O1. Preoperative Dietary Rehab Reduces the Risk of Lethal Gut Derived Sepsis

Robert Keskey; Emily Papazian; Alexander Zaborin; Olga Zaborina; John Alverdy

Background: The intestinal microbiota play an essential role in the host immune response to stress and infection. The intestinal microbiota of surgical patients are exposed to extreme stress including but not limited to antibiotics, starvation and the surgical injury itself. The extent to which an altered microbiome predisposes patients to postoperative sepsis remains to be clarified.

Hypothesis: A high fat Western-type diet (polyunsaturated fatty acid diet (PUFA)) predisposes mice to lethal sepsis following an otherwise recoverable surgical injury and can be reversed by short term exposure to a low-fat diet/high fiber diet.

Methods: In two separate experiments, 6-week-old C57/B6 mice (n=13) were fed PUFA diet versus standard mouse chow (n=6) for 6 weeks and weights monitored. At the 6-week time point, mice were placed on a 5-day antibiotic regimen and underwent a 30% hepatectomy after remaining NPO for 12 hours. In a separate experiment, mice feeding on PUFA for 6 weeks were allowed standard chow diet ad libitum for 1 week (n=8) or 3 days (n=17) prior to the start of antibiotics. After transitioning diets, preoperative microbiome composition of expelled feces was determined by 16S rRNA. Post-operative recovery was monitored for signs of sepsis and scored 1-6 (5 = moribund and 6 = death between assessments). Cecal contents were used to determine microbiota metabolic profile with Biolog Phenotype Microarrays. TUNEL staining was performed on postop cecal tissue to evaluate intestinal epithelial biomarkers.

Results: Mice feeding on PUFA developed a significant increase in postop lethal sepsis compared to chow fed mice (sepsis score PUFA=5.25, Chow= 1.17, $p < 0.001$). Mice transitioned to chow for 1 week prior antibiotics/hepatectomy (PUFA +1w Chow), had 100 % survival. Mice on chow 3d prior to antibiotics/hepatectomy (PUFA +3d Chow) showed improved survival by 63%. A bloom of Proteobacteria was observed in PUFA mice as compared to complete absence in Chow and 1wk Chow fed mice along with significant attenuation in PUFA +3d Chow. There was a significant difference in Firmicutes to Bacteroidetes (F:B) ratio between the groups with a higher F:B ratio in the PUFA group ($p < 0.001$). Cecal tissue in the PUFA +3d Chow mice had less apoptosis in the crypt base compared to PUFA mice ($p<0.001$). PUFA +3d Chow mice demonstrated recovery of their anaerobic metabolic profile back to metabolic profile similar to Chow.

Conclusions: PUFA diet induced severe dysbiosis and caused lethal sepsis in mice following an otherwise recoverable surgical injury. Preoperative rehabilitation with only 3 days of chow feeding had a significant impact on survival in PUFA fed mice that correlated to positive changes in the microbiota and epithelium.

O2. Immunomodulatory Effects of Remote Ischemic Conditioning in Hemorrhagic Shock Patients in a Randomized Controlled Trial

Chung Ho Leung; Sandro Rizoli; Shawn Rhind; Andrew Baker; Christopher A. Caldarone; Ori Rotstein

Background: Derangements in the immune response following hemorrhagic shock/resuscitation

contribute to systemic inflammatory response syndrome and multiple organ dysfunction. We have previously reported that remote ischemic conditioning (RIC) prevented inflammation and organ injury in experimental models of hemorrhagic shock and therefore has potential to improve outcomes in humans. In the present study, we investigated the safety and immunomodulatory effects of administering RIC to trauma patients in hemorrhagic shock following arrival to our Level 1 Trauma Centre.

Hypothesis: RIC is safe and exerts anti-inflammatory effects in trauma patients.

Methods: A prospective phase II double blind randomized controlled trial was conducted on trauma patients admitted to a Level 1 trauma centre with blunt or penetrating injuries in hemorrhagic shock (systolic BP < 90mmHG). Patients were randomized in a 1:1 ratio to receive either Sham (0 mmHg) or RIC (5-min thigh cuff inflation at 250 mmHg followed by 5-min deflation repeated for 4 cycles). Blood samples were taken at admission (pre-intervention), one, three, and 24 hr post-intervention for evaluation of neutrophil oxidative burst activity, adhesion molecule expression, and plasma levels of myeloperoxidase (MPO) as a marker of degranulation. A panel of plasma cytokines and chemokines were evaluated by multiplex assay.

Results: A total of 39 patients (21 Sham and 18 RIC) with a median ISS of 17 were enrolled. Hemorrhagic shock primed neutrophils for augmented PMA-stimulated oxidative burst activity and CD62L expression, but there was no difference between Sham and RIC groups. In addition, both groups had significant elevations in plasma levels of pro and anti-inflammatory cytokines and chemokines, but did not differ between groups. In a subgroup analysis of patients who received transfusion of blood products, RIC patients had significantly lower plasma MPO levels at 24 hr post-intervention ($P < 0.05$). In addition, RIC prevented the significant increases in Th2 chemokines TARC (CCL17) and MDC (CCL22) at 24 hr post-intervention ($P < 0.05$). Secondary clinical outcomes (blood products transfused, ICU and ventilator free days, nosocomial infections, adverse events, and 24 hr and 28 day mortality) were not different between groups.

Conclusions: In our cohort of trauma patients, administration of RIC was safe and did not adversely affect clinical outcomes. RIC appeared to prevent neutrophil degranulation and the rise in Th2 chemokines in the post resuscitation period. Further studies are warranted to study the impact of RIC in trauma patients.

O3. Spatially nested pathobionts in cecal crypts as a potential source of sepsis

Alexander Zaborin; Beatriz Penalver Bernabe; Anukriti Sharma; Sanjiv Hyoju; Neil Gottel; Jack Gilbert; Olga Zaborina; John Alverdy

Background: Genetic tracking of bacteria has revealed that many healthcare-associated infections arise from the patient's intestinal microbiota. These infections can be caused by pathobionts-normal microbial community members that become detrimental under stress. The microscopic niches for pathobionts remain ill-defined. We have previously demonstrated that cecal crypts are densely colonized by microbiota that become disrupted when the host is exposed to major surgical injury.

Hypothesis: Here we hypothesize that pathobionts can remain undetectable when camouflaged within cecal crypt sites, from which they systemically disseminate and propagate when the core crypt microbiota are disrupted. Thus, the aim of this study was to define the composition and structure of the normal cecal crypt microbiota and the fate of crypt pathobionts following surgical injury in mice.

Methods: C57/B6 mice underwent pre-operative antibiotic treatment and overnight starvation followed by 30% hepatectomy. Cecum and liver were collected for microbiota analysis by 16S rRNA. Laser capture microdissection was used to isolate crypt and luminal contents of the cecum from histological samples. DNA was extracted and 16S rRNA amplified and sequenced with Illumina MiSeq. Exact sequence variants (ESV) were identified with DADA2, and abundance differences between the conditions was determined with generalized linear models. Bacterial presence was corroborated using Fluorescence in Situ Hybridization (FISH).

Results: Before surgery, the microbiota in cecal crypts compared to lumen had lower diversity ($p<0.05$) and significantly distinct composition (beta-diversity $p<0.001$). Notably, cecal crypts were enriched with Mucispirilum schaedlery (Relative abundance (RA), 18% in crypts (C) vs 0.4% in lumen (L), $p<0.001$), where they formed tightly bundled packages (as visualized by FISH), incorporated with different potentially pathogenic species of Gammaproteobacteria (RA, 3%C vs 0.6%L, $p<0.001$). In contrast, the lumen was enriched in genera Turicibacter (16%L vs 0.12%C, $p<0.001$) and Lactobacillus (9%L vs 0.7%C, $p<0.001$). Following surgery, microbiota differentiation constraint was lost; M. schaedlery became undetectable in crypts, and Proteobacteria became dominant (86%, $p<0.001$). The luminal microbiota resembled the Proteobacteria-enriched crypts (rho>0.1, $p<0.05$) and was inversely associated with the pre-surgery lumen composition ($p<10\text{-}5$), as 100 Clostridia-related ESVs were highly depleted ($p<0.001$). Some potentially pathogenic Gammaproteobacteria species (e.g., genus Serratia) were observed to propagate and disseminate to distant tissues such as the liver (32%, $p=0.04$).

Conclusions: Cecal crypts may represent a hidden niche for pathobionts that propagate and disseminate following surgical stress. Identification of spatially nested microbes as potential sources of sepsis requires microscopic sampling and genetic speciation.

O4. An Adaptive Surgical Infection Prevention Program in Ethiopia Improves Quality and Reduces Postoperative Infections

Jared Forrester; Tihitina Negussie; Diego Schaps; Andualem Beyene; Seifu Alemu; Nichole Starr; Mohammed Adem; Abebe Bekele; Thomas Weiser

Background: Surgical infections cause major morbidity and mortality post-operatively, particularly in resource-constrained settings. Improved compliance with infection prevention standards embedded in the WHO Surgical Safety Checklist could reduce this burden.

Hypothesis: We developed Clean Cut, a multimodal, adaptive, checklist-based infection prevention program to improve compliance with best practices and reduce complications from surgery.

Methods: We introduced our program at three tertiary surgical hospitals in Ethiopia from July 2016-August 2018. We collected data prospectively on operating room infection prevention practices, assembled process maps to understand barriers to complying with best practices, and identified improvement opportunities through a locally-driven multidisciplinary team collaborative focused on six infection prevention standards: appropriate skin preparation, sterile field maintenance, proper selection & timing of antibiotics, instrument sterility verification, routine gauze counting, and appropriate surgical checklist use. We tracked outcomes for all patients for whom intraoperative compliance information was collected. Approval was obtained from appropriate hospital administrative bodies; as this was a quality improvement initiative, patient consent was not obtained.

