P01. Associations of injury severity with debridement and irrigation practices among patients with open facial fractures

Therese Duane; Erica Sercy; Kaysie Banton; Brian Blackwood; David Hamilton; Andrew Hentzen; Kerrick Akinola; Jeffrey Gordon; Matthew Hatch; David Bar-Or

Background: Early debridement and irrigation are vital to minimize infection in open fractures. This approach is often delayed in facial fractures because a majority have concurrent, life-threatening injuries and require stabilization before initiation of facial fracture management.

Hypothesis: Open facial fracture patients with severe injuries are more likely to receive delayed operative management.

Methods: This was a retrospective study of adult (age ≥18) patients admitted with open facial fracture to six trauma centers in 1/1/2017-3/31/2021. Associations between operative management, including early (≤24h of arrival) versus delayed (>24h) administration, and ISS, type, and extent of facial fractures were investigated.

Results: This analysis included 161 patients with open facial fracture. Infection occurred in 8 (5%). Almost all (98%) received intravenous antibiotics within 24 hours. Only 21% received at least one debridement, and 89% received at least one irrigation (Table 1). Half (50%) of patients who received debridement had early treatment, and 69% of those who received irrigation had early treatment. Higher ISS was associated with increased likelihood of receiving debridement but not irrigation or early treatment. Higher fracture type (type 3a-c) was associated with increased likelihood of receiving both debridement and irrigation but not early treatment. Patients with more open facial fractures (3+) were more likely to receive debridement but were also more likely to have delayed debridement. Two other measures of injury severity (moderate/severe TBI and ICU admission) were associated with both increased likelihood of undergoing debridement and delayed irrigation.

Conclusions: This study found that patients received debridement relatively infrequently at the participating trauma centers (21%), although irrigation rates were high (89%). Results showed that more severely injured patients, who are at higher risk for infection, were more likely to be targeted for appropriate fracture management, including receipt of both debridement and irrigation; however, among those who received one or both of these treatment options, those with more severe injuries were at higher risk of delayed treatment. The impact of this delay in treatment on infection rates requires further study to determine optimal coordination of care.

P02. Factors Associated with Mortality in COVID-19 Patients Receiving Prolonged Ventilatory Support

Zachary Bergman; Jeffrey Chipman; Christopher Tignanelli; Gregory Beilman

Background: Since its emergence in early 2020, COVID-19 associated pneumonia has caused a global strain on ICU resources with high rates of patients requiring intubation. These patients frequently require prolonged respiratory support and critical care. Multiple studies have demonstrated in-hospital mortality rates between 40-45% for COVID-19 patients that receive mechanical ventilation. However, outcomes for patients with prolonged intubation (>21 days) for COVID-19 have not been well established, nor have possible predictors of mortality in this patient group.

Hypothesis: Age and comorbidities are predictors of mortality in patients ventilated for COVID-19

pneumonia. These variables will remain predictors in patients on mechanical ventilation for greater than 21 days.

Methods: This is a retrospective evaluation of prospectively collected data from March 2020 through November 2021. Data collected included demographics, laboratory values, and outcomes of interest. Included were all patients admitted to a system of 11 hospitals with a confirmed COVID-19 infection and placed on mechanical ventilation during the study period. The primary endpoint was in-hospital mortality. Survival was assessed utilizing Kaplan-Meier survival curves and variables were compared using log-rank analysis and multivariate logistic regression.

Results: There were 629 patients placed on mechanical ventilation for COVID-19 pneumonia during the study period, with in-hospital mortality of 40.1%. Mortality was significantly associated with increased age and comorbidities including COPD, CAD, renal failure, and cancer history. Interestingly, for patients intubated for longer than 21 days (n=149), in-hospital mortality was dropped to 26.2%. In this group, increased age is associated with significantly worse survival, but studied comorbidities are no longer associated with increased mortality.

Conclusions: In-hospital mortality in patients with COVID-19 pneumonia occurs primarily in the first 21 days after intubation, possibly related the greater risk of death from the active inflammatory process early in COVID-19 infection. Additional evaluation of one-year survival is necessary to establish the ongoing benefit of long-term mechanical ventilation for COVID-19.

P03. AI discovery of multi-modal immunomodulatory control of sepsis in cases without effective antimicrobials

R. Chase Cockrell; Dale Larie; Gary An

Background: Despite a great deal of interest in the application of artificial intelligence (AI) to sepsis/critical illness, most current approaches are limited in their potential impact: prediction models do not address the lack of effective therapeutics and many existing optimization approaches cannot address the development of new treatment options. The inability to test new therapeutic applications was highlighted by the generally unsatisfactory results from drug repurposing efforts in COVID19.

Hypothesis: Addressing this challenge requires the application of model-based deep reinforcement learning (DRL) in a fashion akin to training the game-playing AIs from Deep Mind. We have previously demonstrated the potential of this method in bacterial sepsis where antimicrobial therapies exist. The current work addresses the control problem of multi-modal, adaptive immunomodulation in the circumstance where there is no effective anti-infective therapy (ala in a novel viral pandemic or in the face of resistant microbes).

Methods: This is a proof-of-concept study that determines the controllability of sepsis without the ability to suppress the infecting pathogen with drugs. We use as a surrogate system a previously validated agent-based model, the Innate Immune Response Agent-based Model (IIRABM), for control discovery using DRL. DRL trains an AI on simulations of infection where the control space is limited to the augmentation or inhibition of immune mediators included in the IIRABM. Policies were learned using gradient descent with the objective function being a return to baseline system health. Generalizability of the discovered control policy was tested on a cohort of alternative parameters/initialconditions with mortalities ranging from 75-85%.

Results: DRL trained an AI policy that improved system mortality from 85% to 12%. Control actions

primarily targeted 3 different aspects of the immune response: 2nd order pro-inflammation governing TH1/TH2 balance, primary anti-inflammation, and inflammatory cell proliferation. Generalizability of the AI policy to systems with different immune responses and pathogen virulence was performed on a set of parameterizations/initial conditions with a mortality rate between 75-85% (N = 1190). The application of the AI (with no additional training or updating) was able to improve survival to 92.7%.

