes in blood coagulation. However, these changes may be due not only to intraabdominal hypertension, but also influenced by other factors (for example: toxinemiya, initial diseases of blood and blood circulation). This fact requires the experiment with “clean” body to assess the influence of intraabdominal hypertension on blood coagulation system without regard of extraneous factors.

**Objective:** To evaluate the influence of intraabdominal hypertension on blood coagulation parameters.

**Methods:** The experimental research: male rats of the same age, weight, diet (n = 100). Among them: a control group (n = 10) — intact animals without affecting; comparison group (n = 90) — animals, which was artificially created by intraabdominal hypertension of different degrees (15, 25, 35 mm Hg) and different exposure times (3, 12, 24 hours). More detailed diagram of the division of animals into groups is presented in Table 1. In all animals we investigated the main indicators of coagulation (fibrinogen, prothrombin index (PTI), activated partial thromboplastin time (APTT)).

**Results:** Results of experiment are presented in Table 1.

### Conclusions:

1. Intraabdominal pressure 15 mm Hg for 3 hours (corresponds to the magnitude and duration of pneumoperitoneum during laparoscopic operations) causes minor changes coagulation parameters (within tolerance), which proves the safety of pneumoperitoneum.
2. Intraabdominal pressure 25 and 35 mm Hg for 3 hours cause laboratory signs of hypercoagulation, however, statistically significant differences are not in all the coagulation indicators.
3. Intraabdominal pressure of 15, 25 and 35 mm Hg for 12 hours caused undoubtedly, statistically significant signs of hypercoagulation.
4. Changes in the coagulation parameters of intraabdominal pressure groups 15, 25 and 35 mm Hg for 24 hours can be considered in two ways: as an adaptation to stress and return to normal coagulation parameters or the initial signs of the next phase — hypocoagulation. There is no possibility to make clear conclusion in this experiment.

**Table 1.**

Control group (intact rats), n = 10									
FG (fibrinogen) 2.16 ± 0.37 g L <sup>-1</sup>									
APTT (activated partial thromboplastin time) 34.5 ± 4.2 sec									
PTI (prothrombin index) 99.75 ± 4.5%									
Comparison group (rats with IAH), n = 90									
15 mm Hg, n = 30			25 mm Hg, n = 30			35 mm Hg, n = 30			
	3 hours (n = 10)	12 hours (n = 10)	24 hours (n = 10)	3 hours (n = 10)	12 hours (n = 10)	24 hours (n = 10)	3 hours (n = 10)	12 hours (n = 10)	24 hours (n = 10)
FG	2.72 ± 0.63	4.06 ± 0.41*	2.72 ± 0.35	2.59 ± 0.3	4.04 ± 0.48*	3.78 ± 0.32*	2.51 ± 0.29	4.16 ± 0.48*	3.03 ± 0.12*
APTT	31.0 ± 5.35	31.0 ± 3.9	35.0 ± 4.1	26.0 ± 5.35	30.0 ± 2.8	30.0 ± 3.91	26.0 ± 5.25*	29.5 ± 2.7*	39.8 ± 3.83*
PTI	107.3 ± 4.04	120.0 ± 4.01*	95.5 ± 4.05	109.5 ± 3.54*	108.8 ± 5.01*	95.5 ± 4.05	108.3 ± 3.44*	110.5 ± 4.01*	91.1 ± 4.05*

\* P < 0.05

#### P4. APACHE II–IAP: a prognostic model for the mortality in surgical patients after abdominal surgery

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**Background:** Although the effectiveness of antimicrobial drugs has increased in the last few decades and the advantages of nutritional support, the mortality rate of surgical patients with infectious intra-abdominal complications after abdominal operation is still too high. That's why it is imperative to study in depth those factors that, in association with clinical signs, can improve the prognosis in order to plan the resources and strategies to diminish morbidity and mortality after abdominal surgery

**Objectives:** To develop a mathematical model for the prognosis of mortality in surgical patients with intra-abdominal infectious complications using some factors related and to evaluate the additive effect of IAP within this model.

**Methods:** A prospective observational study with a cohort of 300 critically ill patients after abdominal surgery consecutively admitted at the "Calixto García" Hospital intensive care unit (ICU), from January 2010 to January 2012. The patients were randomly separated in two groups (2: 1): estimation group and validation group. The dependent variable was mortality, and the independent variables were the age, gender, malignancy, APACHE II AND IAP. The models were developed in the estimation group and validated in the second group. The statistics included collinearity analysis, outliers and binary logistic regression for the development of the models, Hosmer-Lemeshow test for the calibration and ROC curve for the discrimination.

**Results:** Three prognostic models were developed in the estimation group: model I (APACHE II-IAP), model II (APACHE II), and model III (IAP). The common variables included in the three models were the age, gender and malignancy. The three models had a good performance concerning its calibration and discrimination, the difference between the three AUC was not significant ( $P = 0.0941$ ). The AUCs ROC were 0.983 (IC de 95%: 0.960 — 1,000) in model I; 0.989 (IC de 95%: 0.972–1.000) in model II and 0,966 (IC de 95%: 0.932–1.000) in model III (Fig. 1).

**Conclusions:** The combination of different prognostic factors in critically ill surgical patients in the mathematical models presented helped accurately to the prediction of mortality with similar effectiveness, but APACHE II — IAP model was the most integral, followed by the IAP model. Undoubtedly, the combination of IAP and APACHE II in a prognostic model added strength and specificity to the prediction of mortality in this cohort of critically ill patients

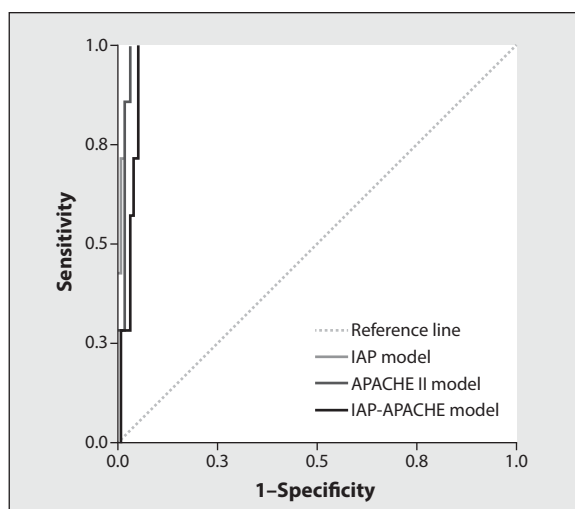


Figure 1.

after abdominal surgery. However, IAP model, the most economical, is more feasible in almost all clinical settings.

#### P5. The endoscopic component separation technique in large ventral hernias: a useful tool to reduce wound morbidity

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**Background:** The technique of Component Separation (CS), is an excellent tool to facilitate closure of large abdominal wall defects, but it's also associated with high wound morbidity, due to the extensive subcutaneous dissection needed. More recently, an endoscopic variant was introduced to decrease these complications especially in high-risk patients.

**Methods:** Two patients underwent an endoscopic CS for repair of a giant incisional hernia. In both the indication of CS was made preoperatively by the clinical examination and the findings on the CT scan of the abdomen. The indication for endoscopic release in the first patient was the presence of morbid obesity and diabetes; in the second patient the reason was a spontaneous skin rupture he presented himself with after treatment with bevacizumab. Due to all related risk factors for wound morbidity, a laparoscopic bilateral component separation with open retro-muscular (Rives-Stoppa) mesh repair was performed. In the first patient an excellent result was obtained, the hernia could be repaired, but in the second one the endoscopic CS had to be converted to open to obtain more fascia release by finalizing the subcutaneous dissection.

**Conclusions:** The endoscopic anterior CST minimizes the subcutaneous dead space using limited-access tunnelled incisions, therefore potentially reducing morbidity. LCS technique should be considered in complex abdominal wall reconstruction, particularly in those patients with an increased risk for wound-healing complications. But the impression arises that there is less gain in fascial mobilization due to a more limited subcutaneous dissection.

## P6. Effect of early enteral nutrition (EN) on outcomes in children undergoing emergent exploratory laparotomy (EEL)

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**Background:** The gastrointestinal tract requires adequate length, motility and perfusion to achieve optimal absorption of nutrients. Intestinal failure (IF) is defined as a critical reduction of the gut mass or function below the minimum needed

to absorb nutrients and fluids required for adequate growth in children, mandating the use of parenteral nutrition (PN)<sup>1</sup>. EN stimulates hormone release; prevents histological changes in the bowel lining; modulates the stress response in critically ill patients, and attenuates the adverse effects of PN<sup>2,3</sup>.

**Objective:** To determine effects of early EN on short term outcomes in EEL.

**Methods:** Retrospective chart review between January, 2013 and December, 2014 at a single tertiary institution. Anthropometric data was used to calculate the calorie goals per patient using pre-determined prematurity calculations for premature children until 40 weeks gestational age. The Schofield and World health organization equations were used for patients born full-term and older, incorporating pre-determined stress factors and nutritional status. Demographics and severity of illness and outcome data were recorded. Data was compared in patients who had EN initiated by post-operative day (POD) 6 versus after POD 6. PN at POD 30 was used as an indicator of delayed return of intestinal function. For patients discharged before POD 30 on PN, it was presumed IF because of extensive bowel resection.

**Results:** Outcomes were better in those with early EN compared to those started on EN after POD 6 (Table 1).

**Conclusions:** Outcomes were better in EEN but this is likely a reflection of the difference in the severity of illness between groups. The clinical presentation and diagnoses

**Table 1.** Comparison of EN before POD6 to after POD 6

	EN before POD #6 (n = 59 )	EN after POD#6 (n = 57 )	P-value
<b>Demographics:</b>			
Median age (range) mths	37.0 (203.2)	1.1 (209.5)	< 0.001***
Median weight (range) Kg	15.0 (122.5)	3.6 (90.8)	< 0.001***
Male (%)	49.2	67.3	
<b>Diagnosis:</b>			
Small bowel obstruction (%)	47.5	30.9	
Ischemia (%)	0.0	10.9	< 0.001*
Trauma (%)	10.2	7.3	
Necrotizing enterocolitis (%)	1.7	29.1	
Other	40.7	21.8	
<b>Severity of illness:</b>			
ICU admission (%)	24.1	96.2	< 0.001*
Mechanical Vent (%)	5.1	41.8	< 0.001*
Inotrope need (%)	0.0	60.8	< 0.001*
Dialysis (%)	0.0	11.3	< 0.010**
CPR (%)	0.0	17.0	0.001**
Bowel resection (%)	24.1	48.1	0.008*
Open abdomen (%)	1.7	56.4	< 0.001*
<b>Outcomes:</b>			
PN at POD 30	1.9	42.5	< 0.001*
<sup>1</sup> PN at discharge	1.7	14.7	0.025**
Primary fascial closure (%)	100.0	62.3	< 0.001*
Median LOHS (ranges) days	8.0 (58.0)	24.00 (194)	< 0.001***
Median LOICU (ranges) days	0.0 (56.0)	18.00 (183)	< 0.001***
28-day mortality (%)	0.0	30.9	< 0.001*
Hospital Mortality (%)	1.7	40.0	< 0.001*

LOHS — days in hospital, LOICU — days in ICU; \*Pearson Chi-Square, \*\*Fisher's Exact Test; \*\*\*Mann Whitney U Test

indicating need for EEL may influence practitioner's decision to initiate EN. Also surgeons rely on vomiting, residual gastric volumes, passing gas and/or stools to indicate return of gastrointestinal function before commencing enteral feeds. These factors may not be sensitive in defining return of bowel function and may negatively impact initiation of feeds. A prospective study is needed to gain better understanding of the impact of EEN on IF.