Results: A total of 1409 operations were prospectively collected (276 during baseline assessment & 1133 following process improvement implementation). Adherence to all standards increased significantly, except skin preparation which was already performed at the standard. At baseline, perioperative teams only complied with an average of 2.8 of the six infection prevention standards; following process improvement changes, compliance rose to 4.6/6 ($p<0.0001$) [Figure 1]. The relative risk of infection following the process improvements was 0.59 ($p=0.0433$); overall surgical infections decreased from 8.52% to 6.70% ($p=0.2993$).

Conclusions: An adaptive, multimodal checklist-based infection prevention program relying on process mapping coupled with locally-led improvement solutions significantly reduced postoperative infection risk. This was accomplished without significant investments in new infrastructure or resources. A larger, more rigorous trial is necessary to determine whether this can be replicated to reduce postoperative complications and improve compliance with critical perioperative infection prevention standards on a larger scale.

O05. Following Feline Sarcoma Related (FER) Kinase in Immune Cells during Klebsiella Pneumonia (PNA)

Vladislav Dolgachev; Thomas Lanigan; MV Suresh; Boya Zhang; Krishnan Raghavendran; David Machado-Aranda.

Background: The role of Feline Sarcoma Related (FER) tyrosine kinase in lung injury and PNA has not been extensively studied, but remains highly intriguing given the results of Genome Wide Association Studies (GWAS) showing its protective effects in Sepsis and Adult Respiratory Distress Syndrome (ARDS). Our previous research in mouse models of lung contusion and PNA found that electroporation-mediated (EP) lung gene delivery of FER plasmid located the majority of its expression on lung epithelial cells, while survival was associated to a robust mobilization of innate immune cells evident during bronchial alveolar lavage (BAL).

Hypothesis: We ask if EP of dsRED-FER plasmid could label these effector cells directly and follow their function during PNA challenge.

Methods: We electroporated dsRED-FER and pSG5-FER plasmid to lungs of C57Bl6 unchallenged mice. 24h or 72h post EP samples were harvested including BAL fluid and lung parenchyma. In parallel, we induced pneumonia 6 h prior to EP by providing 500 CFU of Klebsiella sp via pharyngeal drop. BAL cells were used for flow cytometry (FC) and also viewed after fixing on slides for cytology. Lung parenchyma was processed for mRNA purification and gene expression analysis as well as FC cell quantification. We used a cocktail of antibodies to label monocytes, macrophages and neutrophils (Ly6C, F480 and Gr-1) and determine their positivity to dsRED.

Results: We found that dsRED plasmid induced a robust immune response predominantly labeling monocytes in unchallenged mice. Not surprisingly its expression was more predominant in neutrophils during PNA challenge. Flow cytometry findings were in agreement with histological tissue analysis. Control empty plasmids did not differentiate their response from naïve untreated controls. While numerically more cells were labeled at 24 h in a mixed population, the overall intensity of dsRED signal was higher at 72 h and enriched in monocytes. With unlabeled FER EP no dsRED signal was found. Quantitative analysis of human FER gene overexpression in mice lungs revealed 1323 ± 561 fold change over untreated control, peaking at 24h post EP($p < 0.05$; n=5, ANOVA).

Conclusions: New dsRED human FER plasmid EP represents powerful tool in quantitation of immune response induced by bacterial pneumonia challenge. Our results indicate EP-mediated gene

transfer of FER can occur directly to innate cells and may have a dual phase response. This could constitute a novel strategy for their reprogramming in favor of eliminating bacteria and improving survival.

O6. Intestinal Microbiota And Butyrate Depletion Drive Gut-Derived Infections In Necrotizing Pancreatitis

Fons van den Berg; Demi van Dalen; Hjalmar van Santvoort; Sanjiv Hyoju; Marc Besselink; Olga Zaborina; Marja Boermeester; John Alverdy

Background: Secondary infections in necrotizing pancreatitis are predominantly caused by inhabitants of the gastrointestinal tract.

Hypothesis: We hypothesize that disruption of the intestinal mucosa microbiota – more specifically a shift from obligate anaerobes to an increase of low abundance aerobic pathogens and depletion of butyrate-producers – is driving infectious complications in acute pancreatitis.

Methods: Comparative fecal microbiota analysis was done in 35 Dutch patients with mild or severe acute pancreatitis. Necrotizing pancreatitis in the mouse model was induced by retrograde infusion of taurocholic acid into thepancreatic duct. 6 week old mice were fed a high fat/low fiber Polyunsaturated Fatty Acids (PUFA) diet for 4 weeks prior to the procedure to alter the intestinal microbiota. Mice were postoperatively treated withplacebo or i.p. butyrate injections and monitored for survival during 72 hours. Blood and organs were collected for bacteriology, immune analysis by cytokine assay, and compositional by 16S rRNA sequencing and functional by Biolog Phenotype Microarray analyses of the microbiota. Luminal concentrations of short-chain fatty acids (butyrate, propionate, acetate) in the cecum were measured by gas chromatography-mass spectrometry.

Results: The analysis of human samples demonstrated a domination of potential pathogens in fecal samples in patients with severe pancreatitis. Furthermore, the relative abundance of butyrate-producing bacterial genera was lower in patients with severe acute pancreatitis, as compared to patients with mild acute pancreatitis. In the mouse model, PUFA fed mice showed a sharp decrease in survival (18%, n=11 versus 100% in chow-fed mice, n=14, $p<0.001$) and an increase of gram-negative bacteria (predominant Escherichia coli) during necrotizing pancreatitis. Cecal microbiota analysis showed a decrease in alpha-diversity and a bloom of mucosa-adherent E.coli in the moribund mice. Functional analysis revealed an enhanced aerobic metabolic activity of cecal bacterial communities in moribund mice, and a depletion of luminal butyrate concentrations. Reiterative experiments demonstrated that 88% of the mice were rescued with intraperitoneal butyrate injection (n=7, $p<0.001$). Intestinal abundance of E.coli, bacterial dissemination, serum endotoxin, and IL-6 levels were reduced with butyrate treatment.

Conclusions: This data indicates that disruption of the gut microbiota promotes bacterial dissemination and contributes to severe infections in necrotizing pancreatitis. Butyrate treatment is potentially effective in reducing bacterial dissemination and mortality in necrotizing pancreatitis and may be used as prophylactic therapy. However, the underlying mechanisms are largely unknown and remain under investigation.

O07. Sepsis-Induced Increases in Inflammatory Mediators Associated with Adipose Tissue Browning in Burn Patients

Carly Knuth; Chris Auger; Sarah Rehou; Marc Jeschke

Background: Burn injury and sepsis have been independently shown to trigger a drastic hypermetabolic response. We have previously shown that burn-induced hypermetabolism promotes a systemic inflammatory response mediated by IL-6 signalling, inducing the browning of white adipose tissue (WAT). Browning is characterized by white adipocytes adopting a brown-like phenotype, which is suggested to further propagate metabolic overdrive in burn patients. Whether sepsis contributes to IL-6-mediated WAT browning following burn injury remains unclear.

Hypothesis: Given that the presence of sepsis further enhances the hypermetabolic response in burn patients, we hypothesize that IL-6-mediated WAT browning will be exacerbated in septic burn patients.

Methods: Non-septic (n=58) and septic (n=48) adults with burns over 20% TBSA admitted between 2010-2015 were enrolled in this prospective study. Demographics, injury characteristics, clinical outcomes, resting energy expenditure (REE), and blood samples were obtained throughout hospitalization. Data was stratified based on date of collection into four groups: 0—7 days, 8—14days, 15—30 days, and >30days.

Results: There were no differences in age ($p=0.24$), gender ($p=0.29$), TBSA ($p=0.46$), BMI ($p=0.14$), or baux score ($p=0.28$) between septic and non-septic patients. The average sepsis date of onset was approximately 13 days post-burn, which was accompanied by a signal towards an increase in predicted REE percentage at 8—14 days ($p=0.07$) in comparison to non-septic burn patients and significant reductions ($p<0.05$) in non-esterified fatty acids when comparing pre-septic and post-septic serum concentrations. Additionally, cyto/chemokines TNF-α ($p<0.05$), IL-10 ($p<0.01$), IL-6 ($p<0.01$) and MCP-1 ($p<0.01$) were significantly elevated in septic patients at 8—14 days post-burn compared to their non-septic counterparts. Notably, IL-6 ($p<0.05$) and MCP-1 ($p<0.05$) remained elevated until day 30 and beyond 30 days, respectively. IL-4 and IL-13 were significantly decreased ($p<0.05$) at 15—30 days compared to non-septic patients.

Conclusions: Burn injury compounded by the presence of sepsis provokes an intensified hypermetabolic response, demonstrated by elevations in whole-body energy expenditure and reductions in free fatty acids, indicative of increases in lipid uptake. Additionally, pro-inflammatory cytokines were shown to significantly increase upon septic onset, while IL-4 and IL-13 were reduced in the days following septic onset. In support of previous work that determined IL-6 signalling, and not IL-4/13, mediate the hypermetabolic response of WAT browning in burn patients, we propose that the presence of sepsis contributes in an additive manner to the hypermetabolic condition.

O08. Catheter-Associated Urinary Tract Infections Among Trauma Patients: Poor Quality of Care or Marker of Effective Rescue?

Husayn Ladhani; Esther Tseng; Jeffrey Claridge; Christopher Towe; Vanessa Ho

Background: Catheter-associated urinary tract infections (CAUTI) are a widely-used quality indicator, prompting significant resource allocation towards prevention. Although CAUTI is known to be generally associated with poor outcomes, the effect of CAUTI on specific clinical outcomes is poorly described in trauma patients.

Hypothesis: We hypothesized that trauma patients with CAUTI would have worse outcomes such as prolonged length of stay (LOS), discharge to a facility, and death.

Methods: Patients with LOS >2 days in the 2016 Trauma Quality Improvement Program database were included. Patients with and without CAUTI were matched 1:1 via a propensity score using patient, hospital, and injury factors, including injury mechanism, abbreviated injury scores, and comorbidities (caliper 0.05, no replacements). Outcomes were compared between matched pairs, including other hospital acquired infections (HAI), LOS, intensive care unit (ICU) LOS, ventilator days, unplanned events (intubation, operation, and ICU admission), discharge disposition, and mortality, using the Wilcoxon matched-pairs signed rank test for continuous and exact McNemar test for categorical variables.