Conclusions: The current treatment of sepsis is hampered by limitations in therapeutic options able to affect the biology of sepsis. This is heightened in circumstances where no effective antimicrobials exist. Current AI methods are intrinsically unable to address this problem; doing so requires training AIs in contexts that fully represent the counterfactual space of potential treatments. The synthetic data needed for this task is only possible through the use of high-resolution, mechanism-based simulations. Finally being able to treat sepsis will require a reorientation as to the sensing and actuating requirements needed to develop these simulations, train AIs and bring them to the bedside.

P04. Influence of Maternal Diet on the Tight Junction Remodeling in Baboon Offspring

Alena Golubkova; Heather Liebe; Tyler Leiva; James Papin; Jed Friedman; Dean Myers; Catherine J. Hunter

Background: Obesity and diets rich in saturated fats and sugars have been implicated in gastrointestinal disease, including increased susceptibility to infection. It is proposed that this occurs through molecular remodeling of the gut barrier as well as increased inflammation and compromised immunity. The effect of maternal obesity and diet on offspring gut is currently being investigated.

Hypothesis: We studied the influence of a maternal Western diet on offspring gut in the Olive baboon, hypothesizing that it would lead to offspring changes suggestive of increased gut permeability through changes seen in tight junction composition.

Methods: Ileal samples were collected from an IACUC-approved study investigating influence of maternal diet on offspring. Adult, nulliparous female baboons were fed a Western diet (WSD) and a Control diet of monkey chow. Three months after initiation, baboons were bred. Cesarean sections were completed at 165 ±5 days, and the offspring were euthanized for necropsy and tissue collection. Mother's adiposity (skin fold measurements) and CRP levels were obtained to measure inflammation. Protein and gene expression of select tight junction components, claudin 1, 2, 3, and occludin, was analyzed. Comparison was carried out with Student's t-test.

Results: There was no difference between maternal adiposity at time of cesarean. Maternal CRP was elevated in WSD group ($p=0.009$). A tight junction protein, claudin-1, appeared to have a down trend in RNA and protein expression, although not significant. No other changes suggestive of compromised gut barrier were noted.

Conclusions: Maternal diets rich in saturated fats and sugar have been implicated in changes to neonatal gut immunity and microbiome. We aimed to determine evidence of this by investigating for potential changes in tight junction composition with a translational baboon model. In our study, the maternal exposure time of WSD was insufficient to induce significant obesity in mothers but did increase maternal CRP. Longer maternal exposure times to the diet and larger study numbers in future offspring will potentially delineate if any significant changes do occur to lead to increased gut permeability and in turn susceptibility to infection.

P05. Pneumonia and Dysphagia after Cervical Spine Trauma

Laura Kreiner; Andrew Tran; Christopher Towe; Jeffrey Claridge; Vanessa Ho

Background: Prior studies demonstrate that patients with cervical spine trauma (CST) have a reported incidence of dysphagia at 17%, and 30% in patients with a cervical spinal cord injury (C-SCI). Dysphagia is a risk factor for pneumonia. It is unknown if dysphagia during the index trauma admission is associated with readmission for pneumonia.

Hypothesis: We hypothesize that in patients with CST/C-SCI, dysphagia during the index admission (IA) would be associated with an increased rate of readmission for pneumonia.

Methods: We identified patients who sustained CST/C-SCI in the first 9 months of 2017 from the Nationwide Readmissions Database (NRD). We identified age, sex, injury severity score (ISS), comorbidities, dysphagia at IA, discharge destination, and mortality from IA. We identified all readmissions within 90 days, as well as a diagnosis of pneumonia at readmission. We used logistic regression to identify factors associated with 90-day readmission and pneumonia at readmission. Factors examined included age, injury type (C-CSI vs. no C-CSI), pneumonia or dysphagia at IA, comorbidity count, ISS, IA discharge destination, and payer type.

Results: We identified 29,644 patients with CST, of whom 7,051 (23.8%) had a C-SCI (median age 64, IQR 46-79; median ISS 14, IQR 10-26). 1,892 (6.4%) died during the index admission. Dysphagia was identified in 8.9%. Among C-SCI patients, dysphagia was identified in 12.8%. Of 27,752 patients who survived the IA, 3,284 (11.8%) were readmitted within 90 days, of whom 461 (14.0%) had a diagnosis of pneumonia. In adjusted logistic regression (Table1), dysphagia was not associated with readmission or pneumonia. Pneumonia at IA was associated with pneumonia at the readmission.

Conclusions: The incidence of dysphagia during an IA for patients with CST was approximately half of the expected rate. Pneumonia was a common diagnosis during both admissions, and pneumonia at the IA was a strong predictor of pneumonia at readmission. Although dysphagia did not predict readmission, prior studies suggest significant dysphagia was under-diagnosed clinically and therefore is likely under reported in this database. Protocolized identification of dysphagia in patients with CST and C-SCI may be a key step in minimizing pneumonia related readmission.

P06. Safety and Efficacy of Early Central Line Removal in Post Liver Transplant Patients

Elizabeth MacLean; Tayseer Shamaa; Omar Shamaa; Zoe Lu; Amita Hinge; Sara Saymuah; Adhnan Mohamed; Toshihiro Kitajima; Michael Rizzari; Shunji Nagai; Atsushi Yoshida; Marwan Abouljoud; Kelly Collins

Background: Avoiding central line-associated infections (CLABSIs) is paramount in liver transplant recipients. As a hospital-wide infection control initiative at our institution, early removal of central lines after liver transplant (LT) was instituted beginning in September 2019. The aim of the study was to compare the outcomes of patients before and after this change in practice.

Hypothesis: Our hypothesis is that the rate of CLABSIs in the post-operative period dropped after the implementation of the policy at our institution.

Methods: Retrospective analysis using the databases from a single transplant center and UNOS. 470 adult patients who underwent liver-alone transplants at our center between January 2017 and

June 2021 were included. LTs performed during September 2019 were excluded as a washout period. Demographics, clinical characteristics, and post-transplant outcomes were compared between the pre-and post-policy implementation groups.