#### References:

1. *D'Antiga L, Goulet O*: Intestinal failure in children: the European view. *J Pediatr Gastroenterol Nutr* 2013; 56: 118–126.
2. *de Assis MC, Silveira CR, Beghetto MG, de Mello D*: Is duration of postoperative fasting associated with infection and prolonged length of stay in surgical patients? *Nutr Hosp* 2014; 30: 919–926.
3. *Wales PW, Allen N, Worthington P et al.*: A.S.P.E.N. Clinical guidelines: support of pediatric patients with intestinal failure at risk of parenteral nutrition-associated liver disease. *J Parenter Enteral Nutr* 2014; 38: 538–557.

### P7. Decrease in intra-abdominal hypertension increases peripheral perfusion index in patients undergoing cesarean section

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**Background:** Intra-abdominal hypertension (IAH) caused circulatory disorders. A surgical decompression has been well established methods for correction of IAH-related pathologies. Several studies have presented an increase in cardiac output (CO), stroke volume (SV) and decrease in

pulmonary and systemic vascular resistance following decompression [1, 2]. Unfortunately, the changes in peripheral perfusion has been not documented. The aim of this study was to analyse the effect of rapid decompression of IAH on peripheral perfusion index (PI).

**Methods:** Pregnant woman undergoing Cesarean section under spinal anaesthesia were studied. Intra-abdominal pressure (IAP) was measured via the urinary bladder (Kron technique). PI was monitored using pulse oximeter Radical 7. Cardiac output (CO), cardiac index (CI), stroke volume (SV) and stroke volume index (SVI) were measured using bioimpedance cardiometer ICON C3. PI was measured in the upper and lower limbs (PIU and PIL, respectively). All parameters were measured preoperatively.

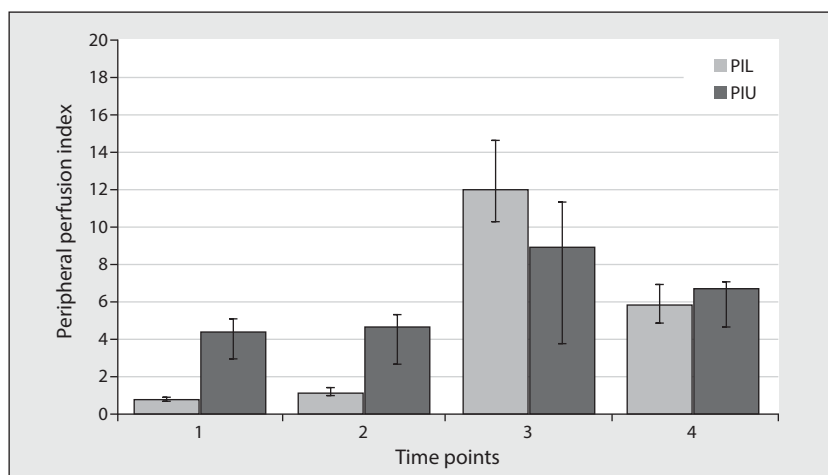
**Results:** 54 woman aged 18 — 26 were enrolled. Mean preoperative IAP, PIU and PIL were:  $16.35 \pm 2.27$  mm Hg, 0.78 and 4.4. The induction of anaesthesia decreased IAP ( $P < 0.01$ ), improved PIL and increased CO ( $P < 0.001$ ). PIU and PIL increased just after surgery, however increase in PIL was significantly greater than PIU (Fig. 1). Higher values of PIU and PIL were also noted six hours after surgery. Surgical decompression reduced IAH and increased CO, CI, SV and SVI ( $P < 0.001$ ). PIL correlated with IAH ( $P < 0.001$ ,  $r = -0.76$ ).

#### Conclusions:

1. Pregnancy increases IAP and Cesarean section reduces IAP.
2. IAH disturbs PIL.
3. Spinal anaesthesia improve IAH-reduced PIL.
4. Surgical decompression improves PI.
5. PIL correspond with IAP.

#### References:

1. *Cheatham ML, Malbrain ML*: Cardiovascular implications of abdominal compartment syndrome. *Acta Clin Belg* 2007; (suppl 1): 98–112.
2. *Malbrain ML, Ameloot K, Gillebert C, Cheatham ML*: Cardiopulmonary monitoring in intra-abdominal hypertension. *Am Surg* 2011; 77 (Suppl 1): S23–30.



**Figure 1.** Changes in peripheral perfusion index in lower limb (PIL) and upper limb (PIU) in comparison with baseline value. Time points: 1 — just before anaesthesia (baseline value), 2 — just before surgery, after spinal anaesthesia induction, 3 — after surgery, 4 — 6 hours after surgery

## P8. Tips and tricks for vacuum assisted closure of enterocutaneous fistulas, the importance of full ambient depression

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**Background:** Vacuum-assisted closure (VAC) therapy is a widely acknowledged method for second intention wound closure. At first, VAC therapy was contraindicated in the treatment of intestinal fistulas as it was reported to delay their closure and cause internal organ damage. But as time went by, this method revealed itself to be a useful tool for fistula management even though with some limits.

**Objective:** of this report is to illustrate our experience with Enterocutaneous (ECF) and enteroatmospheric fistulas (EAFs) in the first place, but also to communicate some tips and tricks that can be useful to operators. The difficulty of performing randomized controlled studies with the use of VAC therapy in these very different conditions is well known and the big part of literature consists in reports of cases or series. However, experience based evidence does reveal itself to be useful.

**Methods:** The history of 13 patients treated for complex fistulas from January 2011 to February 2015 was revised. Five of them presented with enterocutaneous and eight with enteroatmospheric fistulas. All were treated with VAC therapy with variations (tips and tricks) elaborated to help in accelerated closure of intestinal wall lesions. In particular, in the most recent cases, a beneficial effect of depression of the full ambient of the enteroatmospheric fistulas was noticed, especially in high output proximal intestinal fistulas and an easy device to obtain this effect is described.

**Results:** Five out of 5 ECFs closed spontaneously. In the EAF group, in seven cases the fistula/fistulas turned slowly into an entero-cutaneous fistula, and in one out of eight it closed spontaneously. The mean length of VAC therapy™ was 35.5 days and that of spontaneous closure was 36.4 days. Modified vacuum assisted therapy with full ambient depression was adopted in four cases. All these EAFs were transformed into ECFs.

**Conclusions:** The results of our study encourage the use of VAC therapy™ for the treatment of enterocutaneous fistulas. VAC therapy™ use has a double therapeutic value: (1) it promotes the healing of the skin and allows also the management of EAFs; (2) in selected cases, those in which it is possible to create a deep fistula tract ("well") it is possible to assist to a complete healing with closure of the ECFs. 3) Vacuum therapy of the full fistula ambient greatly assists in fistula management and can be done with a simple and practical device.

## P9. Comparison of peritoneal and serum CX3CL1/fractalkine levels in patients with severe abdominal sepsis

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**Objective:** CX3CL1/fractalkine is a unique member of chemokines (CX3C family) and is expressed by inflamed endothelial cells and macrophages. CX3CL1 exists in soluble and membrane-bound forms and it binds to its only specific receptor, CX3CR1. During peritonitis, both CX3CL1 and CX3CR1 are expressed by intraperitoneal macrophages. The aim of this study is to evaluate the levels of soluble CX3CL1 in serum plasma and peritoneal fluid in patients with severe intra-abdominal sepsis treated with Vacuum Assisted Closure (VAC) and to correlate them with morbidity and mortality.

**Methods:** Fifteen patients with severe intra-abdominal sepsis (SOFA score > 6, Mannheim Peritonitis Index > 29) treated with VAC were allocated to two groups; group A: survivors and group B: non-survivors. The onset of peritonitis was > 24h in all patients. VAC dressing changes were made every 48h until abdominal closure or death. Peritoneal fluid and blood samples were obtained for CX3CL1 assessment at initial operation and subsequently in every VAC change until the abdominal closure or death. CX3CL1 soluble form was measured with ELISA at initial surgery (count 1), 1st VAC change (count 2) and final abdominal closure or death (count 3). The following operative and clinical variables were recorded and analyzed: age, sex, pathology, initial SOFA score, APACHE II score, intra-abdominal pressure (IAP) and mortality rate.

**Results:** CX3CL1 peritoneal levels were significantly higher than serum levels in count 2 ( $P=0.019$ ) and count 3 ( $P=0.05$ ). The two groups were not significantly differing as for the clinical characteristics. CX3CL1 serum levels were significantly higher at group B in count 1 ( $P=0.005$ ) when peritoneal levels were significantly higher at group B in count 2 ( $P=0.02$ ).

### Conclusions:

1. CX3CL1 levels are significantly increased in peritoneal fluid and remains at high levels during clinical course.
2. CX3CL1 levels in serum are high at operation and subsequently decreased.
3. CX3CL1 serum levels at initial operation and peritoneal levels at 1<sup>st</sup> VAC change are correlated with significant mortality.



### P10. Outcomes in children undergoing emergent exploratory laparotomies

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**Background:** Emergent exploratory laparotomies (EEL) are commonly performed in patients with acute abdomens. Outcomes in this cohort are not known. Some patients require varying degrees of bowel resection (BR) which may lead to bowel dysfunction affecting alimentation, growth and parenteral nutrition (PN) dependence. Long-term PN is associated with complications like central line access challenges and infections; multiple hospitalizations; PN associated liver dysfunction often resulting in liver transplant or death(1).

**Objective:** To determine 28-day mortality and analyze morbidity associated with this cohort. To understand the effects of BR on outcomes.

**Methods:** Consecutive EEL between January 2013 and December 2014 were reviewed. Demographic, severity of illness and outcomes data including 28-day mortality; length of hospital stay (LOHS) and of intensive care stay (LOICU); and PN dependence at post-operative day (POD) 30 were reported. We stratified outcomes by age.

**Results:** Of 117 EEL (0–18 years), the most common indication was small bowel obstruction (SBO) 39.3% then necrotizing enterocolitis (NEC) (14.5%). Overall, 28-day and hospital mortality was 14.5% and 19.8% respectively. 28-day mortality in those with BR was 24.4% versus 9.5% without (*P*-value 0.031) (Tables 1, 2).

**Conclusions:** EEL requiring BR presented with greater severity of illness and had a higher mortality. Greater focus should be placed on understanding and improving outcomes in this cohort. Prospective studies with larger numbers of patients are needed to validate these findings.

**Reference:**

1. Wales PW, Allen N, Worthington P et al.: A.S.P.E.N. Clinical Guidelines: Support of Pediatric Patients With Intestinal Failure at Risk of Parenteral Nutrition-Associated Liver Disease. *J Parenter Enteral Nutr* 2014; 38: 538–557.