Results: The incidence of CAUTI was 0.73%. 1,529 matched pairs were created from a cohort of 246,126 patients. Propensity match effectively reduced bias; post-match propensity score variables all had absolute standardized differences <0.1. In matched pair analysis, CAUTI patients had lower mortality compared to patients without CAUTI (7.1% vs. 10.9%, $p<0.05$). CAUTI was associated with higher rates of other HAIs, longer overall and ICU LOS, more ventilator days, more unplanned events, and fewer discharges home (all $p<0.01$, Table).

Conclusions: Trauma patients with CAUTI had improved survival despite higher rates of other HAIs, longer LOS, more ventilator days, and fewer discharges to home. The CAUTI group had more unplanned events perhaps suggestive of interventions intended to prevent mortality after complications, such as ICU admission, intubations, and operations. Therefore, CAUTI may be a consequence of effective “rescue” care that leads to decreased mortality, rather than a marker of poor quality.

O09. Is Postoperative Infection a Predictor of 1-year Mortality? A Propensity Score Analysis

William O'Brien; Kalpana Gupta; Kamal Itani

Background: Postoperative infection is associated with subsequent higher cost, morbidity and mortality. The purpose of this study is to determine whether patients with a postoperative infection face increased risk of 1-year mortality, after adjusting for confounding using a propensity score approach to balance observed patient baseline characteristics between control and exposure groups.

Hypothesis: Patients with a 30-day postoperative infection have a higher risk of mortality during the year after surgery.

Methods: We obtained chart-reviewed data on patient and surgery characteristics, 30-day infections (the exposure), and 1-year mortality (the outcome), from the VHA Surgical Quality Improvement Program (VASQIP) during 2008-2015. Surgeries were included if the patient had no prior or subsequent surgery within 1 year, and if the patient had neither 30-day preoperative infection nor 30-day postoperative death. 30-day infection was defined as occurrence of surgical site infection, bloodstream infection, urinary tract infection, or pneumonia. A propensity score model was estimated, and stabilized inverse probability of treatment weights were used in a Cox proportional hazards model to estimate risk of death as a function of exposure to postoperative infection.

Results: There were 538,610 surgeries included in the study, in which 16,178 (3.0%) had a 30-day infection. Of these, 6,570 (40.6%) had an SSI, 4,442 (27.5%) had a UTI, 2,579 (15.9%) had PNA, and 1,137 (7.0%) had a BSI. The remaining 1,450 (9.0%) of patients with infection had a combination of 2 or more infection types (e.g. SSI plus UTI). 1-year mortality occurred in 1,289 patients (0.24%), and median postoperative day of death was 47 (IQR 37-66). Baseline characteristics of patients with and without infection were well balanced in the weighted sample, with surgical specialty being the only

covariate with a standardized mean difference greater than 0.2. Mean age in control patients was 59.0 (SD 13.8), and in exposed patients was 59.2 (13.6). 91.2% of controls were male, compared with 88.9% of exposed patients. In regression analysis, the hazard ratio of mortality in exposed patients was 4.41 (95% CI 3.68 – 5.28).

Conclusions: The occurrence of postoperative infection leads to a 4.4 times higher probability of death at any given time during the 1-year postoperative interval, compared with those patients having no postoperative infection. This is one of the largest studies to date describing long-term harms of surgical infection, using recently developed statistical methods capable of inferring causality in a non-randomized cohort.

O10. Cost-Effective Methods of Optimizing Antibiotic Stewardship in Pediatric Non-Complicated Appendicitis

Angela Kao; Trudy Marks; Sean Maloney; Tanushree Prasad; Brant Todd Heniford; Graham Cosper

Background: Acute non-complicated appendicitis is the most common pediatric surgical diagnosis and has been identified as a high-impact target for antimicrobial stewardship interventions, given the wide variability in antibiotic regimens within and between centers. Unnecessary carbapenem use and inadvertent postoperative dosing contributes to increased antimicrobial resistance and inefficient resource utilization. After observing wide institutional variability, a quality improvement initiative was developed targeting standardization of antibiotics for non-complicated appendicitis.

Hypothesis: We hypothesized that implementation would reduce unnecessary antimicrobial use and improve cost-efficiency of care.

Methods: A clinical practice guideline (CPG) [preoperative single dose ceftriaxone and metronidazole for non-penicillin allergic] was developed for pediatric non-complicated appendicitis and implemented into the standard order set in June 2017. Perioperative data was collected prospectively during the study period (June 2016-August 2018). Patients treated pre- and post-CPG implementation were compared using univariate analysis, with statistical significance set at $p<0.05$.

Results: A total of 167 patients, including 58 pre-CPG and 109 post-CPG, underwent laparoscopic appendectomy. There were no differences in mean age (11.7 vs. 11.0 years, p=0.45), leukocytosis (15.3 vs. 15.5, p=0.82), or time from diagnosis to OR (8.9 vs. 8.8hours, p=0.71) between cohorts. Compared to pre-CPG, post-CPG patients were more likely to receive the recommended antibiotics (13.8% vs. 90.8%, p<0.0001), with a significant reduction in carbapenem use (81.0% vs. 9.2%, p<0.0001). Post-CPG patients also received fewer postoperative antibiotic doses (25.9% vs. 9.2%, p=0.004) and had lower pharmacy costs per patient ($123.20 vs. $67.70, p<0.0001), leading to 50% reduction in total pharmaceutical costs ($2620 vs. $1296, p<0.0001). There were no differences in complications (1.7% vs. 2.8%, p=1.00) or readmissions (5.2% vs. 1.8%, p=0.38).

Conclusions: Implementation of a recommended antibiotic regimen for pediatric non-complicated appendicitis significantly reduced excess antibiotic dosing and pharmacy costs, resulting in improved antimicrobial stewardship and resource utilization. Using standardized orders to minimize practice variation and increase provider compliance, this study demonstrates the cost-effective impact of antimicrobial stewardship efforts in pediatric surgical patient populations.

O11. Multicenter Outcomes of Chlorhexidine Oral Decontamination in Intensive Care Units

Joshua Parreco; Hahn Soe-Lin; Saskya Byerly; Ning Lu; Georgia Vasileiou; D. Yeh, MD; Gabriel Ruiz; Nicholas Namias; Rishi Rattan

Background: The efficacy of oral chlorhexidine (oCHG) for decontamination in patients admitted to the intensive care unit (ICU) is variable. The purpose of this study was to evaluate the effect of oCHG decontamination on the incidence of pneumonia (PNA), sepsis, and mortality in ICU patients.

Hypothesis: It was hypothesized that ICU patients recieving oCHG would have lower rates of pneumonia, sepsis, and mortality.

Methods: The Philips eICU database version 2.0 was queried for patients admitted to the ICU in 2014-2015 for at least 48 hours. The primary outcome was ICU mortality. The secondary outcomes were diagnosis of PNA or sepsis. Patients with PNA or sepsis diagnosed within the first 48 hours of ICU admission were excluded from the respective outcome analyses. Univariable analysis was performed using age, gender, race, Acute Physiology Score III, APACHE IVa score, surgical ICU admission status, trauma ICU admission status, intubation status, teaching hospital status, hospital bed size, hospital region, ICU length of stay, and oCHG order. Multivariable logistic regression was performed using univariable outcomes with a $p<0.05$.

Results: Of the 64,904 patients from 186 different hospitals that met inclusion criteria, 22.1% (n=14,333) had oCHG ordered. The overall mortality rate was 6.9% (n=4,449) and the oCHG mortality rate was 10.6% (n=1,518, $p<0.01$). After controlling for confounding factors, oCHG remained an independent risk factor for mortality (OR 1.25 [1.16-1.34] $p<0.01$). After excluding patients with a PNA diagnosis before 48 hours in the ICU, the overall PNA incidence was 2.6% (n=1,431) and the oCHG PNA incidence was 4.2% (n=517, $p<0.01$). However, multivariable logistic regression revealed no significant difference in risk of PNA with oCHG (OR 0.97 [0.85-1.09] $p=0.58$). After excluding patients with a sepsis diagnosis before 48 hours in the ICU, the overall rate of sepsis was 1.8% (n=949) and for patients with oCHG the rate of sepsis was 3.3% (n=388, $p<0.01$). After for controlling for other confounders, oCHG remained an independent risk factor for sepsis (OR 1.37 [1.19-1.59] $p<0.01$).

Conclusions: Chlorhexidine mouthwash may be associated with an increased risk of mortality and sepsis in ICU patients while not significantly affecting the risk of developing pneumonia. Further randomized, multicenter trials are needed to better understand the effect of oral chlorhexidine on outcomes.

O12. High Tidal Volume Ventilation is Associated with Ventilator-Associated Pneumonia in Acute Cervical Spinal Cord Injury

Gabrielle Hatton; Patrick Mollett; Shuyan Wei; Radha Korupolu; Sasha Adams; Charles Wade; Lillian Kao

Background: Respiratory complications are the main cause of morbidity and mortality after acute spinal cord injury (SCI). Complications are attributed to hypoventilation, increased respiratory secretions, and impaired cough. High tidal volume ventilation (HVtV) is used in SCI rehabilitation centers to overcome hypoventilation while weaning from the ventilator. The effect of HVtV on respiratory complications such as ventilator-associated pneumonia (VAP) during the acute post-injury period is unknown.

Hypothesis: SCI patients receiving HVtV in the acute post-injury period is associated with lower

incidence of VAP when compared to patients receiving standard tidal volumes.

Methods: This was a cohort study of adult (>16 years) trauma patients with cervical SCI admitted to a level 1 trauma center from 2011 to 2015. Exclusion criteria included: head abbreviated injury scale >5, mechanical ventilation <2 days, and a diagnosis of acute respiratory distress syndrome. HVtV was defined as a median tidal volume >10cc/kg ideal body weight during time on ventilator up to two weeks post-injury. VAP was defined according to the National Trauma Data Base Dictionary. Univariate, multivariable, and Bayesian analysis using a neutral prior were utilized to interpret the data.