Results: 447 patients were included in the analysis with 274 (61.3%) patients transplanted prior to the practice change and 173 (38.7%) patients after. Age, gender, race, BMI, MELD, and etiology of end-stage liver disease (ESLD) did not differ between the two groups. The median duration of central line placement in the pre-policy period was 156 hours (Interquartile Range [IQR]: 71-224 hours) compared to 43.5 hours (IQR: 28.4-60.3 hours) in the post-policy period ($p<0.001$). 5.9% of pre-policy patients had a central line reinserted during their initial post-LT hospitalization compared to 0.6% of post-policy patients ($p=0.005$). There was a significant increase in the utilization of peripheral inserted central catheter (PICCs) in the post-policy period compared to the pre-policy period (12.8% vs. 7.1%; $p=0.045$). There was no difference in the rate of CLABSI amongst the two groups with 1.1% (n=3) of pre-policy patients having a CLABSI compared to 2.3% (n=4) of post-policy patients ($p=0.31$).

Conclusions: The early removal of central lines after LT is safe, efficacious, and should be considered in patients without the need for central access. Although CLABSI rates were similar, the shorter central line use was not associated with increased reinsertion of central lines or PICC-associated venous thromboembolism.

P07. The Effect of Time to Redebridement on 30-Day Mortality in Critically Ill Patients with NSTI

Jacob O'Dell; Diego Mazzotti; Christopher Guidry

Background: Necrotizing soft tissue infections (NSTIs) are surgical emergencies which convey high mortality. The optimal time frame for initial debridement has been demonstrated to be “emergent.” In contrast, the optimal time from 1st to 2nd debridement (redebridement interval), is not definitively known, but is frequently recommended to be 24 hours.

Hypothesis: We hypothesized that patients who received redebridement within 1 day would have a lower mortality than those who had a longer redebridement interval.

Methods: This retrospective cohort study identified patients at a single center from January 2005 through September 2021. A deidentified database was queried for all encounters meeting the following inclusion criteria: 1 or more diagnoses of NSTI by ICD code, 2 or more debridements by CPT code, and ICU admission. The variable of interest was redebridement interval, measured in days. Primary outcome was 30-day mortality. Comorbidities and markers of illness severity were gathered. Patients were stratified into Early Redebridement (ER) and Delayed Redebridement (DR) groups by redebridement interval. Day(s) to redebridement were defined as 1 in the ER group, and 2 or more in the DR group. Chi-squared, Fisher’s exact, and Wilcoxon’s Signed Rank tests were used to detect differences between the two subgroups. Significance threshold $p = 0.05$

Results: 127 patients met inclusion criteria (n = 127). 38 patients received redebridement within 1 calendar day (ER: n = 38). 89 patients received redebridement after 2 or more calendar days (DR: n = 89). There were no differences in demographics, comorbidities, ICU status, vasopressor requirements, or number of debridements between groups. At 30 days, 6 (15.8%) patients died in the early group, compared to 3 (3.4%) in the late group ($p = 0.02$). A subgroup analysis of only patients requiring vasopressors showed a similar increase in mortality for patients in the ER group (24.0 vs 5.2%; $p=0.01$).

Conclusions: In our study, patients who received redebridement within the recommended 1-day window sustained a higher 30-day mortality than patients who received later redebridement. This relationship was opposite to both our hypothesis and findings from prior studies. We suspect that redebridement interval is a marker of presenting illness severity. These findings support continued refinement of the paradigm for redebridement urgency in NSTI, specifically a prospective assessment of the recommended 24-hour time frame.

P08. An acute care surgery clinical pathway improves antimicrobial stewardship in patients with acute appendicitis

Garima Thakkar; Celeste Ferguson; Kevin Kennedy; Nicholas Bennett; Tolulope Oyetunji; Sean Nix ; Leo Andrew Benedict

Background: Acute care surgery (ACS) encompasses surgical critical care, emergency surgery and the surgical management of trauma. These patients require expertise in appropriate antibiotic selection and comprehensive surgical care in a time sensitive manner. Following ACS implementation at our institution, we developed a perioperative clinical pathway for acute appendicitis to guide appropriate antibiotic selection and duration.

Hypothesis: ACS clinical pathway for acute appendicitis improves antimicrobial stewardship.

Methods: A retrospective study at a tertiary care facility of patients with acute appendicitis who underwent appendectomy. Demographic data, clinical outcomes and inpatient pharmaceutical data were abstracted from patient medical records. Patients were classified by pre (January 1, 2016-July 31, 2018) and post-initiation (August 1, 2018-December 31, 2020) of ACS pathway. Primary outcome was perioperative utilization of antibiotic piperacillin-tazobactam. Secondary outcomes included time from computed tomography (CT) scan to antibiotics administered, hospital readmission rates within 30 days of surgery and discharge prescription antibiotic rates in patients with non-perforated appendicitis. Statistical analysis was performed using SAS with a p-value <0.05 as significant.

Results: 492 patients analyzed with 225 in the pre-clinical pathway and 267 in the post-clinical pathway. Post-operative LOS was significantly decreased in our post clinical pathway cohort (13 hours vs 18 hours, $p<0.001$) despite treating more patients with perforated appendicitis (29.6% vs. 6.2%, $p<.001$). 30 day hospital readmission rates were similar between the two cohorts (7.1% vs. 4%, $p=.137$). A significant decrease in CT to antibiotics administered time (115 vs 126 minutes, $p=.008$) in our post clinical pathway cohort. Rates of pre-op (55.4% vs. 60.9%, $p<.001$) and post-op piperacillin-tazobactam significantly decreased (55% vs. 61.1%, $p<.001$) following utilization of our clinical pathway. Furthermore, discharge prescription antibiotics in patients with non-perforated appendicitis was reduced following the implementation of our clinical pathway (17% vs. 26.5%, $p=.022$).

Conclusions: Our ACS pathway for acute appendicitis resulted in earlier antibiotic administration following diagnosis, decreased use of piperacillin-tazobactam, decreased post-operative LOS, and decreased discharge antibiotic prescriptions for patients without perforation. Future investigation of the role of an ACS clinical pathway on improving both patient outcomes and antimicrobial stewardship with acute appendicitis is warranted.