**Table 1.** Demographics

	BR (n = 41)	No BR (n = 71)	P-value
Median age (mth)	1.0 (0.0–209.5)	36.38 (0.0–203.2)	< 0.001***
Median wt (kg)	3.6 (0.9–91.6)	14.05 (0.8–125.2)	< 0.001***
Male gender (%)	56.1	60.8	0.622*
<b>Diagnoses:</b>			
SBO (%)	51.2	32.4	0.003**
Ischemia (%)	7.3	4.1	
Trauma (%)	7.3	9.5	
NEC (%)	22.0	9.5	
Other (%)	12.2	44.6	
<b>Severity of illness:</b>			
ICU admission (%)	76.9	47.3	0.002*
ACS (%)	39.0	23.0	0.068*
Mechanical ventilation (%)	14.9	36.6	0.008**
Inotropes (%)	38.5	22.2	0.069*
Dialysis (%)	5.0	5.4	1.000**
CPR (%)	7.3	8.2	1.000**

\*Pearson Chi Square, \*\*Fisher's Exact Test, \*\*\*Mann Whitney U Test

**Table 2.** Outcomes stratified by age

0–28 days			
	BR (n = 20)	No BR (n = 12)	P-value
28-day mortality (%)	35.0	0.0	0.029**
Median LOHS days	21.0 (5–138)	27.0 (6–183)	0.953*
Median LOICU days	21.0 (5–138)	18.0 (1–183)	0.820*
Open abdomen (%)	45.0	25.0	0.452**
1° fascial closure (%)	65.0	90.9	0.203**
TPN at POD 30 (%)	30.8	40.0	0.685**
29 days–12 months			
	BR (n = 10)	No BR (n = 14)	P-value
28-day mortality (%)	21.4	20.0	1.000**
Median LOHS days	31.0 (1–194)	10.0 (2–179)	0.538*
Median LOICU days	17.5 (0–144)	1.0 (0–179)	0.674*
Open abdomen (%)	30.0	28.6	1.000**
1° fascial closure (%)	90.7	85.7	NA
TPN at POD 30 (%)	22.2	16.7	1.000**
> 12 months			
	BR (n = 11)	No BR (48)	P-value
28-day mortality (%)	9.1	8.3	1.000**
Median LOHS days	14.0 (5–59)	6.5 (0–109)	0.019*
Median LOICU days	0.0 (0–14)	0.0 (0–37)	0.151*
Open abdomen (%)	36.4	18.8	0.237**
1° fascial closure (%)	90.9	83.3	1.000**
TPN at POD 30 (%)	14.3	10.0	0.571**

\*\*Fisher's Exact Test, \*Mann Whitney U Test

**Table 1.**

	Beta-galactosidase, IU		N-acetyl-beta-glucosaminidase, IU		Oedema index		Ascytis, ml		Hematocrit	
	1	2	1	2	1	2	1	2		
Sham-operated	3.48 ± 0.008		1.16 ± 0.006		0		0		0.47 ± 0.03	
6 hours	7.96 ± 0.015*	3.59 ± 0.014**	4.30 ± 0.01*	1.21 ± 0.009**	1.7 ± 0.2	2.1 ± 0.1	2.4 ± 0.3**	3.7 ± 0.2	0.53 ± 0.03	0.54 ± 0.02
12 hours	6.66 ± 0.014*	3.62 ± 0.015**	3.75 ± 0.011*	0.73 ± 0.01**	2.1 ± 0.2	2.8 ± 0.2	3.0 ± 0.1**	5.9 ± 0.3	0.56 ± 0.03	0.61 ± 0.04*
24 hours	5.18 ± 0.013*	3.39 ± 0.013**	3.14 ± 0.013*	1.23 ± 0.012**	1.6 ± 0.2**	2.8 ± 0.3	2.8 ± 0.3**	7.4 ± 0.5	0.52 ± 0.02**	0.60 ± 0.02*
48 hours	5.73 ± 0.011*	3.25 ± 0.012**	3.37 ± 0.012*	1.18 ± 0.01**	1.1 ± 0.3**	2.9 ± 0.1	3.2 ± 0.5**	7.7 ± 0.4	0.49 ± 0.04	0.56 ± 0.04

\* $P < 0.05$  in comparison with sham-operated group; \*\* $P < 0.05$  in comparison with sham-operated 1 group; 1 — animals with SAP; 2 — animals with SAP and L-lysine aescinate infusion

### P11. L-lysine aescinate decreases intraabdominal tissue oedema during severe acute pancreatitis

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**Background:** Intraabdominal hypertension (IAH) has harmful effects on progression of severe acute pancreatitis (SAP) due to disorders of intestinal wall metabolism and enhancing of bacterial translocation to pancreatic necroses [1]. Oedema of intra- and retroperitoneal tissues is an important factor of elevation of abdominal pressure during different inflammatory processes including SAP [2]. So aim of our research was to investigate the influence of lysosomal ferments inhibitor L-lysine aescinate on fluids shift into the tissues during SAP.

**Methods:** SAP was induced in 90 Wistar rats by intraperitoneal injection of 250 mg/100 g of L-arginine solution twice during 1 hour. L-lysine aescinate has been infused into femoral vein 0.015 mg/100 g twice per day in 1 group or normal saline — in 2 group. Changes of ascytis volume, tissue oedema index, activity of glycolytic, proteolytic and fibrinolytic ferments were investigated in mucosal layer of small intestine and intraperitoneal mesenteric fat during 6–48 hours from induction of SAP.

**Results:** In animal of 1 group induction of SAP has caused liberation of lysosomal enzymes: glycolytic (beta-galactosidase and n-acetyl-beta-glucosaminidase) activity increased on 2–3 time, proteolytic (mostly collagenolytic) — on 30–54% ( $P < 0.05$ ). As result of disorders of microvascular permeability fluids shift to the tissue occurred — oedema index increased on 2–2.5 time, hematocrit on 24–32% ( $P < 0.05$ ) and large volume ascytis formation (5,9–7,7 mL) appeared. Infusion of L-lysine aescinate returned lysosomal

ferments activity in tissues to sham-operated animals values and was followed with increased oedema index only on 25–41%, hematocrit — on 4–8% and formation of small volume (2,4,3,2 mL) ascytis ( $P > 0,05$ ).

**Conclusions:** Infusion of L-lysine aescinate to rats with SAP prevents disorders of microvascular permeability by lysosomal enzymes and reduces oedema formation in intrabdominal tissues. Such effects of L-lysine aescinate may be directed for prevention and attenuation of IAH syndrome in patients with SAP (Table 1).

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1. Rotar OV, Rotar VI: Increase of intraabdominal pressure worsens progress of acute pancreatitis. *Pancreatology* 2012; 12: S.508.
2. Chen H, Li F, Sun J-B, Jia J-G: Abdominal Compartment Syndrome in patients with severe acute pancreatitis in early stages. *World J Gastroenterol* 2008; 22: P. 3541–3548.

### P12. Temporary abdominal closure with negative pressure therapy. Can we expect to observe different results through comparison of the indication and differences in treatment?

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**Background:** Temporary abdominal closure with negative pressure wound therapy (TACNPWT) is the treatment of choice for abdominal compartment syndrome (ACS) and forms part of damage control surgery (DCS). The results achieved with the therapy vary depending on the indication and technical aspects.

**Objective:** To identify the results of the TACNPWT and to analyze whether they may vary in function of the indication and the different treatments applied.

**Methods:** Observational analytical study performed on a prospective basis. Inclusion criteria: Patients who received TACNPWT between October 2011 to March 2014 and who were medically discharged before the end of the study. All participants completed the TACNPWT using the standard abdominal dressing and connection to KCI's V.A.C.® system, or using KCI's ABThera™ system. The statistical program SPSS 15 was used.

**Results:** 28 patients received TACNPWT, 4 of whom were excluded. There were 18 men and 6 women, with an average age of 54.2 years (15–80). Six procedures (25%) were performed because of ACS, all on male patients; 4 were due to a burst abdominal aortic aneurysm, 1 for acute pancreatitis and 1 after a liver transplant. The average intra-abdominal pressure before the procedure was 27.3 mm Hg (20–40). 18 patients received operations in the context of DCS (12 men and 6 women); 2 for polytrauma, 2 following mesenteric ischemia surgery and 14 because of severe abdominal sepsis. The average SOFA score for the ACS group was 11.3 (7–14), while for the DCS group was 10.5 (3–14) (n.s.). The average APACHE II score for the ACS group was 29.1 (22–38) and for the DCS group, 23.5 (4–34) (n.s.). The average time spent in the ICU was 21.13 days (0–127). Eight patients died (33.3%), 3 from the ACS group and 5 from the DCS group (50% vs 27.8%, n.s.).

Definitive abdominal wall closure (DAWC) was completed in 20 patients. Of the 4 cases in which DAWC proved impossible, 3 patients died, whereas DAWC was achieved in the other 5 fatalities (75% vs 25%, n.s.). Sixteen fascial traction meshes (FTM) were inserted, 9 during the first procedure, 6 during the first revision and 1 in the second revision. No significant differences were observed in the rate of primary fascial closure between cases with and without mesh inserts (81% vs 75%, n.s.).

Two patients presented enteroatmospheric fistulas, both of whom died.

**Conclusions:** TACNPWT was performed on seriously ill patients and resulted with a high mortality, particularly in the case of ACS. DAWC could be achieved in the majority of cases, but when it failed it resulted in increased mortality. The placement of FTMs did not correlate with a higher rate of DAWC following the primary suture. The absence of any significant correlation in mortality rates between the groups can be attributed to the small sample size.

### P13. Pitfalls of rectal intra-abdominal pressure measurements in pregnant women

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**Background:** It has been suggested that intra-abdominal pressure (IAP) might play an important role in the pathophysiology of gestational complications. However, no data about the normal evolution of IAP throughout the course of pregnancy is available in literature. Rectal IAP-measurements (rIAP) seems to be a minimally invasive method to assess IAP. However, to date no standardized protocol is known to measure rIAP in pregnant women.

The aim of this study is to measure rIAP throughout the course of normal pregnancy.

**Methods:** rIAP was measured using a 12CH 2-lumen rectal catheter (Andromeda, Potzham, Germany) connected with a pressure transducer system. This unit was flushed before measurement to avoid column discontinuity from air bubbles. The balloon-tipped catheter was inserted into the rectum and inflated with a saline solution. To avoid displacement during the measurement, the catheter was attached to the leg of the patients. A rapid oscillation test was performed by asking the patient to cough. Measurements were performed in supine, dorsal recumbent position and standing position. After each position change, the pressure transducer was equalized with the rectal catheter and calibrated to the ambient pressure.

After informed consent, rIAP-measurement was performed in three different positions (supine, dorsal recumbent and standing position) in 23 healthy term pregnant women by 2 researchers. Inter- and intraobserver variability was calculated. To minimize the discomfort for the patients, repeated measures were performed without removing the rectal catheter or deflating the balloon. From this, rIAP was measured monthly in 15 healthy pregnant women from the first trimester till term.

**Results:** In term pregnancy, intra-observer correlation was  $\geq 0.936$  ( $P < 0.001$ ) in all positions for both researchers. Inter-observer correlations exceeded 0.95 ( $P < 0.001$ ) in every position.

Throughout the course of pregnancy, strongly fluctuating measurements were observed within a patient, with most values out of physiological range (Fig. 1).