Results: Of 147 patients included, 71 (48%) developed VAP. HVtV was utilized in 20 (14%) patients. Demographics were similar between patients who received HVtV and standard ventilation, except patients were younger in the HVtV group. VAP developed in 70% of patients receiving HVtV and in 45% receiving standard tidal volumes (p=0.01). After adjustment, HVtV resulted in an odds ratio of 1.39 for VAP, credible interval 0.55-3.57, and a posterior probability of 76% that HVtV increases pneumonia (Table).

Conclusions: This is the first study to evaluate the association between HVtV and VAP in the acute post-injury period. While limited by small sample size and selection bias, our data did not reveal benefit from HVtV for patients with cervical SCI in the acute post-injury period, contrary to findings during the rehabilitation period. Further investigation into optimal early ventilation settings is needed for SCI patients, who are at a high risk of VAP.

O13. Does intra-wound vancomycin application during spinal surgery increase rates of surgical wound infection and disruption?

Victor R. Vakayil; James Glover; Jeremiah Atkinson; Ty Kanstrup; James Harmon; Catherine Statz; Robert Bulander

Background: Surgical site infection (SSI) following spinal surgery is associated with increased morbidity, mortality and healthcare costs. The application of intra-wound vancomycin powder prior to closure during spinal surgery is not FDA approved; the lack of randomized clinical trials and concerns for accelerated antibiotic resistance have raised questions about the safety and efficacy of this intervention.

Hypothesis: The use of intra-wound vancomycin powder is associated with decreased postoperative rates of SSI and wound disruption.

Methods: We performed a single-institution, one year, observational cohort analysis of all patients undergoing spinal surgery. Patients were stratified into those who received intra-wound vancomycin powder: the vancomycin group (VG), and those who did not (nVG). We assessed demographics, baseline comorbidities and perioperative variables. Our primary outcome of interest was 90-day SSI rate and rates of wound disruption. We constructed multivariate regression models to evaluate the independent effect of vancomycin application on 90-day outcomes. Additionally, we reviewed culture antibiograms to evaluate vancomycin resistance.

Results: Of the 1081 patients analyzed, 47.2% (N=510) received intra-wound vancomycin powder while 52.8% (N = 571) did not. On univariate analysis, SSI was significantly higher in the VG (4.9%, N=25) when compared to the nVG (2.6%, N=15, P = 0.048). Similarly, rates of wound disruption were also higher in the VG (3.1%, N = 16) than the nVG (0.9%, N = 5, P = 0.007). On multivariate analysis, vancomycin application was independently associated with an increased rate of wound disruption

(OR 3.2, P = 0.038, Table 1), however, the rates of SSI were equivocal. Antibiograms of culture isolates demonstrated the growth of vancomycin-resistant Enterococci in the VG (4%, N=1).

Conclusions: The application of intra-wound vancomycin powder during spinal surgery failed to demonstrate improved protection against developing SSI. Moreover, vancomycin administration significantly increased rates of wound disruption and may be associated with increased antimicrobial resistance. Our results question the safety and efficacy of this practice. Randomized clinical trials are required to demonstrate a benefit to the intra-wound application of vancomycin powder.

O14. Recidivism in Surgical Intervention for Skin and Soft Tissue Infections from Injection Drug Use: Risks and Patterns

Mary Condron; Elizabeth Dewey; Martin Schreiber

Background: Part of the opioid epidemic familiar to all General Surgeons is skin and soft tissue infections (SSTI) secondary to injection drug use (IDU). These infections often require surgical intervention which can range from straight forward incision and drainage all the way to major amputation. We have anecdotally observed a pattern of surgical recidivism among a subpopulation of these patients. To date, there are no studies examining rates, patterns, or associations of recidivism in surgical treatment of IDU related SSTIs.

Hypothesis: We propose that there are identifiable patterns in and risk factors for recidivism in SSTI requiring procedural intervention secondary to IDU.

Methods: 10-year retrospective chart review at an urban tertiary referral center of patients with both IDU and surgical treatment of SSTI. Univariate and multivariate analyses were performed to identify associations with repeated surgical encounters. Significance was evaluated at $p< 0.05$

Results: 2,197 patients meeting inclusion criteria underwent 6,525 surgical encounters during the study period. More than half (1,274) were recidivists. Recidivism was more likely among patients who were older ($p=0.02$), married ($p=0.02$), or identified as religious ($p<0.0001$). Recidivists had longer LOS ($p<0.0001$) with higher in-hospital mortality ($p<0.0001$). Among recidivists, each additional procedure was associated with an increased risk of in-hospital mortality of 17% ($p<0.0001$). Those in the highest quartile of encounters were more likely to be female ($p=0.02$) and to die during the study period (6.3% vs 12.7%, $p<0.0001$).

Conclusions: Patients who underwent multiple surgeries for IDU SSTIs were different: they tended to be older, married, and religious. These findings have important implications for patient care and public policy. We recommend further investigation to determine the impact of delivering additional resources to those at high risk of recidivism. We would predict that this could reduce patient mortality (as each procedure increases risk of death), decrease healthcare costs, and mitigate provider burnout secondary to repeatedly treating the same problem in the same patient.

O15. Comprehensive improvement of infection prevention practices in Ethiopia: Further refining the Lifebox Clean Cut program

Nichole Starr; Assefa Tesfaye; Natnael Gebeyehu; Jared Forrester; Thomas Weiser; Tihitina Negussie

Background: Surgical infections are a major cause of perioperative morbidity and mortality,

particularly in low resource settings. Clean Cut is a quality improvement program co-developed by Lifebox and Ethiopian champions focused on reducing postoperative infectious complications by strengthening adherence to infection prevention standards embedded in the WHO Surgical Safety Checklist.

Hypothesis: Initially implemented in three hospitals in Ethiopia over 2 years, it was refined using peer-to-peer learning strategies.

Methods: Following successful Clean Cut pilot testing, the implementation strategy was refined and modified to a six-month intervention after interviews and facility-level meetings with all involved perioperative staff. A revised strategy of peer-to-peer mentoring was employed to build capacity and leverage local experience and relationships to encourage sustainable change. Subsequently the program was introduced in two additional Ethiopian hospitals. Adherence to Clean Cut standards were continuously monitored and 30-day outcomes obtained for all enrolled patients.

Results: Modifications included 1) creating a local mentor relationship between a tertiary referral hospital and primary hospital, 2) emphasizing active hospital administration participation and engagement of entire operating room (OR) staff in discussions, 3) establishing a platform for shared learning, and 4) instituting supplementary educational trainings reinforcing critical infection prevention standards. Compared to baseline (n=92), adherence to standards improved significantly post-program implementation (n=609). Appropriate use of the WHO Surgical Safety Checklist, proper hand decontamination, sterility indicator use with instruments and surgical linen all improved (Table 1). Additionally, prophylactic antibiotic administration in the OR (rather than prior to entering) increased from 11% to 34% ($p<0.001$). Inpatient surgical site infections (SSI) significantly decreased (6.5% to 2.3%, $p=0.02$); there was a nonsignificant decrease in all inpatient infectious complications (9.8% to 5.4%, $p=0.10$) and overall complications (11% to 7.7%, $p=0.30$).

Conclusions: A modified implementation strategy for the Clean Cut program focused on local mentorship and larger team discussions improved communication, allowing for more rapid uptake through multidisciplinary process change. Adherence to recognized infection prevention standards improved with an associated SSI reduction. Larger scale implementation with further refinement highlighting established mentor hospitals could improve infection prevention practices in Ethiopian ORs and reduce postoperative infections.

O16. The ACA's Impact on Emergency General Surgery Admissions for Complicated Diverticulitis

Paul Albini; Nikolas Kappy; Todd Costantini; Jay Doucet, MD, MSc; Laura Godat

Background: The Affordable Care Act (ACA) expanded access to health insurance for millions. In prior work, the ACA decreased overall need for Emergency General Surgery (EGS) but costs and reported complications increased, with more EGS done at teaching centers. The effects of the ACA on EGS for complicated diverticulitis (CD) are unknown.

Hypothesis: We hypothesized that emergency interventions for CD decreased post-ACA, with more CD admissions at teaching hospitals.

Methods: The National Inpatient Sample (NIS) from 2012 through Q3 of 2015 was used to collect ED admissions for CD, defined as diverticulitis with peritonitis or abscess, in patients aged 18-64. ICD-9 codes were used to identify interventions including open or laparoscopic colectomy, ostomy, or percutaneous abscess drainage. Demographics, length of stay (LOS), hospital type, and Charlson

Comorbidity Index (CCI) were obtained. The ACA effect (pre: 2012-2013, post: 2014-Q3/2015) on mortality, complications, and costs was assessed using Difference-in-Differences (DID) analysis.

Results: A total of 13,909 CD admissions were identified in the unweighted NIS sample. CD admissions increased on average 5.7% annually during the study period with admissions shifting to teaching hospitals post-ACA (44.5% to 60.6%, p<0.001). Post-ACA, self-payers decreased (17.4% to 11.8%, p<0.001) while Medicaid increased (12.3% to 18.0%, p<0.001) and private insurance did not change. Median LOS decreased post-ACA (6 days to 5 days, p<0.001). Median wage-index adjusted admission costs increased post-ACA ($12.0K to $14.1K, p<0.001). Post-ACA, the need for surgery was unchanged as was the need for percutaneous drainage only. Overall, admissions with complications increased post-ACA (28.4% to 30.2%, p=0.026). Complications for surgery were unchanged but were increased for percutaneous drain-only (21.7% to 26.7%, p=0.001). There was no change in mortality post-ACA. Adjusted DID analyses for insured vs uninsured admissions showed no significant difference in the rate of change for interventions, complications or costs post-ACA.

Conclusions: Contrary to our hypothesis, CD admissions increased post-ACA, although the rates of interventions remained similar. Overall costs and complications increased. Teaching hospitals now admit the majority of CD cases, which should drive resource allocation and policy.