P09. MSC-derived exosomes reduce oxidative damage and scarring to promote wound regeneration

Ayesha Aijaz; Dea Metko; Marc Jeschke

Background: Wound regeneration is a dynamic and complex process that requires a collaborative effort between the extracellular matrix, skin-resident cells and growth factors. Wound healing and closure continue to be the rate-limiting factors for survival from burn wounds. Mesenchymal stem cells (MSC) have emerged as promising therapy for wound healing. Contrary to the initial hypothesized mechanism of action that stem cells exert their regenerative potential by differentiating into cells required to replace damaged cells, more and more studies indicate that the observed therapeutic benefit associated with MSC therapy may be attributed to paracrine signaling mediated by secreted factors and extracellular vesicles (EVs). EVs and exosomes present several advantages over transplantation of cells.

Hypothesis: Herein, we hypothesize that MSCs harvested from burn tissue are primed and the thermal injury affects the nature and functionality of the secretome conducive to burn wound healing.

Methods: MSCs derived from burn tissues and umbilical cords were cultured in vitro and supernatant was collected. Exosomes from the supernatant were purified using polyethylene glycol. Exosome markers and exosome protein concentration were quantified. Exosomal bioactivity was assessed via acetylcholinesterase activity, oxidative stress, scratch, and TGF-b1 induced fibroblast to myofibroblast differentiation assays.

Results: Presence of purified exosomes was confirmed by expression of HSP 90, CD81 and CD63 (Fig 1A). No significant difference was observed in protein concentration (PC) or acetylcholinesterase activity (AA) between exo UC (PC:9.01 ± 2.7 mg/106 cells; AA: 251.8 ± 43.57 mU/mL) and exo BD(PC: 8.44 ± 1.10 mg/106 cells; AA: 240.6 ± 46.77 mU/mL) (Fig 1B, C). Exo-BD demonstrated significant reduction in oxidative stress levels in dermal fibroblasts compared to controls, serum and exo-UC groups (Fig 1D). Dermal fibroblasts demonstrated lower expression of p-p38 and NRF2 following treatment with both exoUC and exoBD (Fig 1E). TFurthermore, fibroblast treatment with exoUC and exoBD reduced NRF2 to basal levels indicating reduction in fibroblast senescence following oxidative damage that occurs with excessive expression of NRF2. Both exo-UC and exoBD accelerated in vitro scratch wound closures in dermal fibroblasts (Fig 1F). Dermal fibroblasts were induced towards myofibroblast differentiation by exposure to TGF- β1. Both exoUC and exoBD inhibited fibroblast to myofibroblast transition as demonstrated by lower expression of α-SMA (Fig G).

Conclusions: Our results suggest exosomes from burn tissue may be an effective cell-free therapeutic strategy for wound healing.

P10. Rectus femoris flap as the preferred salvage procedure for the management of vascular graft groin complications

Ashley Holly; Maxim Pekarev; Therese Duane

Background: Groin infections are a substantial risk for graft failure often resulting in the need for graft excision and/or amputation. The groin is the most common site of infection, and most are managed with local wound care and negative pressure therapy. These methods are costly and have a high rate of failure ultimately resulting in need for excision of the infected graft.

Hypothesis: The purpose of this study was to demonstrate the role of the rectus femoris flap (RFF)

as a salvage procedure for groin complications following vascular surgery.

Methods: We performed a retrospective review of patients who underwent a RFF as a salvage procedure for groin complications following vascular surgery between 2015 to 2021. A groin complication was defined as any groin infection, hematoma, seroma, or lymphocele following vascular surgery. Data points for patient demographics included age, sex, comorbid conditions, original vascular procedure, date of procedure and type of groin complication were recorded. Other data points collected were the date the RFF was performed, any additional groin complications (i.e. flap failure) complications related to the flap donor site, and time to healing.

Results: A total of 47 patients required 50 muscle flaps to cover 50 groin reconstruction sites. The patient population consisted of 29 males (61.7%) and 18 females (38.3%), with a mean age of 65 years (range, 48 to 87 years). A six month follow up revealed an 98% groin flap success rate with a 100% vascular graft salvage rate. The overall complication rate was 22%. Groin flap complications occurred at a rate of 6% with one groin flap failure due to thrombosis that required removal and reconstruction with a sartorius flap. The other two complications were due to seroma and mild flap necrosis that were managed with local wound care. A donor site complication rate of 16% was identified: 7 seromas, 1 abscess. Of the seroma related complications 5 were able to be managed with local wound care while 2 required additional operative intervention. One of these seroma complications required a split thickness skin graft to the area. The other one involved a donor site seroma that extended to the groin and required reconstruction with a vastus lateralis flap and sartorius flap.

Conclusions: Management of groin complications following vascular surgery remains a challenging problem. Local wound care remains the standard despite the cost, length of treatment and additional complication rate. Our study demonstrated the use of a RFF as a salvage procedure following groin complications is a safe and highly effective treatment with a 100% graft salvage rate with few overall complications.

P11. Ventilator-Associated Pneumonia: A riddle, wrapped in pleura, inside an enigma

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Background: Difficulty in defining ventilator-associated pneumonia (VAP) has implications in quality reporting. The Trauma Quality Improvement Program (TQIP) defines VAP using laboratory findings, pathophysiologic signs/symptoms, and imaging criteria. Many critically ill trauma patients meet both laboratory and sign/symptom thresholds for VAP; therefore, the TQIP designation of VAP depends heavily upon imaging evidence. Reliance on imaging to identify VAP is problematic, as the radiology report verbiage reviewed by registrars is not specific to infectious etiologies and likely contributes to variability in reporting.

Hypothesis: Physicians do not always agree with radiology reported chest radiograph findings significant for VAP.