**Conclusions:** rIAP measurements in pregnant women is unreliable according to the presented protocol. There are

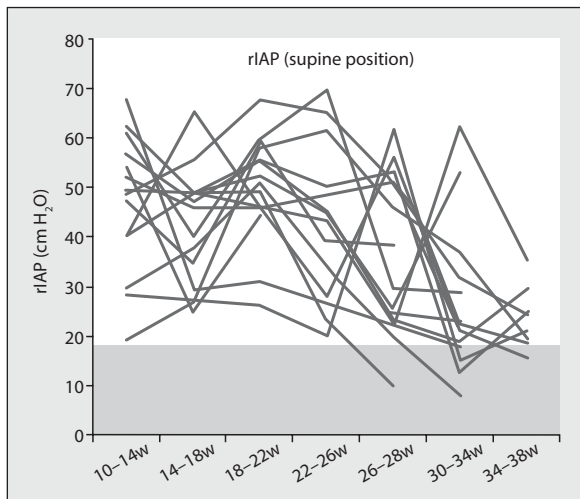


Figure 1.

different explanations for this: (a) volume of inflated fluid and thereby the wall stress of the balloon (b) the presence of stool into the rectum, (c) peristaltic movements of the bowel, (d) fetal position and movements. A different technique for rIAP and/or a different route measurement according to a standardized protocol is preferable.

**Acknowledgements:** This work is part of a PhD-thesis, which is supported by the Limburg Clinical Research Program (LCRP) UHasselt-ZOL-Jessa, supported by the foundation Limburg Sterk Merk, Hasselt University, Ziekenhuis Oost-Limburg and Jessa Hospital.

#### P14. The Americas survey: current awareness of medical staff in IAH — Interim results of WSACS Study 17

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University of Campinas, Brazil; WSACS; SBAIT

**Background:** Intra-abdominal Hypertension is a relatively new entity in medical science and still on continuous research.

Awareness and knowledge of medical staff are not clear in all three Americas. This motivated a WSACS group to run a web based questionnaire to answer these questions.

**Methods:** A questionnaire was created by the WSACS and emailed electronically to independent physicians, Medical Universities and recognized Associations in South, Central, North America.

**Results:** 168 replies were received from 13 different countries in the Americas in a month. In a population of predominantly physicians (93%) from different specialties most respondents

(94%) indicated that they were familiar with IAH/ACS concepts. Only 31% know about the recommended guidelines for bladder instillation volume and are still confused about the interval of measurements. Many clinicians didn't know what defines a normal IAP (32%) and 58% didn't know when to start measuring IAP. In septic patients 32.3% indicated to screen for increased IAP, while this reached up to 76% in trauma patients. About 54% of respondents are aware of the existence of the consensus definitions for IAH/ACS [1].

**Conclusions:** Physicians from the Americas are answered to be aware of and to be familiar with the concepts of IAH and ACS. However, approximately 68.5% don't know how to measure IAP correctly, especially with regard to the correct bladder instillation volume. Almost 50% of the respondents were unaware of the existence of updated guidelines on this important syndrome.

#### P15. Quality of life after damage control laparotomy for trauma

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**Background:** Though short term survival advantage of damage control laparotomy in management of critically ill trauma patients is established, there is little known about the long term quality of life of these patients. Facial closure rate after damage control laparotomy is reported to be 20–70 percent. Abdominal wall reconstruction in those who failed to achieve facial closure is challenging and can potentially affect quality of life of these patients.

**Methods:** We conducted retrospective matched cohort study. Adult patients who underwent damage control laparotomy from Jan 2007 till Jun 2013 were identified through medical record. Patients who had concomitant disabling brain injury or limb injuries requiring amputation were excluded. Age, gender and presentation time matched non exposure group of patients who underwent laparotomy for trauma but no damage control were identified for each damage control laparotomy patient. Quality of life assessment was done via telephonic interview at least one year after the operation, using Urdu version of EuroQol Group Quality of Life (QOL) questionnaire EQ5D after permission. Wilcoxon signed rank test was used to compare QOL scores and McNemar test was used to compare individual parameters of QOL questionnaire. Study was approved by institutional ethical review committee.

**Results:** Out of 32 patients who underwent damage control laparotomy during study period, 20 fulfilled the selection criteria for which 20 matched controls were selected. Median age of patients (IQ Range) was 33 (26–40) years. Facial closure

rate in damage control laparotomy group was 40% (8/20). One third of those who did not achieve facial closure (4/12) underwent abdominal wall reconstruction. Self-reported QOL score of damage control laparotomy patients was significantly worse than non-damage control group ( $P = 0.032$ ). There was no statistically significant difference in two groups regarding individual QOL measures. Significantly more patients in damage control group were requiring use of abdominal binder, and more patients in damage control group had to either change their job or had limitations in continuing previous job. Our study was not adequately powered to detect factors responsible for worse QOL in damage control group.

**Conclusions:** Quality of life of damage control patients is worse than their age and gender matched patients who underwent trauma laparotomy but not damage control. Adequately powered studies need to be conducted to explore factors responsible for this finding for potential improvement.

### P16. Emergency abdominal surgery course (EASC)

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**Background:** Sharing knowledge and training in Emergency Abdominal Surgery is vital to optimising care and reducing complications such as ACS. Few courses exist and EASC has now run 6 courses in 3 countries. This paper evaluates the new Emergency Abdominal Surgery Course developed by the Donegal Clinical Research Academy at Letterkenny Hospital Ireland.

**Methods:** The course curriculum, endorsed by WSACS, consists of one day, 8 hours teaching, of which 40% is didactic and 60% interactive. There are 12 short 15 minute lectures. These are followed by 11, 20 minutes case discussions. A standard template based on probability, decision making and management are common to all the presentations. Each case discussion includes video of presentation, examination findings, imaging and surgery. The course was first run in 2012 and modified between each course to include the latest significant publications. Participants complete a detailed evaluation of the course, which has a faculty of 10 to 15 consultants, including radiologist and gastroenterologist. The curriculum covers a spectrum from appendicitis to abdominal compartment syndrome and its prevention.

**Results:** 278 participants; surgery trainees (65%), consultants (9%), nurses (10%) and other (16%) have attended the courses. 135 in Ireland, 65 in Portugal and 78 in Spain. The course lecture and case discussion are highly rated. Com-

ments were universally favourable. Highlights were the use of audiovisual clips of patients findings and their surgery.

**Conclusions:** EASC is outstanding platform for providers of emergency care to learn about the care of patients presenting with common abdominal emergencies. While the course is focused for surgical trainees it uniquely multidisciplinary bringing all the providers of care together.

### P17. An experience of component separation technique with mesh augmentation in post laparostomy incisional hernia patients at tertiary care hospital

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**Background:** In a 3000 bedded hospital with busy emergency wing we receive large number of acute abdomen patients with abdominal compartment syndrome. Raised intra abdominal pressure makes laprostomy mandatory as initial management. Healing with granulation tissue is the only choice left for those patients where abdominal wall approximation cannot be undertaken in immediate post operative period. Most of these cases go unnoticed or without any definitive intervention.

**Objective:** The study was undertaken to see the feasibility of managing these large incisional hernia with Component Separation Technique with mesh augmentation along with the early and late post operative complications. The literature is full such studies separately. We have only combined the methods in our own indigenous modification. We expect a better result of our methods. Patient compliance with rehabilitation back as productive member of society with early return to job was also noted.

**Methods:** In our study group thirty patients were subjected to component separation technique with mesh augmentation after obtaining due consent and clearance from ethical committee of the hospital. Demographic profile with preoperative investigation for general anesthesia, preoperative defect size mapping, per operative IAP measure and close post operative monitoring of IAP was undertaken. Pain scoring by visual analogue scale, early complications of surgical site infection, seroma, hematoma, skin necrosis, wound dehiscence, length of hospital stay were noted. Patients were followed up for post operative 12–24 months follow up at surgical department.

**Results:** Feasibility of Component Separation could be well established in our hospital patients with 96.77 patients returning with no recurrence in span of follow up 12–24 months. Preoperatively average BMI noted was 26.09. Length of

defect size varied from 17–20 cms and width 9–16 cms. Early complication of seroma was noted in 50% of patients which resolved in post operative period. Skin necrosis was present in 6.6% and wound dehiscence was noted in one patient. Pulmonary complication ,haematoma , was not present in any patients. No patient had to be shifted to ICU and average length of hospital stay was 5.22 days. Close monitoring of Intra Abdominal Pressure in immediate post operative period was an important parameter. Routine follow up with monitoring of any discomfort and any foreign body reaction were noted. All successful operated patients returned back to job of same profile as earlier.

**Conclusions:** Physical acceptance of good scar by the patients gives a psychological boost to patients with early ambulation ,early recovery and early return to work after the badly scarred post laparostomy abdomen.

### P18. Recent trend of abdominal compartment syndrome (ACS) study in Japan

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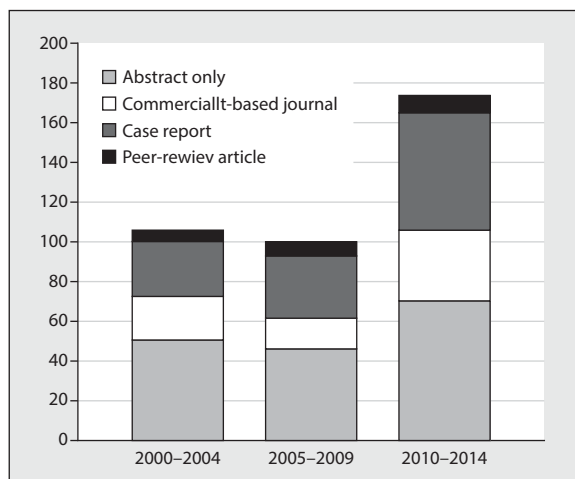
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**Background:** Abdominal compartment syndrome (ACS) as a lethal complication has been emphasized for a long time, however, intra-abdominal pressure (IAP) monitoring appears not to be familiar to medical staff in Japan. In addition, number of members from Japan in this society remains small.

**Objective:** This study was to overview the trends of the study of ACS in Japan and investigate the activity of ACS study using the domestic data repository.

**Methods:** The repository of Japan Medical Abstracts Society was queried for the period of January 1, 2000 to December 31, 2014, for all original articles, case reports, commercially-based journal/textbook, and abstracts (proceedings) for ACS/high IAP written in Japanese. Type of papers, category were compared among 3 period (2000–2004, 2005–2009, 2010–2014). Area of interested of original article was also reviewed.

**Results:** A total of 378 articles/presentations were retrieved, and the number of case reports, commercially-based journal/textbook, and abstracts (proceedings) increased in recent 5 years (Figure). There were 117 peer-reviewed case reports and 22 peer-reviewed original articles. As for category, damage control surgery (DCS), open abdominal management, abdominal closure, and their techniques are most published, followed by pathophysiology. Trauma, Abdominal aortic aneurysm (AAA) rupture, acute abdomen are almost same numbers as subjects. The subjects in peer-reviewed original articles were AAA rupture in 6 papers, DCS in 6, burn in 3, pediatric ACS in 2, continuous hemodiafiltration



**Figure 1.** Articles and presentations of ACS in Japanese

(CHDF)/pancreatitis in 1, neutrophil function in 1, pelvic fracture in 1, animal model in 1, and other in 1. Most of study followed IAH/ACS definition/criteria by WSACS.

**Conclusions:** Not a few surgeons and intensivists are interested in ACS/IAH and the number of peer-reviewed case reports and presentations increased. WSACS definition/criteria is most referenced. We should encourage them to join this society to publish their work (Fig. 1).