O17. Risk of Surgical Site Infection in Exploratory Laparotomy

Erin Andrade; Jarot Guerra; Laurie Punch

Background: Laparotomy incisions with contamination have higher incidence of surgical site infection (SSI). One management strategy has been to allow these wounds to heal by secondary intention to reduce rates of SSI; however, this results in ongoing need for wound care after discharge.

Hypothesis: We hypothesized that the use of a high-risk incision closure protocol (HRICP) could allow for primary closure in contaminated wounds without increasing the SSI rate.

Methods: A prospectively maintained Acute and Critical Care Surgery (ACCS) database spanning 2008-2018 was queried for patients who underwent exploratory laparotomy. Patients were stratified into two time periods 2008-2015 (no protocol) and 2016-2018 (closure protocol). All patients in the later period were operated on by a single surgeon utilizing HRICP, which included dilute Chlorhexidine lavage, closed suction drains for incisions deeper than 3 cm and topical negative pressure therapy. Trauma patients and in hospital deaths were excluded. CDC guidelines were used to determine wound classification and SSI based on chart review. Data were analyzed using chi-squared and logistic regression.

Results: There were 148 patients who met study criteria. Rates of wound closure at discharge were higher in the closure protocol (CP) group than the no protocol (NP) group across wound classes but the difference only achieved significance in dirty wounds (50% NP vs 96% CP, p<0.0001). CP significantly increased the likelihood of wound closure at discharge (OR=42.9, p=0.001) even after controlling for age, gender, BMI, smoking, diabetes, and wound classification. The overall SSI rate, including superficial and deep space infections, was not significantly different in NP versus CP (18 vs 21%, p=0.659). Rate of superficial SSI was similar between NP and CP (10 vs 7.8%, p=0.653). In a subgroup analysis of contaminated and dirty wounds, CP increased the likelihood of wound closure at discharge significantly (OR=6869, p=0.015) and was not associated with increased risk of superficial SSI (OR=0.565, p=0.559) or overall SSI (OR=0.914, p=0.905).

Conclusions: Utilization of HRICP allows for increased primary closure, less need for post-operative wound care, and a similar rate of SSI. Further study of the components of HRICP are required to assess which ones have maximal impact in minimizing SSI after high-risk closure.

O18. Machine Learning Prediction Of Surgical Site Infection Using Color Images Of Wound Captured By Community Health Workers

Richard Fletcher; Frederick Kateera; Theoneste Nkurunziza; Joanna Ashby; Olasubomi Olubeko; Harsh Sonthalia; Bethany Hedt-Gauthier; Robert Riviello

Background: BACKGROUND: Surgical site infections are a particular concern in low-resource areas, where there is poor access to clinical facilities or trained clinical staff. In Rwanda in particular, infection of Cesarean section wounds occurs in approximately 11% of patients and is a leading cause of maternal mortality. To address this problem, our team has begun to explore the use of mobile smart phones as a tool to examine a surgical wound and automatically predict infection.

Hypothesis: HYPOTHESIS: Based on the photographs caputured by the mobile devices, we expected that some aspect of the photographs could be used to help distinguish between infected and non-infected wounds.

Methods: METHODS: We have conducted an initial study to predict infection in Cesarean section wounds using image data collected by community health workers in rural Rwanda. From May-October 2017, all women undergoing Cesarean sections at Kirehe District Hospital were invited to return to a study clinic at postoperative day 10. At this visit, women were assessed for a surgical site infection (SSI) by a general practitioner which was used as the gold standard for SSI diagnosis. In addition, color images of the surgical wound were also captured by the community health workers using the internal camera on mobile devices (Android tablets). DATA ANALYSIS: Machine learning models (Logistic regression and Support Vector Machines (SVM)) were developed independently for the image data. Cross validation and L1 regularization was used to prevent overfitting. The features used for the color image analysis consisted of Gabor wavelet coefficients for texture analysis, and color analysis with histogram features using the median and variance of the pixel color in the L-A-B color space. To reduce the computational load, all images were reduced to a standard size of 160x340 pixels.

Results: RESULTS: Of the 572 women, 61 were determined to be infected by the general practitioner. Using the image data alone, the SVM model performed best, with an AUC Accuracy = 99.5% (99.2%-100%), Sensitivity = 0.99 (0.99 – 1.00), and Specificity = 0.99 (0.99 – 1.00). The image color components, using the L-A-B color space, had the most predictive value.

Conclusions: CONCLUSION: Results from this initial study are very encouraging and demonstrate that good prediction of surgical infection is feasible using machine learning methods. This study also demonstrates that images captured by community health workers using mobile devices are of sufficient quality for use in infection prediction. Further work is currently underway to explore how such algorithms can be implemented on a mobile smart phone to enable real-time wound assessment at the patient bedside.

O19. Trauma Center Ratings in Hospital Compare: Poor Performance or Biased Modeling?

Brian Young; Joseph Golob Jr M.D.; Alexis Harvey; Samuel Zolin; Vanessa Ho; Jeffrey Claridge

Background: Surgical site infection (SSI) after colon surgery is a key component of the Centers for Medicare & Medicaid Service's (CMS) star rating as well as incentive and penalty programs. All colon cases, including those for trauma, are evaluated; however, trauma status is not included in the logistic regression model used to calculate standardized infection ratios (SIRs) for hospital comparison.

Hypothesis: We hypothesized that trauma centers would have worse colon SIRs and star ratings when compared to non-trauma hospitals.

Methods: Current hospital star ratings and 2014 and 2016 colon SIRs were obtained from Hospital Compare and matched to state trauma designations from the Trauma Information Exchange Program. Trauma centers were defined as level 1-3. Hospitals without 2016 colon SIRs were excluded. SIRs and star ratings were compared for trauma and non-trauma centers and by trauma level. Student's t-test, analysis of variance (ANOVA), and Tukey post hoc analysis were used for comparison.

Results: 1951 hospitals were included. 849 (44%) were trauma centers: 206 level 1s, 307 level 2s, and 336 level 3s, respectively. 2016 colon SIRs were higher for trauma centers than non-trauma centers (0.98±0.69 vs 0.88±0.72, $p<0.01$). ANOVA yielded significant variation among trauma levels for colon SIRs in 2016, $p<0.01$. A post hoc Tukey test showed that level 1 centers had higher SIRs than each remaining hospital type, $p<0.05$. These results were similar for the 2014 baseline (1.03±0.78 vs 0.90±0.76 $p<0.01$; ANOVA, $p<0.01$), Tukey $p<0.05$. Despite an apparent dose effect for higher trauma designation, no significant differences were noted between level 2, 3, and non-trauma hospitals. A review of hospital star ratings noted no difference based on trauma center status alone (2.97±1.13 vs 3.01±1.21, $p=0.47$), but ANOVA was significant ($p<0.01$), with level 1 trauma centers having lower star ratings than each remaining hospital type by Tukey analysis, $p<0.05$.

Conclusions: Level 1 trauma centers perform worse on CMS's SIR calculation for colon SSIs, contributing to lower overall star ratings. Our data suggests a biased model which may be penalizing hospitals for providing care to trauma patients. Despite a new model being introduced in 2019, trauma status remains excluded.

O20. Primary and Secondary Empyema have distinct bacterial pathogens: implications for empiric antibiotic treatment

Christopher Towe; Sudershan Srinivasan; Vanessa Ho; Malavika Kesavan; Katherine Wu; Stephanie G. Worrell; Yaron Perry; Philip Linden

Background: Empyema can be characterized as either primary (parapneumonic) or secondary (post-traumatic, perforation, or procedure), and often requires surgical intervention.

Hypothesis: We hypothesized primary and secondary empyema have distinct bacteriology.

Methods: Consecutive surgical decortications in an academic Medical Center from 1/1/2010-10/1/2017 were reviewed and categorized as primary or secondary empyema. Cases were matched to microbiology cultures. Descriptive statistics were used to describe the relationship of cultured bacteria to empyema type.

Results: 183 patients were included; 119 (64%) had primary and 66 (36%) had secondary empyema. Positive culture results were present in 79 (43%), 46/119 (38%) with primary empyema and 33/66 (50%) with secondary empyema ($p=0.14$). The most commonly isolate was Streptococcus, present in 29 (37%), followed by Staphylococcus in 19 (24%). 11 patients (13.9%) had fungal infections. 16

(20%) patients had polymicrobial empyema. Primary and secondary empyema differed in several ways (table), including the rate of gram-positive and gram-negative isolates, and specifically the presence of ESKAPE pathogens (Enterococcus, S. aureus, Klebsiella, Acinetobacter, Pseudomonas, Enterobactericeae). There was a trend towards higher rates of fungal infections in secondary empyema, candida infections were more common in secondary empyema (2/46 vs 7/21, p=0.02). Streptococcus species rarely exhibited resistance (7% intermediate to ceftriaxone, 4% intermediate to PCN). Staph Aureus was frequently resistant (26% clindamycin, 25% ciprofloxacin, 89% to penicillin, 42% to oxacillin (MRSA), and 5% to TMP-SMX). Seven MRSA isolates were tested against carbapenems and were resistant to imipenem, meropenem, and ertapenem. All MRSA were susceptible to linezolid and vancomycin.

Conclusions: Distinct bacteriology characterizes primary and secondary empyema, which may support individualized empiric antibiotic treatment for empyema based on etiology. Multi-institution study to establish antibiotic guidelines for empiric treatment prior to surgical culture and drainage is appropriate.

O21. Aged Dependent Long-Term Outcomes after Sepsis in Critically Ill Surgical Patients

Philip Efron; Gabriela Ghita; Scott Brakenridge; Zhongkai Wang; Quran Wu; Anna Gardner; Frederick Moore; Michael Cox; McKenzie Hollen; Russell Hawkins; Julie Stortz; Christiaan Leeuwenburgh; Babette Brumback; Alicia Mohr; Lyle Moldawer;

Background: Early detection & treatment has decreased inpatient sepsis mortality. An increasing number of early sepsis survivors now progress into chronic critical illness (CCI = ICU LOS≥14 days with persistent organ dysfunction) & it is unclear how age affects these outcomes.