Methods: The TQIP Spring 2021 Benchmark Report was used to identify patients diagnosed with VAP at an academic Level 1 Trauma Center (VAP group). A control group consisted of trauma patients who spent at least four days intubated in the ICU without VAP, according to the TQIP report. For each patient, four successive chest X-rays (images only, no associated reports) were compiled

and arranged sequentially. In the VAP group, the selected images overlapped with the date of VAP diagnosis. All patient identifiers were removed, and images from the VAP and control groups were randomly arranged in an electronic presentation. Twenty-two physicians (trauma/critical care and radiology attendings) were asked to identify patients with VAP based solely on imaging evidence, as defined by TQIP. The presentation included 14 VAP-positive patients from the TQIP report, and 11 VAP-negative controls. Respondents' answers were compared to their peers to assess the likelihood of internal agreement.

Results: Internal agreement among physicians was 70% for trauma/critical care and 81% for radiologists. Physicians agreed with the TQIP designation of VAP on only 60% of reported VAPs ($p<0.001$). Trauma/critical care attendings agreed with TQIP on 52% of reported VAPs, while radiologists agreed with TQIP on 72%, both $p <0.001$.

Conclusions: Compared to physicians, registrar interpretation of imaging resulted in 40% overreporting of VAP to TQIP. The current definition of VAP ignores the biologic reality that there are multiple causes for opacities on chest X-ray. The subjectivity of imaging interpretation among physicians and the protean physiologic findings for VAP in trauma patients should preclude VAP from being used as a quality improvement metric in TQIP.

P12. The impact of pre-operative sepsis on patients undergoing emergency general surgery

Anahita Jalilvand; Holly Baselice; Alex Helkin; Jon Wisler

Background: Sepsis is one of the leading causes of death for patients admitted to the hospital. While development of sepsis following surgical procedures has been shown to increase morbidity and mortality, the impact of preoperative sepsis on outcomes has not been clearly delineated. Therefore, this study aimed to evaluate the association between preoperative sepsis status and overall morbidity and mortality following emergency general surgery.

Hypothesis: Patients undergoing emergency general surgery with pre-operative sepsis will experience worsened short and long-term outcomes compared to non-septic patients

Methods: We conducted a retrospective review of patients admitted through the emergency department who underwent emergency general surgery within 6 hours of presentation (n=483) at a single large-volume academic center. Patients were grouped based on whether they presented with sepsis (n=100) or not (n=383) using Sepsis III criteria. Baseline demographic and clinical characteristics were compared between groups. Primary outcome measures included in-hospital and 90-day mortality, discharge disposition, and overall post-operative complication rate. A p value <0.05 was considered statistically significant.

Results: Baseline age, sex, racial distribution, and insurance status were similar between septic and non-septic groups. Patients who presented with sepsis were less likely to be employed compared to the non-septic cohort (12.1% vs 22.7%, $p = 0.01$) and more likely to be transferred from an extended care facility (62.5% vs 46.0%, $p = 0.006$). Septic patients were more likely to undergo surgery within 1 hour of presentation (64.7% vs 47.0%, $p = 0.004$) compared to the control cohort. Compared to non-septic patients, those with sepsis demonstrated higher overall complication rate (67.0% vs 33.9%, $p <0.0001$), in-house mortality (25% vs 6.5%, $p<0.001$), were less likely to be discharged home (17.33% vs 48.8%, $p <0.001$), and demonstrated a 68% increase in the risk of 90-day mortality.

Conclusions: This study demonstrates that preoperative sepsis confers substantial risk to patients

requiring emergency general surgery in terms of mortality and functional status. This risk appears to extend beyond discharge, suggestive of post-sepsis chronic illness. In our data, the majority of septic patients originated from an extended care facility, which may indicate that frailty plays a role in these outcomes. Further studies are required to determine how to mitigate this risk in the perioperative setting, as well as improve post-discharge care or follow-up to address the higher long-term mortality.

P13. The Impact of the COVID-19 Pandemic on Utilization of Emergency Medical Services (EMS) in New York City (NYC)

Megan Donnelly; Kate Kirby; Anthony Chau; Sebastian Schubl; Philip Barie

Background: During the early coronavirus disease 2019 (COVID-19) pandemic, utilization of both elective and emergency health care services decreased. Public health advocates advised patients to defer elective care in order to manage inflows of infected patients, whereas other patients avoided acute-care facilities for fear of becoming infected. Stay-at-home orders, closures of businesses, and curtailment of surgical services correlated with fewer emergency department visits, particularly for injury care. This study evaluates patterns in utilization of EMS in NYC, the “epicenter” of the first “wave” of the pandemic (March 20-June 15, 2020), in 2019 (pre-pandemic) and afterward.

Hypothesis: We hypothesize that EMS call volumes decreased overall in NYC during the early phase of the pandemic, specifically with respect to trauma/injury calls. By contrast, we posit that calls for “sick” events (i.e., fever, nausea, rash, or cough) increased, given rising fear of virus transmission.

Methods: Retrospective NYC EMS calls data (1/1/2019-7/31/2020) were obtained from NYC Open Data/EMS Incident Dispatch, an open-access database that is maintained by the Fire Department of NYC. Total EMS calls, trauma/injury calls, and sick event calls were collected for NYC overall and for all five boroughs (Bronx, Brooklyn, Manhattan, Queens and Staten Island). United States Census data for each borough were used to weight daily EMS calls per 100,000 individuals. Mann-Whitney U tests were used to compare pre-pandemic (2019-March 2020) vs. pandemic (4/1/2020-7/31/2020) EMS call volumes, $\alpha=0.05$.

Results: Median daily EMS calls decreased 21.8% overall at the start of the pandemic (pre-pandemic: 3,262 calls; pandemic: 2,556 calls, $p<0.001$), and similarly when stratified by borough and indexed per population median daily total EMS calls per 100,000 individuals decreased during the COVID-19 pandemic (all $p<0.001$) (Table). Locale NYC Bronx Brooklyn Manhattan Queens Staten Island Pre-Pandemic 39.1 55.4 35.3 49.0 27.9 28.8 Pandemic 31.8 46.3 28.4 37.0 23.6 23.5 Median daily trauma/injury and sick event calls per 100,000 also decreased in NYC and the five boroughs from pre-pandemic to pandemic time periods (all $p<0.001$).