### P19. The effect of body position of the patient on measuring intra-abdominal pressure at the patients admitted in intensive care unit (ICU)

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**Background:** The Advised position of measuring Intra-Abdominal Pressure (IAP) is supine position. Putting the patient in this position increases the risk of Ventilator-associated pneumonia. The current study aimed to evaluate the effect of head-of-bed (HOB) on measuring IAP.

**Methods:** A semi-experimental study was conducted. Seventy-six critically ill patients admitted to ICU underwent IAP measurements with KORN method at 0, 15, 30 HOB.

**Results:** 684 observations were carried out. Intra-abdominal Hypertension was 18.42%. There was a significant difference between IAP and HOB ( $P = 0.0001$ ). The bias between IAP $0^{\circ}$  and IAP $15^{\circ}$  was 1.13 mm Hg. The bias between IAP $0^{\circ}$  and IAP $30^{\circ}$  was 2.66 mm Hg.

**Conclusions:** Elevation HOB significantly increases IAP measurement. The study showed the measurement of IAP at  $15^{\circ}$  was more reliable compared to  $30^{\circ}$ . To achieve the right angle to measure IAP in ICU patients, require more studies.

## P20. A cost-effective technique of temporary abdominal closure using the Bogota bag in combination with a sealed negative pressure suction system

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**Background:** The open abdomen management implies tremendous financial burden to the patient and family due to prolonged hospitalization and re-interventions. Non-availability of contemporary temporary abdominal closure devices in our region necessitates use of the Bogota bag. We combined this with a sealed negative pressure suction system which allows clearance of peritoneal fluid and secretions, creating an effective temporary closure system.

**Objective:** We describe a simple and economical technique of temporary abdominal closure using the Bogota bag in combination with a sealed negative pressure suction system. We discuss the technical details of creating this closure system, its utility, and the costs involved.

**Methods:** We performed temporary abdominal closure by this technique in 9 patients, during the last 48 months. All 9 patients had bowel perforation with gross intra-abdominal contamination and peritonitis, which was due to sub-acute intestinal obstruction in 6 patients, and due to blunt abdominal trauma in 3 patients. We use a sterile plastic urine collection bag for creating the Bogota bag, as plastic intravenous fluid bags are unavailable here. The bag is sutured to fascia at the wound edge using continuously placed 1–0 polypropylene sutures. Two multi-perforated tubes of 14 French size, obtained from a conventional wound suction drain set, are placed over the Bogota bag, and sutured on it, using 3–0 polypropylene sutures. The tubes are also fixed to skin to prevent detachment. Sterile gauze packs are placed over the tubes and the Bogota bag, and a sterile adhesive drape of appropriate size applied to cover the entire wound area and adjacent margins. The multi-perforated tubes are connected to a continuous low pressure suction system using a connection tubing. Under absolute sterile precautions, the adhesive drape and the sterile gauze packs are changed on every third day or more frequently, depending on the soakage within the system.

**Results:** Adequate drainage with no seepage from the wound edges could be obtained in all patients. In two patients, partial loosening of the Bogota bag occurred due to sloughing off at the fascial margins, which necessitated return to operating room and re-placement of the Bogota bag. In none of the patients, evisceration of bowel occurred. There was no injury to bowel or occurrence of fistula attributable

to the Bogota bag being in contact with viscera. The total cost of construction of this Bogota bag with negative pressure suction system is twenty four Euro (€ 24), with every dressing change costing eleven Euro (€ 11).

**Conclusions:** Temporary abdominal closure using this technique gives adequate protection to intra-abdominal viscera. It also provides well-controlled drainage of fluid and secretions from the peritoneal cavity, without any seepage and excoriation of the wound edges. It is cost-effective, simple to construct and can be used safely as an alternative to commercially available appliances for temporary abdominal closure.

## P21. Enteral oxygenation — an effective approach for the intestinal paresis resolve

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**Background:** Paresis of the intestine — common component of the enteral insufficiency syndrome, which frequently occurs in postoperative patients. One of the possible way for peristalsis activation is enteral administration of pure oxygen described earlier [Gelman S., 1976].

**Objective:** To determine the clinical effectiveness of the intestinal insufflation of oxygen for the intestinal paresis treatment.

**Methods:** This study was approved (Protocol #12) by the Local Ethical Committee of North-Western State Medical University named after I.I. Mechnikov, Saint-Petersburg, Russia (Chairperson Prof Shevyakov M.A.) on 2 October 2013. 68 surgical and therapeutic critical patients with the intestine paresis because of multi-organ failure of different severity were included. The patients with severe congestive heart failure and recently performed surgical anastomoses of the gastrointestinal tract (GIT) were excluded. Insufflation of 100% O<sub>2</sub> was performed in two ways: through nasointestinal (n = 52) and nasogastric (n = 16) tubes. An intestinal tube (2.2 m, Ø1.4 cm. CJSC "MEDITEK", St. Petersburg) was placed endoscopically after the ligament of Treitz to a depth of 30–40 cm. A gastric tube was introduced by the common way. The administration of oxygen into the GIT was provided by several slow boluses with 60 mL syringe. The first proce-

cedure lasted 30–160 minutes (injected volume 0.8–1.2 liter of oxygen). Later, the oxygen boluses (250 mL) repeated every 3–4 hours. The treatment duration was 3–6 days with the average daily introduced oxygen 2.5 liter.

Intra-abdominal pressure (IAP) evaluated in the urine bladder before and just after the first procedure. Non-invasive monitoring of blood pressure, heart rate, EKG, hemoglobin saturation and arterial gases were monitored.

Evaluation of peristalsis performed by auscultation of the intestinal sounds, looking for the bowel gases discharge and defecation appearance.

**Results:** There were no significant changes in hemodynamics during and after the insufflation of oxygen, regardless of the total amount of the introduced gas. Initial IAP ( $8.3 \pm 2.1$  mm Hg in the “stomach” group, and  $7.9 \pm 2.4$  mm Hg in the “intestine” group) was increased to  $10.1 \pm 1.9$  mm Hg and  $10.1 \pm 2.4$  mm Hg respectively ( $P > 0.05$  between groups;  $P < 0.05$  between the initial and final IAP).

Peristaltic sounds over the entire surface of the abdominal cavity began to listen in the vast majority (93%) of the patients  $25 \pm 12.2$  minutes after intestinal introduction of oxygen. In 37 patients (71%) by the end of the first procedure discharged bowel gases were observed, in 17 (33%) — the defecation was noted. Delayed and prolonged improvement of systemic oxygenation (increased  $\text{PaO}_2/\text{FiO}_2$  ratio) was revealed in all the cases.

In contrast, oxygen introduction into the stomach caused the epigastrium bloating, frequent backward gas discharge through the esophagus.  $\text{PaO}_2/\text{FiO}_2$  ratio was decreased owing, probably, cranial shift of the diaphragm domes and compression basal regions of the lungs. Activation of the intestinal motility was not observed.

#### **Conclusions:**

1. Background: of oxygen into the small intestine stimulates the peristalsis of the gastrointestinal tract, whereas intragastric insufflation has no such effect.
2. To assess the clinical applicability of the intestinal insufflation of oxygen for the intestinal paresis therapy further researches are needed.

### **P22. Abdominal wall reconstruction series: a single surgeon’s experience of performing abdominal wall reconstruction with mesh reinforcement in complex hernia repairs**

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The Bolton NHS Foundation Trust, Bolton, United Kingdom

**Background:** The rise in incisional hernia repairs being performed over the last decade has been attributed to an ageing population, rise in obesity and diabetes, and improved

survival rates from intra-abdominal cancers and critically injured patient. This produces an increasing number of medically complicated patients with structurally complex abdominal wall defects.

**Objective:** This study aims to evaluate the post-operative outcomes of patients who have undergone abdominal wall reconstructions for complex hernias by a single surgeon.

**Methods:** A retrospective study examining the rate of post-operative complications in consecutive abdominal wall reconstructions for complex hernias by a single surgeon between January 2014 and November 2014. Data was collected from medical records to classify each patient according to the Ventral Hernia Working Group System and analyse the outcomes of these cases.

**Results:** 9 patients were identified. They had a median age of 63 years and median follow-up of 4 months. 6 patients were identified with grade II ventral hernias and 3 patients with grade III ventral hernias.

For all cases, a Rives-Stoppa-Wantz technique was used and 2 cases required lateral external oblique sheath incision. All cases also required mesh reinforcement: in 7 patients a GORE® BIO-A® mesh and in 2 patients an ETHICON PHYSIOMESH™ was used.

There were no hernia recurrences in this group during the follow-up time period. However, 5 patients developed seromas (55%) which were treated conservatively, 1 patient developed a wound infection which required negative pressure wound therapy, and 1 patient developed intra-abdominal tuberculosis which was treated with long term antibiotics.

**Conclusions:** The data described in our series shows that in expert hands, even complex hernias in a contaminated field can have very good outcomes in terms of hernia recurrence. The majority of our post-operative complications were seromas which resolved in a few weeks without any further intervention.

### **P23. Intraoperative determinants for intra-abdominal hypertension and open abdomen management: A retrospective analysis of operative findings and decisions**

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**Background:** Decisions on open abdomen management are usually determined by the operative findings, the primary disease in the patient, anticipated need for re-intervention and the potential for intra-abdominal hypertension.



**Objective:** To analyze intraoperative findings and on-table decisions which were determinants for open abdomen management with temporary abdominal closure.

**Methods:** We retrospectively analyzed patients with an open abdomen, managed by us in the last 48 months. We analyzed indications for operation, intraoperative findings, documented on-table decisions, postoperative outcomes, re-interventions, and outcomes in these patients.

**Results:** During these 48 months, 9 patients underwent open abdomen management. In all 9 patients the primary surgical intervention was an emergency, the decision on open abdomen management being made during the primary surgery in 7 patients, and during the third surgical intervention in 2 patients. All 9 patients had temporary abdominal closure using Bogota bag with negative pressure suction system technique. In all patients, there was bowel perforation with intra-abdominal collection and peritonitis. In 6 patients this was secondary to sub-acute intestinal obstruction [SAIO], and in 3 patients due to blunt abdominal trauma. In the 6 patients with SAIO, the cause was bowel malignancy in 3, bowel malignancy with strangulated incisional hernia in 1, multiple inflammatory strictures in 1, and strangulated bowel within an incisional hernia in 1. In the 3 patients with blunt abdominal trauma, one had evisceration with rupture of the abdominal wall. In all 9 patients, some form of bowel resection and anastomosis was performed during the primary intervention itself. The number of surgical interventions per patient were four times in 1 patient, thrice in 5 patients, twice in 1 patient, and once in 2 patients. Gross peritoneal contamination with dilated, edematous and aperistaltic small bowel loops was a common intraoperative finding in all 9 patients. This was associated with thickened, edematous and non-pliable mesentery in 4 patients. In all patients there was concern about intra-abdominal hypertension because of difficulty in approximation of the abdominal wall edges, which was due to intra-abdominal contents in 6 patients, and due to loss of abdominal wall tissue in 3. Removal of the Bogota bag suction system with split skin graft cover was achieved only in 2 survivors. There were 7 non-survivors, with death attributed to the primary disease and its complications, and not to the open abdomen and technique of temporary closure.

**Conclusions:** Edematous, dilated and aperistaltic small bowel was the common determinant for decision on open abdomen management in all 9 patients. Another common determinant in all 9 patients was difficulty in approximation of the wound edges. Associated non-pliable and edematous small bowel mesentery in 4 patients was not an independent determinant. Need to re-intervene was a determinant in one patient. Condition of the small intestines and difficulty in abdominal closure with concern of causing intra-abdominal

hypertension were the two key determinants for deciding on open abdomen management.