Hypothesis: We hypothesize that the functional outcomes & mortality of rapid recovery (RAP; non-CCI) & CCI patients after surgical sepsis will significantly worsen with increasing age (young adult (YA)≤45yo; middle age (MA)=46-64yo; & older adult (OA)≥65yo).

Methods: We performed a prospective, longitudinal (1-year) cohort study of critically ill surgical patients with sepsis. Statistical analyses were performed by SAS (v.9.4) & R. Fisher's exact, Kruskal–Wallis, & Log-rank tests were used for categorical, continuous & survival variables, respectively.

Results: We enrolled 287 consecutive surgical patients with sepsis. Only 13 (5%) of the patients died within 14 days, while 97 (34%) developed CCI & the remaining 177 (62%) exhibited RAP. In general, CCI compared to RAP patients were older, had greater comorbidity burden, more severe organ dysfunction & had a higher incidence of 2° infections (all $p<0.001$). OA CCI patients had a 53% mortality at 12 mos, & this was greater than both MA & YA CCI (33% & 14%, respectively; $p<0.05$; Fig 1). Importantly, OA CCI sepsis survivors had worse disability ZUBROD scores at 12 mos post-sepsis as compared to OA RAP (3.7±0.26 vs 2.0±0.24, respectively; $p<0.05$; Fig 2), and at 3 mos even OA RAP had worse ZUBROD scores than their own baseline or YA & MA RAP ($p<0.05$).

Conclusions: Acute mortality from sepsis is infrequent & CCI is becoming more predominant. Septic OA with CCI have extremely dismal 1-year outcomes, even after ICU discharge. Additionally, OA are more disabled after-sepsis. This is vital information when discussing expected outcomes of surgical sepsis patients & needs to be a focus for future sepsis research.

O22. Even Surgeons Can Use Quality Improvement Science To Eliminate CAUTIs From ICUs

Laura Kreiner; Jeffrey Claridge; Joseph Golob Jr M.D.

Background: As stewards for change, surgeons must embrace nontraditional investigative methodologies such as quality improvement science to improve patient care and eliminate preventable harms. Yearly, 1.7 million patients are affected by such harms, of which catheter associated urinary tract infections (CAUTIs) comprise 450,000 nosocomial infections.

Hypothesis: Utilizing quality improvement science, we hypothesized that creation of a CAUTI stewardship program would decrease urine catheter-days, urine cultures obtained, and CAUTI rates.

Methods: January 1, 2017 to February 28, 2018 urine catheter utilization, number of urine cultures obtained, and CAUTI rate per 1000 catheter-days were collected in an academic surgical and trauma intensive care unit. A CAUTI stewardship program was established on August 1, 2017. The program standardized urine catheter utilization and urine culture practices. CAUTIs were defined using Centers for Disease Control definitions. Statistical process control was used to compare urine catheter use, urine culture practice, and CAUTI rates before and after program initiation. To monitor for urosepsis as a balancing measure, blood cultures sent after program initiation were screened for Gram-negative bacteremia (E. coli, Proteus, Pseudomonas, and Enterobacter).

Results: A total of 8,454 patient-days were evaluated including 6,315 urine catheter-days (74.7%). 263 urine cultures were obtained. 13 CAUTIs were identified. Process control charts demonstrated special cause variation, signifying a statistically significant decrease in urine catheter-days, urine cultures obtained and CAUTI rates after program implementation. CAUTIs were eliminated during the 7-month post intervention period. During the study period, 474 blood cultures were obtained of which 70 (14.8%) were positive including 6 patients with Gram negative bacteremias of interest. These bacteremias were identical pathogens concurrently associated with bacterial infections in other locations (intra-abdominal and pulmonary sources).

Conclusions: This study demonstrates the importance of utilizing quality improvement science to eliminate preventable harms. A CAUTI stewardship program concentrating on urine catheter insertion, maintenance, and removal, in conjunction with culture stewardship, safely eliminated CAUTIs. Statistically significant process improvements were demonstrated in decreased urinary catheter use, number of urine cultures collected, and overall decrease in CAUTI rate.

O23. Necrotizing Soft Tissue Infection: Time is Crucial and The Admitting Service Matters

Haytham Kaafarani; Napaporn Kongkaewpaisan; John Hwabejire; Jae Moo Lee; Natawat Narueponjirakul; Karien Meier; April Mendoza; Noelle Saillant; Martin Rosenthal; David King; Peter Fagenholz; George Velmahos

Background: Early diagnosis and prompt debridement of necrotizing soft tissue infection (NSTI) improves outcome.

Hypothesis: We sought to evaluate whether failure to admit NSTI patients to Acute Care Surgery (ACS) results delays treatment and increases mortality.

Methods: NSTI patients were identified using the 2007-18 institutional emergency surgery database at a tertiary hospital. The diagnosis was confirmed by the operative/pathology reports. Patients who developed NSTI during hospitalization or underwent initial debridement at an outside hospital were excluded. Patients admitted to a non-ACS servic (e.g. medicine, gynecology, surgical oncology) were compared to those admitted to the ACS service with respect to comorbidities, clinical presentation

(e.g. fever, sepsis, LRINEC score), initial diagnosis, time to surgical incision and mortality. Multivariable linear and logistic analyses were performed to identify whether admission to a non-ACS service predicts a delay in surgery and/or increase in mortality.

Results: Of 132 patients, 91 met inclusion criteria. The mean age was 53 years, 56% were male and 69% had diabetes mellitus. Twenty patients (22%) were admitted to a non-ACS service, two thirds of which with an initial misdiagnosis (e.g. thrombophlebitis). The demographics, comorbidities and clinical presentation were similar between the 2 groups, except that the non-ACS group more often had HIV (15.0% vs. 2.8%, p=0.04) and less often presented with skin erythema (73.7% vs. 94.4%, p=0.01). The median time to incision of non-ACS patients was significantly higher (24.8 vs. 3.9 hours, p<0.001) [Figure1]. The mortality rates were 20.0% for the non-ACS group vs 7.0% for the ACS group (p=0.086). Multivariable analyses revealed that absence of erythema is independently associated with a non-ACS admission (OR= 5.3; CI= 1.2-23.3, p= 0.02), and non-ACS admissions independently correlate with delay surgery (Coefficient= 22.75, p<0.001).

Conclusions: Admission of NSTI patients to a non-ACS service often occurs because of initial misdiagnosis, especially in the absence of skin erythema, correlates with a significant delay to surgery, and might lead to increased mortality.

O24. An Actionable Risk Model for the Development of Surgical Site Infection Following Emergency Surgery

Joseph Fernandez-Moure; Ari Wes; Lewis Kaplan; John Fischer

Background: Surgical site infections (SSI) increase mortality and the economic burden associated with emergency surgery (ES). A reliable and sensitive scoring system to predict SSI can help guide clinician assessment and patient counseling of post-operative SSI risk.

Hypothesis: We hypothesized that after quantifying the ES post-op SSI incidence, readily abstractable variables can be used to develop an actionable risk stratification scheme.

Methods: We retrospectively reviewed all patients who underwent ES operations at an urban academic hospital system (2005-2013). Comorbidities and operative characteristics were abstracted from the electronic health record (EHR) with a primary outcome of post-op SSI. SSI risk was calculated using logistic regression modeling and validated using bootstrapping techniques. Beta (β) coefficients were calculated to correlate risk. A simplified clinical risk assessment tool, the emergency surgery infection risk score (ESIRS) was derived by assigning point values to the rounded β-coefficients.

Results: 4,783 patients with a 13.2% incidence of post-op SSI were identified. The strongest risk factors associated with SSI included acute intestinal ischemia, weight loss, intestinal perforation, trauma related laparotomy, radiation exposure, previous gastrointestinal surgery, and contaminated peritonitis (Table 1). The assessment tool defined three patient groups based on SSI risk. Post-op SSI incidence in high risk patients (34%; ESIRS score= 6-10) exceeded that of medium (11.1%; ESIRS score =3-5) and low-risk patients (1.5%; ESIRS score =1-2) (C-statistic=0.802). Patients with a risk score > 10 points evidenced the highest post-op SSI risk (71.9%).

Conclusions: Preoperative identification of ES patient risk for post-op SSI may inform pre-operative patient counseling and operative planning if the proposed procedure includes medical device implantation. A clinically relevant 7-factor risk stratification model such as this empirically derived ESIRS may be suitable to incorporate into the EHR as a decision-support tool.

O25. Post-operative Antibiotics After Simple (Acute) Appendicitis Are Not Associated with Improved Clinical Outcomes

Alexis Cralley; Ryan Lawless; Sinong Qian; Georgia Vasileiou; Daniel Yeh

Background: The post-operative management of simple (acute) appendicitis differs throughout the United States. Guidelines regarding post-operative antibiotic usage remain unclear and treatment is generally dictated by surgeon preference.

Hypothesis: We hypothesize that post-operative antibiotic use for simple appendicitis does not improve post-operative complication rates.

Methods: In this post-hoc analysis of a large, multi-center appendicitis observational study, only patients with intra-operative diagnosis of AAST EGS Grade I (simple appendicitis) were included. Subjects were classified into those receiving post-operative antibiotics (POST) versus pre-operative antibiotics only (NONE). Clinical outcomes examined included length of stay (LOS), 30-day Emergency Department (ED) visits and hospital readmissions, secondary interventions, surgical site infection (SSI), and intra-abdominal abscess (IAA).

Results: A total of 2191 patients with simple appendicitis were reviewed and 612 (28%) received post-operative antibiotics. Compared to the NONE group, POST patients were older, weighed more, and had higher WBC, Alvarado Score, Charlson Comorbidity Index (Table 1.). These differences were not clinically significant. There were no significant differences between groups regarding 30-day ED visit, hospital readmission, index hospitalization and 30-day SSI, index hospitalization and 30-day IAA, or index hospitalization and 30-day secondary interventions (Table 1.).