Conclusions: These data reflect an unprecedented window into EMS utilization during an infectious disease pandemic. Call volumes in NYC changed considerably in the wake of the pandemic. Surprisingly, even calls for sick events decreased, which may be attributed to patients avoiding accessing the 911 system due to a perceived risk of COVID-19 disease acquisition. Decreased EMS utilization for multiple conditions likely reflects delayed or impeded access to care for many patients. Utilization data have important implications for provision of acute care services during possible future disruptions related to the pandemic.

P14. Temporal Profile of the Inflammatory Response During Six-month Follow Up After Severe Trauma

Lauren Kelly; Jennifer Munley; Erick Pons; Kolenkode Kannan; Philip Efron; Alicia Mohr

Background: Post-discharge inflammation and its correlation with recovery following severe trauma is poorly described. Severe traumatic injury induces a systemic inflammatory and hypercatecholamine response associated with critical illness and end organ dysfunction, including disordered hematopoiesis and anemia. This study sought to characterize trajectory and resolution of the postinjury inflammatory state.

Hypothesis: We hypothesized that severe trauma would induce prolonged inflammation lasting several months after injury.

Methods: This single-institution cohort study prospectively enrolled 90 trauma patients with an injury severity score >15, hemorrhagic shock, and a pelvic, hip, or femur fracture. Patients undergoing elective hip replacement (n=34) were enrolled as operative controls. Plasma was obtained at enrollment and after 14 days, one, three and six months. Inflammatory cytokines were measured using immunosorbent assays. Cytokines at each time were compared using two-tailed t-tests with correction for multiple comparisons in GraphPad Prism v9.1.

Results: Plasma levels of norepinephrine (NE), hepcidin, C-reactive protein (CRP), interleukin (IL)-6, granulocyte colony stimulating factor (G-CSF), tumor necrosis factor alpha (TNFa) and erythropoietin were significantly elevated on enrollment compared to operative controls (Table 1, presented as median (IQR), * adjusted p value < 0.05, ^ clinically elevated). Erythropoietin, G-CSF, TNFa, and CRP were elevated following trauma for two weeks. IL-6 was persistently elevated compared to controls for up to 1 month. NE remained elevated and significantly higher than controls at 2 weeks, and this elevation was again significant at 6 months. Using a multiple linear regression model, there was a significant relationship ($R2 = 0.312$) between day 14 IL-6 and hospital length of stay ($p = 0.03$) and total red blood cell transfusions ($p = 0.03$).

Conclusions: Severe trauma is associated with a persistent inflammatory and hypercatecholamine response. This inflammatory response in turn is associated with increased transfusion requirements and prolonged hospitalization. Further analysis is needed to identify correlations between persistent inflammation and clinical outcomes after discharge.

P15. Risk Factors for Mortality Following Gastroduodenal Perforations: H. Pylori is alive and well in the USA!

Lamis El Kabab; Yen-Hong Kuo; Eric Klein; Niamh McGowan; David Pechman; Andrew Bates; Dominick Gadaleta; John Davis

Background: Upper gastrointestinal perforation is a life-threatening disease. Recent research suggests that up to 10% of acute care surgery patients have gasstroduodenal disease requiring surgery. Limited data is available regarding the risk of mortality and morbidity rates in the United States.

Hypothesis: With the advances in the understanding of the etiology of peptic ulcer disease and numerous medications to block acid production one might expect a decrease in the incidence and severity of complications of ulcer disease.

Methods: The National Surgical Quality Improvement Program (NSQIP) database from 2015 to 2019 was queried for risk factors for mortality. Healthcare Cost and Utilization Project (HCUP) data from 1993 to 2014 was used to calculate the national trends in the incidence of gastrodudenal perforations over time.

Results: Total of 4,754 patients were identified in the NSQIP database, 2322 patients had a gastric perforation, and 2432 patients had a duodenal perforation. HCUP data demonstrated a slight decrease of both gastric perforations (5600 down to 5535 cases) and duodenal perforatins (8680 down to 6370 cases) from 1993-2014. The six most common risk factors for mortality following a gastric perforation in decreasing orders were septic shock (OR, 5.3, 95% CI 3.2-8.7, p<0.001), ascites (OR, 3.8, 95% CI 2.0-7.4, p <0.001), post-surgical wound infections (OR, 3.8, 95%CI 2.1-6.9, p<0.001) ventilator dependency (OR,3.8, 95% CI 2.0-6.8, p<0.001), dyspnea at rest (OR, 3.5, 95% CI 1.4-8.8, p=0.007) and disseminated cancer (OR, 3.3, 95% CI 1.8-6, p<0.001). The six most common risk factors for mortality following a duodenal perforation in decreasing orders were septic shock (OR, 12.8, 95% CI 7.4-22.0, p<0.001), disseminated cancer (OR, 6.9, 95% CI 3.6-13.2, p<0.001), ventilator dependency (OR,2.9, 95% CI 1.4-6.0, p=0.005), ascites (OR, 2.7, 95% CI 1.3-5.2, p=0.005), weight loss (OR,2.5,95% CI 1.6-4.0, p<0.003) and history of COPD (OR,2.5,95% CI 1.6-4.0, p<0.001).

Conclusions: Despite significant advances in our understanding of peptic ulcer disease there has been almost no change in the incidence of perforation over the past two decades. Septic shock was the single greatest risk factor for death following both gastric and duodenal perforations. Further lomgitudinal prospective research is needed to make an impact on this surgical disease.

P16. The Performance of Fever as a Univariate Predictor of Infection

Divya Devineni; Neftali Watkinson; Victor Joe

Background
Fever is a physiological response in which normal body temperature is elevated and defined by the Centers for Disease Control (CDC) and World Health Organization (WHO) as a temperature (T) > 100.4° F. Clinicians commonly use T > 101.5° F as an indication of infection, and prescribe medications and/or initiate a “fever workup”.

Hypothesis
Fever is poorly predictive of the presence of infection.