## **P24. Intra-abdominal negative pressure therapy is more than just a solution for temporary closure of an open abdomen**

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**Background:** Numerous methods of temporary abdominal closure (TAC) have been proposed and researched. Vacuum-assisted wound closure with mesh-mediated fascial traction (VAWCM) is a technique that combines the benefit of vacuum therapy and fascial traction, leading to high rates of fascial closure with low morbidity. However, the therapeutic effect by removing inflammatory-mediator-rich ascites from the abdomen using negative pressure therapy has been conceptualized, but never clinically shown.

**Objective:** This report supports the hypothesis that intraabdominal vacuum therapy is a therapeutic tool as well as an effective TAC.

**Methods:** Two patients with obvious signs of abdominal sepsis were treated with VAWCM for at least 48 hours and extensive analysis of both biochemical and clinical response was performed.

**Results:** A 46 year old female patient had a severe septic shock after incarceration and perforation of small bowel in a chronic epigastric hernia. VAWCM was applied just after surgery. At day 4 false application of VAWCM was diagnosed causing absence of negative pressure therapy intra-abdominally. Surgical correction of TAC therapy was performed with sudden decrease of inflammatory parameters and resolution of sepsis within 24 hours.

The second case was a 26 year old female patient, who was admitted for an acute abdomen after stimulation of the ovaries and subsequent rupture of ovarian cysts and *E. Coli* sepsis. After application of intra-abdominal negative pressure therapy sepsis resolved within 48 hours with easy secondary fascial closure.

**Conclusions:** This report clearly supports the hypothesis that continuous removal of inflammatory exudate from the abdominal cavity is a key factor in the efficient treatment of abdominal sepsis. As RCT's will probably never be performed in this heterogeneous patient population, intraabdominal negative pressure therapy should be considered a therapeutic tool rather than just a temporary closure method in these patients.

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## P25. Is there a relationship between intra-abdominal pressure and mortality?

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**Background:** The interest in studying intra-abdominal pressure began in the mid-nineteenth century, when the abdominal cavity was considered a compartment where any increase in the volume of its contents could increase the pressure inside with adverse consequences for these people.

**Objective:** Because the abdominal cavity is a compartment and volume changes that occur inside are directly related to the pressure in the interior, and in accordance with the observations of different studies showing that greater intra-abdominal pressure increased morbidity and increased mortality we conducted this study.

We conducted an observational prospective study from January to September 2014, it involved 25 patients from one Intensive Care Unit (ICU), 14 men and 11 women. We measured intra-abdominal pressure and classified patients into 2 groups: Group A, patients who were discharged from the ICU for improvement; and Group B, patients discharged from the ICU by death.

**Methods:** Measurement of intra-abdominal pressure was via the bladder, with the standard technique of injection of 25 mL of solution by Foley catheter in the patient in supine position and measured with pressure transducer.

**Results:** In Group A (20 patients), intra-abdominal pressure ranged from 4-20 mm Hg with an average of 12. Group B (5 patients), pressures ranged from 20 to 52 mm Hg with an average of 46. The diagnoses, ages and gender distribution in both groups were similar. Also, we noted that in Group A, the days of ventilation were 4, while in the Group B were 9.4 days.

**Conclusions:** This study shows that constant Intra-abdominal pressures greater than 20 mm Hg, causes an expected mortality of approximately 95% and more days on mechanical ventilation.

## P26. Changing of the guard, time to move on in the management of cholecystitis

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**Background:** Paradigm shifts in the care of gallbladder disease occurred with the introduction of laparoscopic cholecystectomy. Further paradigms and shifts in care suggest index cholecystectomy is optimal patient management for those presenting with cholecystitis. Optimal initial care may

reduce adverse outcomes including intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS).

**Objective:** This study undertook an analysis of outcomes in patients presented to a regional hospital with cholecystitis.

**Methods:** An ethically retrospective review of 100 patients presenting with acute cholecystitis to a regional 350 bed hospital between January 2013 and August 2014 was undertaken. Patients clinical signs, liver function tests, imaging and management were recorded.

**Results:** 100 patients between the age of 58.7 years  $\pm$  21.2 range, 21–97 years, 62% were female. Average length of stay was 7 days, range (1–20), 11 had cholangitis, 62% had abnormal liver function tests and 13 had a CRP beyond 50. Gallstone pancreatitis with elevated amylase occurred in 14 patients. Index admission surgery was performed in 6/100 compared to 26/100 who had interval cholecystectomies. 39 patients had an ERCP, 38 had an MRCP and 32 had a CT scan. Re-admission occurred in 29 patients during the study period

**Conclusions:** This study has identified a very low index admission rate for surgery with resulted in re-representation in 29% of the group. New strategies for management of Cholecystitis need to be introduced at this regional hospital to optimise patient outcome, reducing complications including IAH and ACS.

## P27. The abdominal compartment under pressure: outer and inner levels

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**Background:** Some critically ill patients may have a laparostomy to treat abdominal compartment syndrome or for better control of a peritoneal infection. The troublesome option of managing an open abdomen is more straightforward to be dealt with if secondary to over-resuscitation. The development of necrotizing fasciitis adds complexity to the management of an abdominal infection. Dealing with an extra-peritoneal fascia contamination following the spread from an intra-peritoneal level is a challenging situation in septic source control amongst the presence of severe physiologic derangement, high fluid losses, major septic response, massive tissue destruction and loss of domain of the abdominal wall.

**Objective:** Our goal is to share tips for possible faster septic source control and abdominal closure. To the best of our knowledge there is a comprehensible lack of evidence-based recommendations regarding the use of two different levels of Negative Pressure Wound Therapy (NPWT) in open abdomen management associated with the destruction of

the abdominal wall components after severe peritoneal contamination.

**Methods:** We collected physiological, microbiological and treatment data from two patients with two simultaneous NPWT systems involving a laparostomy and abdominal wall necrotizing fasciitis treated recently.

**Results:** One patient was transferred from a smaller health unit after a colorectal dehiscence and fecal peritonitis evolving into extensive tissue destruction from abdominal wall fasciitis. The other patient developed Fournier's Gangrene after a hemorrhoidectomy in a rural hospital. He was transferred in septic shock between 3 hospitals during 4 hours having been massively resuscitated (more than 12 liters of volume) leading to the need for a descompressive laparostomy. Both patients revealed multiple organ dysfunctions and started a vicious cycle of volume resuscitation, sepsis response and loss of abdominal wall domain. We performed several surgical debridements using commercial devices to aid in the control of abdominal infection and edema (VAC<sup>®</sup> — Abthera™ for the contaminated peritoneum and VAC<sup>®</sup> — Black foam™ — polyurethane foam, for the abdomen with compartment syndrome). In both cases, fasciitis control required a separate system of NPWT (VAC<sup>®</sup> — Silver foam™ — nanocrystalin silver foam). In each surgical visit we collected microbiological specimens (deep tissues) that guided our antibiotics. Both patients were submitted to daily hyperbaric oxygen therapy until fascia infection source control was considered as controlled by the surgeon in charge. Early enteral nutrition for gut rehabilitation was started despite the open abdomen. In both cases, early planned ventral hernias were performed to reduce the risk of enteral-atmospheric fistulas in the belief that an expeditious and safe abdominal closure should reduce the rate of sepsis and edema.

**Conclusions:** These types of case presentations lack statistically significant data. Yet, we would like to highlight that both patients survived. Despite the loss of part of the abdominal wall to fasciitis, it was still possible to perform ventral hernias during the first month. The simultaneous use of the above measures with two applied systems of NPWT may aid in more efficient septic source control, better and progressive fascia healing. One to two years later, both patients were respectively submitted to complex abdominal wall reconstruction resulting in excellent functional status.

## P28. Abdominal compartment syndrome caused by rectus sheath hematoma

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**Background:** Normal intra-abdominal pressure (IAP) is 5 mm Hg. Intra-abdominal hypertension refers to a pressure of over 12 mm Hg. When symptoms of organ dysfunction and an elevated IAP both present, then the condition can be considered as abdominal compartment syndrome (ACS). ACS is associated to a very high mortality rate, even when the indicated treatment is established.

**Objective:** Rectus sheath hematoma is an uncommon, but possible, cause of ACS.

**Methods:** We present a 74-year old patient taking oral anticoagulants and a history of high blood pressure, diabetes mellitus, nephropathy and cardiopathy (metal prosthetic mitral and tricuspid valves) which requires a VVI pacemaker. After falling on her right side, the patient's underlying heart condition worsened, with right basilar pneumonia and acute on chronic renal failure, thus she was admitted to hospital. During her stay in the cardiology department she presented symptoms of sustained hypotension, progressive anemia, abdominal pain and vomiting. In the inferior left abdominal wall, ultrasound revealed the presence of a 16 × 12 × 9 cm multiseptate hematoma with a hematocrit effect which caused displacement of the intestinal mass. The patient was transferred to the ICU and given a blood transfusion. Considering the patient's instability and increasing abdominal circumference, an arteriography was performed revealing areas of extravasation in the left epigastric artery which was successfully embolized.

After the percutaneous treatment, the IAP was 20 cm H<sub>2</sub>O and the acute renal failure persisted. The patient presented an established ACS and so we proceeded with surgical drainage.

An infraumbilical left pararectal incision was made to open the subcutaneous layer and the anterior rectus sheath. There was a large organized hematoma contained by the posterior rectus sheath which had dissected the preperitoneal space. We proceeded with the drainage, debridement and abundant washing of the area, leaving a chest drain inserted. The post-operative IAP was 10 cm H<sub>2</sub>O.

**Results:** Despite the surgical procedures, the patient died after 11 days in post-operative intensive care due to a massive intestinal ischemia as evidenced by CT which revealed images of generalized pneumatosis intestinalis of the small intestine.

Throughout this period the patient required vasoactive drugs to control blood pressure, with no improvement in her kidney function, thus requiring hemofiltration.

**Conclusions:** In patients with a high abdominal pressure and organ failure that are refractory to medical treatment and support, surgical decompression is the treatment of choice.

The increased use of antithrombotic and anticoagulant treatments has seen a rise in the incidence of rectus sheath

hematomas. It occurs secondary to bleeding of the inferior epigastric artery and can lead to abdominal compartment syndrome.

The evolution of ACS can be dangerous. Therefore, when presented with conditions that could trigger ACS it is important to establish a rapid and, above all, aggressive treatment. Observation and monitoring of the IAP in at-risk patients is essential for controlling and preventing ACS.

### **P29. The use of vacuum-assisted closure to prevent anastomotic fistula in open septic abdomen**

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**Background:** Laparostomy may be useful in severe peritonitis for bowel distension and abdominal wall oedema to obtain a tension-free closure. Negative Pressure Therapy (NPT) during laparostomy have been proposed in septic peritonitis to enhance healing of bowel anastomoses by reducing the amount of interstitial fluid and improving local blood supply and tissue oxygenation. Furthermore, NPT appears to reduce bacterial growth, providing a good control of sepsis.

**Objective:** The aim of this study was to assess the effectiveness of this technique in preventing anastomotic fistula in patients with septic peritonitis undergoing intestinal resection with primary anastomosis without a protective diverting stoma.