Conclusions: Post-operative antibiotic use for simple appendicitis following appendectomy is not associated with improved post-operative clinical outcomes at index hospitalization nor at 30 days after discharge. Consideration should be given to eliminating the routine use of post-operative antibiotics following simple appendectomy. Non-inferiority can only be proven by randomized trials.

O26. The usefulness of subjective vs objective factors in predicting postoperative complications after appendectomy

Andrew Vallejo; Patrick McGillen; Tejal Brahmbhatt; Minh-Thuy Nguyen; F. Thurston Drake, MD, MPH; Sabrina Sanchez, MD

Background: There is little data exploring the role of a surgeon's intraoperative assessment of disease severity when assessing patients for risk of postoperative complications. We aimed to compare intraoperative findings, imaging, and histopathology results to determine reliable predictors of postoperative complications.

Hypothesis: We hypothesized that a surgeon’s assessment of disease severity during appendectomy would be more closely associated with the development of postoperative complications than objective measures of disease severity.

Methods: We conducted a single-institution retrospective review of patients receiving an appendectomy for acute appendicitis, 2012-2016. Variables measured included admission vital signs and laboratory results, imaging findings, the surgeon's intraoperative description of the appendix, and

histopathology results. Complications of interest included readmission, postoperative ileus, surgical site infection, extra-abdominal infection, clostridium difficile infection, and death. Descriptive and inferential statistics were used to [1] compare complicated and uncomplicated appendicitis as determined by imaging characteristics, final histopathology, and surgeon's intraoperative diagnosis and [2] evaluate the risk of postoperative complications based on these variables.

Results: 1,058 patients underwent appendectomy for acute appendicitis during the study period. Based on the surgeon's intraoperative findings, 188 had complicated appendicitis. Of these, 136 (72.3%) were classified as uncomplicated on histopathology and 128 (68.1%) were classified as uncomplicated on imaging. A total of 73 patients (6.9%) developed a postoperative complication of which 48 (65.8%) were patients with complicated appendicitis based on intraoperative assessment. On nominal logistic regression, surgeon's intraoperative diagnosis of complicated appendicitis was the only factor found to be significantly associated with postoperative complications (OR=5.54, p=0.0004).

Conclusions: In this cohort, intraoperatively identified complicated appendicitis, but not complicated appendicitis classified as such by imaging or histopathology, was associated with higher rates of postoperative complications. This highlights the importance of a surgeon's intraoperative evaluation of the appendix compared to preoperative imaging and final histopathology both in perioperative management and in clinical outcomes research comparing uncomplicated versus complicated appendicitis.

O27. The Influence of the STOP-IT Trial on Antibiotic Prescribing in the ICU

Max Kopitnik; Abby Tyson; Brent Goslin; Abby Tyson; Gregory Vereb; John Elliott; Kevin Harris; Adam Smith

Background: Complicated intraabdominal infections affect thousands of patients each year in the United States. The Study to Optimize Peritoneal Infection Therapy (STOP-IT) trial concluded that intraabdominal infections with source control can be adequately treated with 4 days of antibiotics compared to a typical extended duration of 7-10 days, but did not exclusively examine patients requiring critical care management.

Hypothesis: We suspect that patients admitted to the Surgical Intensive Care Unit after the STOP-IT trial received fewer antibiotic days, in addition to notable improvements in other outcome parameters.

Methods: We conducted a retrospective, single-center chart review of patients who were admitted to the MICU or SICU with a diagnosis of a complicated intraabdominal infection after a definitive source control procedure. To be eligible, patients must have received at least 24 hours of antimicrobial therapy from January 1, 2014 to December 31, 2014 (pre-STOP-IT) and January 1, 2016 to January 31, 2016 (post-STOP-IT). A Chi-Square test or a Fischer's exact test were used to compare the proportion of patients admitted to the ICU with a complicated intraabdominal infection who received 4 (±1) days of antimicrobial therapy after an adequate source control procedure.

Results: Critical care patients admitted with intraabdominal infections in 2016 (post-STOP-IT) were more likely to receive ≤ 5 days of antibiotic therapy compared to those in 2014 (pre-STOP-IT) (47.2% vs. 27.2%, p=0.024) and fewer total days of antimicrobial therapy (7.5 days vs. 6.3 days, p = 0.020). Mortality was higher in patients receiving a longer course of antimicrobial therapy (18.7% vs. 12.5%). The rate of sepsis remained constant between 2014 and 2016 (65.9% versus 66.7%), as did the mean length of stay (14.7 days versus 14.6 days). In-hospital mortality was higher at 18.7% in 2014 compared to 12.5% in 2016. This trended toward statistical signficance. The presence of recurrent intraabdominal infection (11.0% vs. 22.2% p = 0.056) and of clostridium difficile infections (6.6% vs

6.9%, p = 1) also remained similar between groups.

Conclusions: Implementing a shorter duration of antimicrobial therapy in the critical care patient population results in decreased antibiotic use without increasing morbidity and mortality.

O28. Transcriptomic profiles of patients' peroperative samples developing colorectal anastomotic leak show distinct signature

Jasper van Praagh; Peter Olinga; Jacco de Haan; Rudolf Fehrmann; Wouter Nagengast; Klaas Havenga;

Background: Anastomotic leakage (AL) is a severe complication in about 10% of patients that undergo a colorectal resection with the creation of an anastomosis. AL is associated with prolonged hospital stay, reintervention, intensive care admission, permanent ostomies and even death. Many factors, like patients' comorbidity and chronic use of immune suppressive agents, are associated with the development of AL. However, much remains unknown about the underlying biological processes involved in the development of AL. The aim of this study is to elucidate the biological processes behind the development of AL on the transcriptomic level.

Hypothesis:

Methods: Samples of circular stapled anastomoses of the colon (i.e. the 'donuts') were collected from patients who participated in the C-seal trial. In this multicenter trial patients underwent an elective colorectal resection with the creation of an anastomosis. Primary endpoint of this study was AL requiring intervention. Gene expression profiles were created for the collected samples with the Illumina NextSeq500 sequencing platform. Differential gene expression analysis was performed with Deseq2 package (v1.21.22) in R (v3.4.3). On the ranked list of differentially expressed genes, gene set enrichment analysis (GSEA) was performed utilizing several databases from the Molecular Signature Database(MSigDB).

Results: After quality control of extracted RNA and sequencing results, we continued analysis with 91 samples. Out of these samples, 22 samples were from patients that developed AL and 69 from patients that did not. Differential expression analysis showed that 533genes were significantly ($P < 0.05$) upregulated and 1,655 downregulated in AL samples compared to non-AL samples. GSEA showed 46 significantly upregulated pathways in patients developing AL, mainly associated with energy metabolism. Moreover, 1,604 downregulated pathways were significantly downregulated, mainly associated with the immune system.

Conclusions: This study shows differences in the colon tissue at transcriptomic level at the time of creation of the anastomosis between patients that develop AL and patients that do not. These results can be used for future (peroperative) identification of patients that are at risk for the development of AL. It can also be used to adjust peroperative or even preoperative treatment in order to reduce this serious adverse event.

O29. Notch signaling is protective in CD4+ T cells against apoptosis via negative regulation of STING signaling pathway

Chenxuan Yang; Patricia Loughran; Timothy Billiar; Meihong Deng

Background: Notch signaling regulates cell communication and fate decisions, though recently

implicated in inflammatory responses, its regulation and roles in sepsis are unknown. Our previous study has shown that notch is a negative regulator of the Stimulator of Interferon Genes (STING)-DNA sensing pathway

Hypothesis: We hypothesize that Notch signaling regulates the pathogenesis of sepsis via suppression of STING signaling.

Methods: WT (C57BL/6) and Stinggt mice were injected with or without a notch inhibitor (DAPT, 5mg/kg) and subsequently challenged with or without LPS (5mg/kg) for 0, 4, 8, 12, 24h. The activation of Notch signaling was assessed as notch intracellular domain (NICD), and apoptosis was measured as cleaved-caspase 3 level by western blot.

Results: The activated Notch (NICD) levels in spleen peaked at 8h, decreasing to baseline level at 24 h after LPS injection. Cleaved-caspase 3 level in spleen was inversely correlated to the NICD level. Inhibition of Notch activation using DAPT (5 mg/kg) resulted in an increase of cleaved-caspase-3 at 8h after LPS stimulation, suggesting a critical role of Notch signaling for splenocyte survival after LPS stimulation. Furthermore, inhibition of Notch specifically increased CD4+ T apoptosis in spleen at 8h after LPS stimulation. Importantly, the apoptosis initiated by blockade of Notch activation was completely abrogated with STING deficiency. This suggested that Notch activation enhances the survival of CD4 T cells during endotoxemia possibly by inhibiting STING activation and the consequent cell death.

Conclusions: The negative regulation of STING by Notch reduces STING-dependent CD4+ T cell loss. Therefore, targeting Notch signaling could be of great value to prevent lymphocyte loss and immunosuppression for septic patients.

O30. STING-mediated intestinal barrier dysfunction contributes to lethal sepsis

Qiong-yuan Hu; Robert Sawyer; Xiuwen Wu; Jianan Ren

Background: Gut integrity is compromised in abdominal sepsis with increased cellular apoptosis and barrier permeability. Intestinal epithelial cell (IEC) form a physiochemical barrier that separates the intestinal lumen from host's internal milieu and is strongly involved in the mucosal inflammatory response, as well as in immune response. Recent research indicates the involvement of the stimulator of interferons genes (STING) pathway in uncontrolled inflammation and mucosal immune response.

Hypothesis: We therefore investigated the role of STING signaling in sepsis and intestinal barrier using patients samples and mouse model of sepsis. We hypothesis that STING is involved in the pathogenesis of sepsis by mediating IEC apoptosis induced by increased intestinal inflammation.

Methods: Animals and severe CLP model; Measurement of intestinal permeability and bacterial translocation; Histology and Immunofluorescence; Quantitative PCR analysis; Western blot analysis; Cell culture preparation ;Serum and tissue cytokines levels;Analysis of apoptosis by TUNEL analysis.