Methods
Data from the Center for Biomedical Informatics (CBMI) at the University of California, Irvine (UCI) that contains structured and de-identified patient data collected from UCI Medical Center were queried using SQL. We targeted common fever-causing diseases using ICD-10-CM codes. We data-mined for the maximum T recorded for each person from the time of admission to the day the code was registered. For each code, we captured the highest and lowest maximum patient T observed. We calculated the sensitivity of using temperature as a predictor of infection using 100° F as the threshold.

Results
A total of 53461 patients coded with infection. The average maximum T for these patients was < 101.5° F, with the exception of botulism food poisoning. Using a T of 100.4° F, five of

seventeen groups were below threshold. Of the selected patients, 37076 were under the threshold of 100.0° F, while 16385 were over. The average threshold sensitivity was 30.6% with a range of 14-67%.

Conclusions
Fever is a poor predictor for infection. Utilizing fever as an indication to initiate a workup for infection and/or administer empiric antimicrobials may lead to delays in identifying infection. Studies to examine alternative univariate predictors for infection or to develop multivariate indices that can be utilized as indications to workup patients for infection and start empiric antibiotics are needed. To comment on tendencies toward over testing and over treatment, we would have to identify specificity of fever. Currently we only report on sensitivity because we need data on patients who do not have an infection of any kind. We require a comprehensive list of all the codes that correlate to an infection so we can identify patients who do not have any. Such effort is part of the future work for this project.

P17. A Descriptive Review of Bacteremia in Trauma Patients

Arthur Grimes; Ryan Kennedy

Background: Bacteremia is described as the presence of bacteria in the bloodstream. This can occur after manipulation of infected tissue, disruption of mucosal or skin barriers, due to persistent endovascular infection, or in the presence of systemic infections. Bacteremia, when present with sepsis, is associated with increase morbidity and mortality in non-trauma patients. There is limited literature regarding bacteremia in trauma patients.

Hypothesis: We describe characteristics, therapy, and outcomes in trauma patients with bacteremia.

Methods: Bacteremia was defined as positive blood culture. Data was collected over a 5.5 years period from 5/2014 to 4/2019. Data on patient demographics and clinical characteristic was collected.

Results: Of the 25,624 trauma patients' records that were screened for positive blood cultures, 202 patients met the inclusion criteria and were analyzed for the study. The mean age was 47.4. The mean ISS was 23.2, with majority (73.9%) having an ISS ≥16. 69.8% of patients had positive cultures from non-blood site within 48 hours of positive blood culture primarily (56.9%) from a pulmonary source. The mean duration of antibiotic therapy was 308.6 hours. 106(52.5%) of patients had SOFA scores ≤ 6. The mean hospital LOS was 29.4 days. The overall mortality was 20.8%.

Conclusions: This study shows that bacteremia is uncommon in trauma patients. Frequently it is associated with other sites of infections. Consideration should be made to tailor duration of antibiotic therapy to sites other than bloodstream infections. Further studies should assess the need for blood cultures in trauma patients.

P18. Management of Sternal Infections and Sternal Disruptions after Sternotomy with Plate Fixation

Alexandra Blake; Megan Condrey; Vineet Mehan

Background: Sternal disruption and deep sternal infections after cardiac surgery remain with higher mortality rates than those without sternal complications after cardiac surgery. The reconstructive approaches on these patients have largely centered on soft tissue reconstruction by a variety of

methods that result in functional loss, such as using pectoralis major or rectus abdominus muscles, to obliterate the soft tissue defect. Omental flaps have also been employed but usually necessitate a hernia. Sternal reduction and rigid fixation with transverse plates is debated in the setting of infection. Some data shows early positive advantages. The distinct advantage to reduction and fixation is use of pedicled pectoralis flaps without turnover flaps or use of abdominal flaps, as well as maintenance of sternal rigidity and upper girdle function and strength. The goal of this study was to examine the outcomes of rigid plate fixation (RPF), and to determine what factors lead to better patient outcomes

Hypothesis: We hypothesized that despite infections most patients could be treated with RPF.

Methods: This is a retrospective study of patients who underwent sternal reconstruction by a single plastic surgeon from April 2013 to March 2021. We evaluated the demographic and perioperative factors that were associated with recurrent sternal infection after RPF. Inclusion criteria- sternal reconstruction with RPF. Exclusion criteria- death within six months of reconstruction, addition and removal of plates multiple times.

Results: Of the 101 patients who underwent sternal reconstruction during the timeframe, 91 met the criteria. 10/63 (16%) patients who had either clean-contaminated or infected wounds developed recurrent infection, while 4/28 (14%) patients who had clean wounds developed infection after plating ($p>0.05$). Of the 63 clean-contaminated/infected patients, 7/23 (30%) with high creatinine levels versus 3/40 (8%) with normal levels, and 6/18 (33%) females versus 4/45 (9%) males had recurrent infection ($p=0.029$, $p=0.026$ respectively). Over time, there was a significant increase in the number of platings performed, while the number of infections did not differ yearly ($p=0.002$ vs $p=0.783$).

Conclusions: Overall, there is no statistically significant difference between patients with clean-contaminated/infected wounds and those with clean wounds and development of infection after RPF. Other than creatinine level and sex, all other demographic and perioperative factors were insignificant for recurrent infection.

P19. ANALYSIS OF THE CAUSES OF LETHAL OUTCOMES AMONG PATIENTS WITH ACUTE PURULENT-DESTRUCTIVE LUNG DISEASES WITH COVID-19

Alisher Okhunov; Shokhista Bobokulova

Background: COVID-19 is a rapidly evolving new disease first detected in China in December 2019 According to WHO, as of December 5, 2021, coronavirus was diagnosed in 265 million people, and in 5.2 million cases, the disease was fatal. Since the discovery of SARS-CoV-2, purulent-destructive lung diseases have been described and diagnosed more and more throughout the world in patients who have fallen ill or have had COVID-19 pneumonia.

Hypothesis: Target of our research was to identify the main causes of death in patients with acute purulent-destructive lung diseases who have undergone COVID-19.