**Methods:** All patients had an emergency bowel resection for septic peritonitis, extensive intraoperative lavage, insertion of abdominal drains and laparostomy using a temporary closure device generating continuous NPT of -125 mm Hg. Seventy-two hours after surgery, direct evaluation of both peritoneal septic effusions and anastomotic integrity was made and, if appropriate, a definitive fascial closure was performed.

**Results:** Between November 2009 and May 2014, 5 patients (3 males, mean age 48 years) were recruited. In all 5 patients the fascial closure was achieved at 72 h after primary surgery. One patient died of heart failure 3 days after the procedure. The other patients were discharged in good health after a mean hospitalization time of 11 days.

**Conclusions:** NPT appears to be a promising approach to prevent the formation of fistulas communicating with bowel anastomoses in septic peritonitis making a diverting stoma unnecessary. Randomized prospective studies are needed to corroborate our findings.

### **P30. Management of severe acute necrotizing pancreatitis complicated with abdominal compartment syndrome**

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**Background:** Development of abdominal compartment syndrome (ACS) may seriously aggravate clinical course of acute necrotizing pancreatitis and is associated with fast progression of MODS and increased risk of mortality. Surgical intervention with application of negative pressure therapy may significantly improve prognosis.

**Objective:** To report a treatment strategy of patient who developed ACS, respiratory distress, acute renal failure and dynamic ileus during the early phase of acute necrotizing pancreatitis.

**Methods, case report, results:** A 49-year-old male patient was admitted to the emergency department with clinical signs of acute pancreatitis within 24 hours from the onset of the diseases. Progressive SIRS, evidence of MODS and massive fluid sequestration to the retroperitoneal space and to the free abdominal cavity was recognized at the admission. Patient was transferred to the ICU for commencement of the intensive conservative management. Due to progression of organ failure and MODS continuous veno-venous hemofiltration was started after the unsuccessful 24-hour initial treatment. Despite this progression of the intra-abdominal hypertension resulted in development of ACS associated with respiratory distress and dynamic ileus. CECT proved necrosis of the 70% of the pancreatic tissue and massive peripancreatic and retroperitoneal necroses which got infected later. Ten days after admission patient underwent first surgical intervention through transverse laparotomy approach and lumbotomy with the aim to drain peripancreatic, retroperitoneal space and free abdominal cavity. Ten days later was performed second operation — relaparotomy with partial sequestrectomy and ileostomy due to not resolved small bowel ileus. Massive retroperitoneal fat tissue necrosis involving mesentery of the colon and small bowel propagating to the free abdominal cavity with small bowel mechanical obstruction was found during the intervention. Despite all attempts resolution of the small bowel ileus was not achieved. Desperate third operation was performed providing additional necrosectomy, decompression of the small bowel, wide drainage, and vacuum assisted abdominal closure (VAAC) as a last chance option. Three days later bleeding from the retroperitoneal space mandate additional tamponade. Application of VAAC resulted in recovery of

the respiratory and kidney function and resolution of the ileus, however progression of severe sepsis due to large masses of the infected necrotic tissue was still obvious. At the 4th week after admission patient underwent additional sequestrectomy and repeated VAAC system change. Frozen abdomen developed after the 8 VAAC systems changing, and the abdominal wall was closed using wound VAC system 2 month after admission. Colon fistula developed during this time, but closed spontaneously. ICU treatment period lasted 74 days including 21 day on mechanical pulmonary ventilation, patient underwent 15 surgical interventions including 5 sequestrectomies and 8 VAAC system changes and finally overall hospital stay was 101 day.

**Conclusions:** Development of ACS critically aggravates clinical course of necrotizing pancreatitis. Timely application of negative pressure therapy is strongly recommended in cases with ACS and extensive necrosis of the peripancreatic and retroperitoneal fat tissue.

### P31. Laparostomy for treating the abdominal compartment syndrome and severe abdominal infection and truma

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**Background:** Abdominal High Pressure Syndrome (also called Abdominal Compartment Syndrome, ACS) is a severe affliction in the Abdomen Surgery which is recognized in recent decades. It leads to a high incidence of MODS, MOF and even death. Laparostomy is a kind of effective operation in saving the patients with such illness, whereas there are still many problems for this surgery, such as the time of celiotomy, the drainage methods of peritoneal cavity, and the chance and pattern of laparotomy closure etc. The paper summarizes our experiences of a series of 45 patients with ACS, and discuss the associated problems.

**Objective:** To discuss the chance and methods of laparostomy involving open abdominal surgery to treat abdominal injuries and severe intra-abdominal infection complicated with abdominal compartment syndrome, and the closure of reconstruction of abdominal wall thereafter.

**Methods:** The experiences of repairing abdominal wall defect is retrospectively assessed, which is caused by the laparostomy for a series of 45 patients with Abdominal High Pressure Syndrome (because of severe blunt abdominal trauma) and severe intra-abdominal infection. Results: Of the 45 patients whom underwent laparostomy, 33 were

cured, eight died, three were transferred to another hospital, 1 patient is being treated. There were 19 patients of the 33 cases that being cured were repaired to edge suture, 14 were repaired by skin transplantation in Phase II, and 2 cases, by pedicle intestinal flap mending in Phase III.

**Conclusions:** The blood and oxygen supply of abdominal organs was markedly improved and organ dysfunction was reversed when the abdomen was opened surgically (Laparostomy) to treat patients with abdominal compartment syndrome caused by blunt abdominal injury and severe intra-abdominal infection. The technique was able to control the intra-abdominal infection effectively and was instrumental in saving the lives of the patients. A big problem of the operation is that some weak area of abdominal wall is left over. The second set of incision sutures was usually made 2 to 3 weeks after the illness was under control. Skin grafting or associated operations may be needed if the time of laparostomy exceeds 3 weeks.

### P32. Polycompartment syndrome after elective surgery

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**Background:** There are four major compartments in the human body: the head, the chest, the abdomen and the extremities. When two or more compartments have elevated pressures the name of the clinical entity is the polycompartment syndrome, firstly described in 2007. Some small studies have demonstrated that there is a direct correlation among intracranial, intrathoracic and intra-abdominal compartments.

**Objective:** We report the case of a 67-years-old patient who suffered a polycompartment syndrome after his elective foregut surgery. The first stage of the extremely fast evolution was the thoracic compartment syndrome which complicated with abdominal compartment syndrome.

**Methods:** The indication for the elective surgery was morbid obesity and a giant diafragmatic hernia causing chronic anemia. Resection of the hernial sac, diafragmatic hernia repair and sleeve gastropasty was performed without bleeding or any other complication. The patient was transferred to the intensive care unit where presented a hemodynamic collapse and cardiac arrest immediately, with elevation of the intra-abdominal pressure. After cardiopulmonary resuscitation we decided urgent laparotomy. With the decompression the vital functions recuperated. A big haematoma was found

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in the chest cavity and no complications in the abdominal cavity. The abdominal wall was left open for 12 hours. The patient stayed in the hospital during two weeks and was discharged after complete recovery.

**Results:** The thoracic compartment syndrome results as an accumulation of air, fluid or blood in the chest which may precipitate cardiac tamponade leading to haemodynamic collapse and secondary to abdominal compartment syndrome. We demonstrated that the urgent decompressive laparotomy was successful in decreasing intra-abdominal pressure and intra-thoracic pressure, thus supporting the correlation of pressures in the polycompartment syndrome theory.

**Conclusions:** This case clearly illustrates the complex interplay between body compartments in critical care patient and shows the importance to be aware of the existence of the multicompartment syndrome.

### **P33. Rapid onset abdominal compartment syndrome secondary to iatrogenic tension pneumoperitoneum: a case discussion and review**

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**Background:** Abdominal compartment syndrome is classically described as a disease process secondary to intra-abdominal edema or excessive intra-abdominal fluid. There is a small body of literature describing compartment syndrome secondary to pneumoperitoneum. This pathology presents acutely and requires immediate temporizing decompression followed by abdominal exploration.

**Objective:** This case discussion will detail a clinical scenario involving an acute presentation of abdominal compartment syndrome secondary to iatrogenic pneumoperitoneum. It will illustrate syndrome development and the need for both rapid recognition and temporizing intervention prior to formal operative exploration.

**Methods:** A single case chart review was performed to acquire patient history and relevant clinical data for the purpose of case discussion and illustration. Personal health information was not acquired for this review.

**Results:** A 76-year-old female patient presented to the Level 1 trauma center with injuries secondary to a motor vehicle collision. Injury survey revealed multiple rib fractures with small hemopneumothorax and a thoracic vertebral body fracture. Relevant medical history includes obstructive sleep apnea, COPD, and umbilical hernia. The patient presented in stable condition and was admitted for pain control, pulmonary support, and preparation for thoracic spine surgery. Post trauma day two the patient developed progressive

hypoxic and hypercarbic respiratory failure. Care was progressively escalated throughout the day. A chest tube was placed for drainage of hemothorax. This was followed by utilization of continuous positive airway pressure ventilation progressing to bilevel positive airway ventilation. Patient body habitus prevented the use of a gastric decompression tube concomitantly with the use of the ventilation mask. The decision was made to intubate the patient secondary to failure of these non-invasive modalities. The intubation was technically difficult and the first attempt resulted in esophageal intubation. This was immediately identified and removed. The patient, however, required a significant period of bag valve mask ventilation to recover from hypoxia. The patient was subsequently intubated via fiberoptic laryngoscopy. Significant abdominal distension was noted and nasogastric decompression was started. The previously hemodynamically stable patient acutely developed hypotension coupled with progressive hypoxia and hypercarbia despite intubation. Immediate post-intubation x-ray was concerning for free intraperitoneal air. The abdominal compartment was decompressed at bedside for progressive patient instability. A large volume central venous line was placed percutaneously into the abdominal cavity using standard modified Seldinger technique. Abdominal diameter was rapidly reduced accompanied by hemodynamic and ventilatory improvement. The patient was subsequently taken to the operating room for repair of gastric perforation.

**Conclusions:** This case details an unusual presentation of abdominal compartment syndrome in a patient with progressive ventilatory decline and failure of non-invasive positive airway interventions. Technically difficult intubation coupled with prolonged bag valve mask ventilation created the scenario of tension pneumoperitoneum and compartment syndrome. A high index of suspicion leads to recognition of the clinical scenario, diagnosis, and intervention. A temporizing decompression technique is essential to stabilize the patient while being transported for operative intervention.

### **P34. Conservative management of IAH in the emergency department**

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**Background:** Intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS) have serious effects on all organs frequently leading to life-threatening situations. During the last years the clinical management of these entities has completely changed. The importance of the measurement of the intra-abdominal pressure (IAP) and the

importance to reduce it has been recognized. Nowadays we know that the IAH and the ACS are not only surgical but also medical problems. However the surgical decompression is one of the possible and definitive solutions, the non-operative medical management plays a very important role in the prevention and treatment of IAH caused organ failures.

**Objective:** Similar to other hospitals in our Emergency Department we designed and started to use the new non-surgical methods for resolve the acute IAP elevations. The goal of our protocol is to start the IAP measurement immediately in case of abdominal distension and activate the conservative management strategy.

**Methods:** The importance and fundamentals of the non-operative management are well described by M. L. Cheatham. The main strategies of our protocol based on his publication and on the non-operative protocol of the WSACS: evacuate intraluminal contents, evacuate intra-abdominal space occupying lesions, improve abdominal compliance, optimization of fluid administration and optimization of systemic and regional perfusion.