Results: In abdominal sepsis patients, STING expression was elevated in peripheral blood mononuclear cells and intestinal specimens compared with healthy controls, and the degree of STING expression in human lamina propria correlated with intestinal inflammation in sepsis patients. Moreover, elevated STING expression was associated with high level of serum intestinal fatty acid binding protein that served as a marker of enterocyte damage. In mice, intestinal STING signaling pathway was markedly activated following the induction of sepsis induced by cecum ligation

perforation (CLP). STING knockout mice showed alleviated inflammatory response, attenuated gut permeability, and decreased bacterial translocation. Whereas mice administrated with STING agonist (DMXAA) developed more severe IEC apoptosis and systemic inflammatory response. We also showed that the blocking of TNF or type I interferon signaling suppressed DMXAA-induced systemic shock and IEC apoptosis. In addition, we demonstrated that mitochondrial DNA was released during sepsis, which induced intestinal inflammatory response through activating the STING pathway.

Conclusions: Our results indicate that STING signaling pathway can contribute to lethal sepsis by promoting IEC apoptosis and disrupting intestinal barrier. Our findings suggest that STING regulation may be a promising strategy to promote mucosal healing and protect intestinal barrier in sepsis patients.

O31. Localization of staphylococcal superantigens in solid organs of rats with infected burn wounds

Gaurav Garg; Matthew Mino; Anna Day; Robert Smith; Rachel Ortiz; Pranay Randad; Lauren Moffatt; Marion Jordan; Jeffrey Shupp.

Background: Burn wounds are susceptible to invasive infections which can be associated with graft loss and sepsis. Methicillin-resistant Staphylococcus aureus (MRSA) is a common cause of burn wound infection. It produces the superantigens (SAgs) toxic shock syndrome toxin-1 (TSST-1), staphylococcal enterotoxin A (SEA), and staphylococcal enterotoxin B (SEB), which have the ability to crosslink major histocompatibility complex class II molecules and the variable β region of T-cell receptors and thus bypass the typical antigen presenting mechanism to cause a cytokine storm. Previous work demonstrated increasing amounts of TSST-1 and SEB in kidney tissue over time in an infected burn wound model.

Hypothesis: As in kidney, TSST-1, SEA, and SEB will be present in the liver and spleen of a non-septic animal model.

Methods: Aluminum billets heated to 100°C were used to generate partial-thickness dorsal burn wounds on 12 male rats. On postburn (PB) day 1, wounds were inoculated with 1x108 colony-forming units of toxin-producing MRSA. Rats were divided into 3 groups of 3 animals based on date of necropsy, either PB days 3, 6, or 10. A sham group killed on PB day 10 was burned and inoculated with vehicle alone. Blood and wound biopsies were taken at each time point, and organs were harvested on day of necropsy. Quantitative bacterial cultures and ELISA quantification of toxins were performed on skin and blood samples. Immunofluorescent staining was used to identify the localization of TSST-1, SEA, and SEB in liver and spleen. Serial images were obtained from each section and the Cy3 fluorescence intensity was quantified using Zen Imaging Software.

Results: No MRSA was detected in any blood sample, day 0 wound biopsies, or any sham PB biopsies. MRSA was detected in the wounds of all treatment animals. TSST-1 was detected in serum for one rat on days 2 and 10 (4.79 ng/mL and 0.38 ng/mL, respectively); TSST-1 was otherwise not detected in any other rat. SEB was not detected in serum at any time. In wounds, TSST-1 peaked on day 6 (39.35 ng/mL) while SEB peaked on day 10 (2.12 ng/mL). In liver, there were no differences in TSST-1 fluorescence intensity between sham and treatment animals at any time point (sham: 849.1 ± 309.7; day 3: 1020.8 ± 398.0; day 6: 859.0 ± 294.6; day 10: 1003.6 ± 483.6; $p > 0.05$ for all vs. control).

Conclusions: Although MRSA SAgs localize to the kidney in the absence of bacteremia and toxemia, it is unlikely that they localize to the liver. This is the first attempt at localization of SAgs in

the liver and spleen of animals with infected burn wounds. Future work will quantify SAgs in organs with ELISA.

O32. Synovial Fluid has Antibacterial Effects

Samy Gabriel; Reuben Judd; Michael Bubb.

Background: Septic arthritis is one of the most dreaded and challenging complications of total joint arthroplasty. While external factors are thought to play a large role in post-operative infections, there is a possibility that inherent patient susceptibilities may play a role as well. There are a few reports of the antimicrobial properties of synovial fluid, however the exact mechanism of this property has not been identified.

Hypothesis: The purpose of this report is to demonstrate the bactericidal effects of human synovial fluid, and attempt to characterize it. We hypothesize that antimicrobial peptides may be responsible for the bactericidal effects of synovial fluid.

Methods: After IRB approval, synovial fluid was collected from patients who underwent knee aspiration. This fluid was then ultra-centrifuged and cell free supernatant was plated with bacterial suspension and broth in 96 well microtiter plates. Growth was measured by optical density at 30 minute intervals and compared to controls. Growth curves were created to evaluate rate of growth in each solution. This test was repeated using different doses of synovial fluid in the bacterial suspensions to assess the strength of the antibacterial effect. Synovial fluid supernatant was then separated by size exclusion and ion exchange chromatography and the process was repeated to assess the activity of components of synovial fluid. Mass spectrometry was then performed on the fraction that maintained activity.

Results: All four collected samples of cell free synovial fluid showed decreased optical density (mean=0.117) at 5 hours of growth compare to that of controls (mean= .413, $p>0.0001$). Subsequent fractionation has led to two peaks of UV absorption, with only one fraction maintaining anti-microbial activity (mean optical density =0.291 vs control mean=0.411, $p=0.007$). In the two patient samples that were tested using different amounts of synovial fluid in the bacterial suspension, doses of 60, 40, 20, and 10 uL of synovial fluid showed significant antibacterial effect with slight increases of bacterial proliferation as the dose of synovial fluid was decreased from 60 to 10 uL.

Conclusions: Cell free synovial fluid displays a dose dependent bactericidal effect. After purification, this effect was limited to a single fraction. Based on UV absorption, it is likely that a small peptide present in this fraction is responsible for the observed anti-microbial activity. Mass spectrometry identified dermcidin as a candidate peptide present in the active fraction. Ongoing studies are being performed to further elucidate and confirm the identity of active peptides.

O33. Machine learning for predicting pathogenic organisms in bacterial infection based on Gram Stain images

Kensuke Minami; Junya Sato; Jumpei Yoshimura; Kazuma Yamakawa; Kazuaki Nakata; satoshi fujimi.

Background: Gram staining provides immediate information about predicted pathogenic organisms to optimize antibiotic agents for bacterial infections. Since microscopic interpretation of stained smears is one of the most operator-dependent activities in the clinical microbiology laboratory,

automated interpretation of Gram stains might improve the diagnostic accuracy of predicting pathogenic organisms. The purpose of this study is to construct a machine learning model of automated interpretation of Gram stains and to evaluate its predictive value.

Hypothesis: Automated Interpretation of Gram Stains accurately predicts pathogenic organisms.

Methods: A total of 450 Gram Stain images was collected during the course of normal clinical workup between June 2018 and December 2018. Images were selected based on the presence of any of the morphotypes: Gram-positive bacteria (150 images), Gram-negative bacteria (150 images), no bacteria (150 images). Polymicrobial images were excluded in this analysis. The dataset was divided into two subsets: 80% of images were used to train the model and 20% of images were reserved for validation. We evaluated model performance on accuracy, sensitivity, and specificity of the validation dataset. A size of images was at 2448 pixel wide by 1920 pixels in height. After converting images into vectors, we created a supervised machine learning model with logistic regression.

Results: After training validation, Machine learning model achieved a classification accuracy of 58% on the test images. Sensitivity and specificity were 65% and 81% for Gram-positive bacteria, and 64% and 96% of Gram-negative bacteria.

Conclusions: Our machine learning model achieved high specificity for both Gram-positive and Gram-negative bacteria. The number of slides used for training is relatively modest and could be increased to improve machine learning model accuracy.

O34. Manuka honey microneedles for enhanced wound healing and the prevention and/or treatment of MRSA surgical site infection

Galit Frydman; David Olaleye; Damodaran Annamalai; Kim Layne; Illina Yang; Haytham Kaafarani; James Fox

Background: Methicillin-resistant Staphylococcus aureus (MRSA) is the most common cause of Surgical site infections (SSIs). Manuka honey is currently FDA-approved and suggested to be effective in MRSA elimination.

Hypothesis: We sought to investigate whether using micro-needling, an FDA-approved technique commonly used in dermatological applications to stimulate wound healing and reduce scar formation, to administer Manuka honey could improve healing and eliminate MRSA.

Methods: Manuka honey microneedle (MHM) patches were developed using multiple methods (vacuum, high temperature [cook], and raw) and tested in an in vitro setting. MHMs were co-incubated with various concentrations of MRSA to evaluate bacterial-killing properties and killing kinetics. The bacterial solutions were then plated and colony formation was evaluated. Scratch assays were also performed using established human dermal fibroblasts in order to evaluate the wound healing properties of MHMs. Various preparations of the MHMs were tested in a fibroblast wound healing assay.

Results: MHMs demonstrated excellent bactericidal activity against MRSA at concentrations >10% of honey (Figure 1, Panel A). Results of duplicate bacterial killing experiments are presented in Figure 1, panel B. MHMs at 0.1% concentration in the scratch healing assay had wound closure within 24 hours; in the gap healing assay, MHMs stimulated healing within 24 hours while the negative control did not appear to stimulate healing. Panel C shows representative data of the healing kinetics in a scratch model, showing that complete wound healing occurs within 24 hours in all conditions. Panel D

shows representative images of a gap healing model, demonstrating that the cooked and raw honey result in complete wound closure within 24 hours, while the vacuum honey and negative control do not appear to stimulate wound closure.

Conclusions: We have thus synthesized MHM patches and demonstrated their in vitro ability to eliminate MRSA and stimulate wound healing. This is the first time that Manuka honey has been combined with microneedling technology and our results support the need for further exploration of this new approach.