Methods: The autopsies of 42 deceased patients with acute purulent-destructive pulmonary diseases (PDPD) who had undergone COVID-19 were analyzed. The data of pathomorphological examination of internal organs were studied

Results: Mortality among patients with PDPD who underwent COVID-19 was 17.6% (42 cases) and in the dynamics of treatment was distributed as follows. On the day of admission, 2 (0.84%) patients died, by the end of the first day - another 1 patient (0.42%). Subsequently, on days 2-3 of treatment, 4

patients (1.68%) died, 3-7 days - 9 patients (3.78%), 7-14 days - 10 patients (4.2%) and in the long term (over 14 days and up to 3 months), another 16 (6.7%) patients died. Thus, the most dangerous were the first 14 days, during which 26 (61.9%) patients out of 42 died. The most common causes of death among patients with PDPD who underwent COVID-19 were purulent-septic (70.9%), pleural (59.6%), cardiovascular (58.3%) and hepatic-renal (45, 4%) complications. Pulmonary bleeding was less common (1.1%). Such a high specific percentage of multiple organ "interest" prompted us to retrospectively study the pathomorphological changes in patients with a comparative analysis of lethal outcomes. It was found that fatty and granular degeneration of liver cells was noted in 29 cases, cirrhosis of the liver - 9, amyloidosis - in 4. Kidney changes in 33 deaths were characterized by granular degeneration of the epithelium of the convoluted tubules and in 2 - by amyloidosis. Pathological changes in the muscle of the heart were found in 30 patients (no changes were found in 12). These changes were characterized by granular degeneration, combined in three patients with muscle fiber fragmentation.

Conclusions: Thus, among the internal organs, the liver underwent the most profound changes, which, as is known, to a greater extent than other organs, is exposed to purulent intoxication. The revealed changes were characterized by granular degeneration of internal organs, combined in one patient with damage to several organs at once and the development of multiple organ failure.

P20. Vitamin C deficiency may be a significant risk factor for surgical infections

Hugo Bonatti; Victoria Giffi; Catherine Faege; Maulik Joshi; Aaron George

Background: Vitamin C deficiency (VCD) is a rare condition in developed countries. Poor dietary choices, socioeconomic barriers, and chronic health conditions may put subsets of the US population at risk for malnutrition including in vitamin deficiencies. Vitamin C may aid in the treatment of severe infections including sepsis.

Hypothesis: VCD may be underestimated in surgical patients, leading to detrimental complications.

Methods: After reviewing the course of a patient, who succumbed to Scurvy due to atypical presentation and delay in diagnosis, patients considered at risk to suffer from multi Vitamin deficiency were tested for Vitamin C levels. A data base was created including demographic, clinical and outcome data of VCD patients.

Results: During a two years period, 44 surgical patients with VCD were identified, fourteen with severe surgical infections. Median age of the ten females and four males was 62.1 (range 45.4 to 77.6) years, median body mass index 33.4 (range 18 to 58.9) kg/m2 (6 morbidly obese); seven suffered from malignancies. The index patient was a 77-year-old female presenting with septic shock, who underwent emergency amputation of her necrotic leg (Figure). After stabilization she underwent debridement of sacral/gluteal necrosis and during laparoscopy for a colostomy the ileocecal region and sigmoid colon were found necrotic causing diffuse peritonitis and were resected. After a protracted course she was made comfort care by her family, and subsequently her Vitamin C levels came back unmeasurable. One cachectic iv drug abuser presented with survey and necrotic leg ulcers. Four patients had leaking staple line/sutured viscus perforation requiring repeat surgery or drainage, three patients had delayed anastomotic leaks and five had poor healing infected soft tissue wounds. Ten patients also had Thiamin deficiency, eleven Zinc deficiency, and twelve had low prealbumin levels. Once diagnosis of VCD was made, patients were started on intravenous ascorbic acid, which was then switched to oral maintenance. Two patients died as a direct result of their VCD, two died from progressive cancer and ten are currently alive.

Conclusions: VCD is a much more common condition than expected in our rural setting with detrimental consequences in surgical patients. The collected data has prompted us to increase testing for multiple vitamin deficiencies. A prospective study is planned at our hospital to determine the true incidence and prevalence of these deficiency especially in surgical, oncological and bariatric patients as well as various demographics and socioeconomic populations.

P21. Burn-specific triage guidelines in state-based crisis standards of care

Rabia Nizamani; Booker King; Felicia Williams

Background: In times of crisis, medical institutions must utilize contingency plans to ensure the highest quality of patient care. When these plans are overwhelmed, crisis standards of care may be adopted, resulting in modifications in resource allocation. The current coronavirus pandemic has created tremendous strains on hospitals throughout the world, with periodic shortages in equipment, PPE, ICU beds, and personnel. These pressures have been great enough at times to result in several states implementing crisis standards of care to allow hospitals to triage patients and "do the most good possible for the largest number of people with limited resources". However, these guidelines may not account for the unique needs of burn patients, whose care is often resource intensive.

Hypothesis: We hypothesized that the majority of state-specific crisis standard of care guidelines would not provide guidance for appropriate triage of an acute surgical population, burn patients.

Methods: Internet search engines were used to locate state-specific actionable “crisis standards of care” or “scarce resource allocation” policies available by December 15, 2021. Once identified, these guidelines were further examined to determine whether explicit information was provided to direct the triage of burn patients.

Results: Of the 50 states and the District of Columbia, only 37 states (74%) were confirmed to have official crisis standards of care policies that could be implemented by healthcare institutions during the current pandemic. Additionally, guidelines from non-governmental entities were identified for 5 states (Florida Bioethics Network, Ohio Hospital Association, Maine Hospital Association, Missouri Hospital Association, and West Virginia Hospital Association). Of the 42 plans available, only 13 (31%) provide specific information regarding triage of burn patients during implementation of crisis standards of care. Thus, 74% of states and the District of Columbia do not provide any guidance for triage of burn patients when resource levels reach a critical stage.

Conclusions: Crisis standards of care are heterogenous throughout the United States and have varying levels of specificity. The majority of states and the District of Columbia do not provide clear, actionable guidance on the triage of burn patients during the current coronavirus pandemic. Without specific criteria, burn patients may be mis-triaged by providers who lack experience in treating them.