**Results:** Thanks to this protocol the early detection and treatment of the IAH helped us to reduce hospitalizations and solve basic problems, or achieve better prognosis in serious ill patients.

**Conclusions:** The IAH and ACS represent significant morbidity and mortality. In the last ten years, the diagnostic procedure and management has changed. During a long time the surgical management was considered the only therapeutic option. Our results showed that with the early and effectively performed medical management is possible reduce the IAP and avoid the need for abdominal decompression. Nevertheless, in case of failure of the conservative way or when the IAP raise to 20 mm Hg the surgical way is inevitable and life-saving.

### **P35. Traumatic right diaphragmatic hernia: a case report**

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**Background:** Traumatic diaphragmatic hernia is an infrequent clinical problem. The signs and symptoms of this condition are varied and non-specific, as are the radiological findings, making it a challenge for both surgeons and radiologists alike. A high level of clinical suspicion is required for the correct diagnosis of a pathology whose management

typically needs urgent surgical examination. Traumatic injury of the diaphragm presents in around 3% of thoraco-abdominal traumas, with an overall associated mortality of up to 14%. In over 90% of cases, traumatic diaphragmatic hernias caused by a closed mechanism are secondary to road traffic accidents, with a clear predominance affecting the left hemidiaphragm. There are very few cases cited in the literature which are related to sudden increases in the intra-abdominal pressure.

Here we present the case of a right traumatic diaphragmatic hernia presenting in a postpartum patient who required emergency surgical repair.

**Clinical case:** 38-year old woman, postpartum (+ 33 days) after an instrumental delivery with Kristeller maneuver, presented a clinical picture of diffuse abdominal pain coursing for 5 days with vomiting and food intolerance. Examination revealed right basilar hypoventilation and severe abdominal pain but with no clear evidence of peritoneal irritation. Notable analytical results were leukocytosis plus elevated CRP and LDH levels. An abdominal ultrasound and CT study revealed a right diaphragmatic defect, to the right of the falciform ligament (ruling out the possibility of Morgagni and Bockdalek congenital hernias), with herniation of a segment of the colon, the hepatic dome and several loops of small intestine, which suffered vascular damage due to rotation and traction of the adjacent mesenteries.

In light of these findings, an emergency laparotomy was performed confirming the ischemic necrosis of the herniated loops of the small intestine. Next, the herniated material was reduced prior to enlargement of the diaphragmatic defect, resection of a large segment of the terminal ileum and cecal pole (with primary anastomosis), and closure of the herniary orifice. The patient developed favorably once residual pneumothorax had been controlled.

**Discussion:** While the majority of diaphragmatic injuries usually present acutely, in some cases they may manifest months or years after the causal incident. Patients with a complicated diaphragmatic hernia can present dyspnoea, cyanosis, thoracic pain, restlessness or non-specific gastrointestinal symptoms. Diaphragmatic hernias secondary to abdominal hypertension during labor are rare occurrences with only a few cases reported in the literature. An open abdominal approach should be the first choice in the case of acute/subacute presentations because they tend to be associated with complications. The standard technique is to reduce the intestinal content with resection if it is in an inviable ischemic phase, in addition to direct suture of the diaphragmatic defect with resorbable monofilament material or through the use of plasties or prosthetic material, as necessary.

### **P36. Nutrition therapy for early postoperative inflammatory small bowel obstruction**

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**Objective:** To investigate the effects of nutrition therapy for early postoperative inflammatory small bowel obstruction (EPISBO).

**Methods:** Thirty-eight EPISBO patients were retrospectively reviewed in the Department of Surgery, 1<sup>st</sup> Affiliated Hospital of Gannan Medical College from July 2004 to May 2014.

**Results:** Eighteen of 38 patients with EPISBO received nutrition therapy along with other medical treatment (nutrition group), and 20 only had medicine (control group). All patients recovered uneventfully after non-operative therapy. By the end of the treatment, the serum level of Na, K and Glu in the two group patients did not have significant differences ( $P > 0.05$ ). The time to flatus and the duration of the treatment were significantly shorter in nutrition group than in control group ( $P < 0.05$ ). Also, nutrition parameters (Hb, Alb, Pre Alb, TFN) were improved remarkably in nutrition group than in control group ( $P < 0.05$ ).

**Conclusions:** The nutrition therapy can improve patients' nutrition status, shorten the conservative treatment course, and attain a better curative results for EPISBO patients.

### **P37. Intra-abdominal hypertension grade III after abdominal dermolipectomy: be aware and don't tie to hard or expect the worse — a case report**

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**Background:** Unfortunately, worldwide physicians are not fully aware about Abdominal Compartment Syndrome (ACS) entity.

This case report brings to light the importance of recognizing the ACS as a potential complication in elective surgery.

**Case report:** 49 years old female, submitted to an abdominal dermolipectomy plus breast augmentation by over the same anaesthetic procedure. Immediate postoperative follow up was benign with general complains of abdominal pain. Patient was discharged from hospital on 1<sup>st</sup> PO day with painkillers. After 72 hours, patient returned with refractory abdominal pain, difficulty for walking, emesis and darkish urine output. Physical exam was determined as

difficult due to recent abdominal surgery, tense and tender. By that time, the patient was seen by plastic surgery team, which proceeded with endovenous hydration, anti-emetics and opioids for pain. Labs went normal as well as abdominal x-ray. Patient was discharged from emergency department after 4 hours referring feeling better. Six days after the elective surgery she was admitted in septic shock, demanding mechanical ventilation (MV) and critical care support.

Emergency and Trauma Surgery team (ETST) were activated. Grade II IAH was observed and clinical measurements were installed. A CT scan was ordered and no significant alterations were found, except a muscle haematoma at the right lower quadrant. After 24 hours, IAP kept holding on 20 mm Hg with clinical worsening of general condition. On PO 7<sup>th</sup>, IAP raised to 22 mm Hg as well as MV parameters. ETST decided for an open laparotomy.

At surgical field, small bowel was found in violet colour, oedematous with no perforation encountered. A necrotic segment was found and removed. After releasing abdominal pressure the role small bowel showed recovery and returned to normal colour. Patient was left in peritonostomy (Fig. 1).

**Conclusion:** Surgeons must be aware of IAH and ACS as a potential severe complication. In the case reported above, abdominal restriction was under estimated by elective surgeons and could conduct to patient's death.



**Figure 1.**



### **P38. A series of cases using GORE BIO-A mesh for early closure the open abdomen and its implications for the combative setting**

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**Background:** In modern day surgery the "open abdomen" or laparostomy is increasingly being used in the combative field during damage control surgery. The management options for laparostomies can be summarised into closure with the help of negative pressure closure therapy, and early closure of the defect with a mesh. Previously, the only meshes suitable for use within a contaminated field were expensive biological meshes. Since the arrival of an absorbable synthetic mesh, GORE BIO-A, which is also suitable in a contaminated field, the optimal type of mesh for early closure of laparostomies has not been elucidated.

**Objective:** We present a series of 3 patients that have had early closure of laparostomies, using GORE BIO-A mesh and evaluate their outcomes.

**Methods:** A retrospective study of patients who underwent early closure of a laparostomy with GORE BIO-A mesh using medical notes. The outcomes and complications of each case were reviewed.

**Results:** 3 patients were identified with a period of 6 to 12 months follow up. All 3 cases required laparostomy due to persisting intra-abdominal sepsis. In the short term, 1 patient developed a seroma post-operatively but long-term results for all of the cases were satisfactory with minimal morbidity and no signs of herniation.

**Conclusions:** Our experience shows that the use of GORE BIO-A mesh in the early closure of laparostomies is safe and produces good cosmetic outcomes. Use of GORE BIO-A also minimised the risk of tissue reactions associated with biologics. We further propose that abdominal injuries sustained in a combative setting where a contaminated field is more likely, GORE BIO-A mesh's suitability for insertion within a contaminated field makes it a more cost-effective alternative to traditional biologics. Further prospective studies are required to support the use of GORE BIO-A mesh in this role.

### **P39. Surviving lifethreatening complications and eight months with open abdomen after surgery for colorectal cancer**

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**Background:** A 37 year old, previously healthy, preschool teacher and mother of 8-year old twins, was diagnosed in February 2014 with synchronous rectal- and coloncancer (coecum). Preoperative radiochemotherapy was given due to expansive tumor growth onto the mesorectal fascia. No metastases to liver or lungs or other organs were present. Primary surgery Coloproctectomy and endileostomy at her local hospital on May 7<sup>th</sup> 2014.

Complications on second postoperative day: The patient developed early sepsis and was reoperated, where a perforation in a necrotic part of the ventricle was found. This required ventricle-resection and the abdomen had to be laid open with a home made vacuum system. Due to severe septic shock and disseminated intravascular coagulation she was transferred to Oslo University Hospital.

Surgical treatment and international support. In the following weeks several complications followed, and surgery with necrosectomy of the posterior abdominal wall, re-resection of the ventricular necrosis, splenectomy, pancreatic tail resection and resection of necrotic small intestine. She was left with 170 cm small intestine and a high jejunostomy 15 cm from the ligament of Treitz. The small intestine had multiple perforations and KCI AbThera VAC was changed every second to fourth day. The patient was tracheotomized and treated on the mechanical ventilator, with continuous renal replacement therapy, but most of the time being awake. Pain management, psychological support and antibiotic treatment were challenging, although her haemodynamic situation stabilized over time. She received continuous parenteral nutrition (PN). New perforations kept developing in the proximal jejunum and ventricle and histoacrylic glue was inserted in the distal pancreatic duct in an attempt to stop a severe pancreatic leakage. A pancreatic stent was inserted in order to lead the pancreatic content via the duodenum and out through the jejunostomy. However, pancreatic juice entered the abdominal cavity through several perforations in the proximal jejunum, thereby continuing the erosions of the surrounding tissue. To decrease the amount of bile passing through the duodenum, a pigtail drain was placed transhepatically into the bile.

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The proximal jejunum was resected and the duodenum left open drained with a foley catheter passing through the VAC. End of VAC treatment. In January 2015 the abdominal cavity was too small to keep the small intestine inside. The small intestine was totally adherent in an oedematous ball.

We managed to cover the intestine with the patients skin and subcutaneous tissue. A penrose drain was placed far from the midline and as low as possible into the duodenum and through the abdominal wall to make use of gravity.

We managed to separate the compartments so that there was no spillover of duodenal contents into the abdominal cavity. Duodenal content passes out into a stoma bag, about 1200 mL per 24 hours. About 1000 mL  $24\text{ h}^{-1}$  fluid drains from the lower part of the abdominal cavity.

Status February 10<sup>th</sup> 2015: The patient is walking with support, is self breathing without a tracheal canula and has

a normal renal function, maintaining low CRP and she was discharged from the ICU to the surgical ward 9 months after primary surgery.

Future plans: In 6–12 months we intend to anastomose the duodenum to the remaining 170 cm of small intestine, with an end-ileostomy, with or without lifelong support with PN. Hopefully a perforation at the oesophageal/ventricular junction will close. She is free of cancer.

**Conclusions:** The chances of surviving these multiple life-threatening complications after colorectal surgery would have been very limited without the VAC system and the multidisciplinary team approach with high quality intensive care treatment and daily rounds between surgeons and intensivists. Obviously, new challenges appear since more patients are surviving complications to gastrointestinal surgery.