

Oral: 1

Category: CQI/EBM

Institution: Allegiance Health

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Penicillin Allergy Assessment - A Quality Improvement Project

BACKGROUND

Approximately 10% of the U.S. population and up to 20% of hospitalized patients report having penicillin allergy. Recent studies suggest that fewer than 10% of these patients are truly penicillin allergic following skin testing and oral challenges. Penicillin allergy designations have been associated with increased costs, patient morbidity, and development of antibiotic resistance. We hypothesize that obtaining a thorough drug allergy history may either exclude patients from being labeled penicillin allergic or identify eligible candidates for penicillin skin testing.

MATERIALS AND METHODS

A standardized allergy assessment form was created and utilized. Patients aged 18 years or older with a recorded penicillin allergy and not in any immediate harm or at risk for delay of care were interviewed.

RESULTS

A total of 80 patients were interviewed with charted penicillin allergies. Nine of them denied having penicillin allergy. Among the remaining 71 patients, a total of 88 documented reactions were recorded. Immediate type reactions, including angioedema, shortness of breath/wheezing, or hives composed 60% of the reported reactions. Subsequently, a penicillin allergy skin testing program has been created as part of a multi-disciplinary antimicrobial stewardship and so far 66% of the tested patients have been found to be not allergic to penicillin.

CONCLUSION

The low observed prevalence of true penicillin allergy among patients with a reported penicillin allergy has brought light to the healthcare providers about the necessity for better antimicrobial allergy assessment and antibiotic streamlining in a setting of increased healthcare costs and multi-drug resistant organisms.

Oral: 2

Category: Research

Institution: Central Michigan University – Saginaw

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Contrary to Expectations: Seasonal Variation in Sickle Cell Crisis

Background: Hospitalizations for sickle cell crisis are on a raise in the past decade. Though previous studies have described seasonal variations in African and Caribbean population, but there is no similar data in US. We reviewed a large national hospitalization database to determine whether rates of sickle cell crisis have varied by season.

Methods: Sickle cell crisis-related hospitalizations were identified from NIS data from 2000-2012 based on diagnosis of ICD-9 code 282.62. The frequency of hospitalization per month cumulative over 12 years was calculated and divided by number of days in that month to determine the mean hospitalizations per day for each month. All calculations were carried out using the weighted estimates approximating nationwide population estimates.

Results: An estimated 744,072 hospitalizations with primary diagnosis of sickle cell crisis occurred in the US from 2000 to 2012. The number of hospitalization was highest in winter and lowest in summer. The mean number of hospitalizations in each day was highest in January and thereafter hospitalizations rate dropped to nadir in December.

Conclusion: We identified for the first time in US an impressive pattern of seasonal variation in hospitalizations for sickle cell crisis raising in winter and fall with a significant drop during summer months. The seasonal pattern may reflect a viral or other infective agent and physiologic changes responsible for precipitation of sickle cell crisis. Further efforts needs to be done to identify triggers and methods to determine the relationship of these variations and reduce its burden on health care system.

Oral: 3

Category: Research

Institution: Henry Ford Health System – Detroit

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Factors Influencing the Decision to Pursue Stress Testing in Low-Risk Patients Presenting with Chest Pain

Background:

Cardiac stress testing in low risk patients has been the center of attention due to concerns for over-utilization, rising healthcare costs and potential patient harm.

Objectives:

To identify factors influencing the decision to pursue stress testing in low-risk patients presenting with chest pain.

Methodology:

We prospectively studied 397 patients in the observational unit of an urban teaching hospital presenting with chest pain, who had no continuing chest pain, dynamic ST-segment changes, or elevated troponin I levels. Demographic and clinical data were obtained at the time of recruitment. The attending physicians used their clinical judgment to decide on ordering stress tests. Results were analyzed using chi-squared test to compare categorical variables.

Results:

There was no statistically significant relationship between the decision to stress test patients and their age, gender, coronary artery disease risk factors, or previous history of heart disease. The independent factors associated with a higher likelihood of pursuing cardiac stress testing in this patient population were nature of the chest pain (typical), exacerbation with exertion and relief with Nitroglycerin (P-values: 0.017, 0.012 and 0.015 respectively). North American Chest Pain Rule (NACPR) and History, Electrocardiogram, Age, Risk factors, Troponin (HEART) scores were calculated for each patient; however, no significant correlation between stress testing and these factors were found.

Conclusion:

Nature of the chest pain was the strongest predictor of pursuing stress testing among low risk patients. Validated scoring systems designed to limit unnecessary testing do not appear to significantly influence clinician's decision to pursue stress test.

Oral: 4

Category: CQI/EBM

Institution: Henry Ford Health System – Detroit

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Preventable ED Visits in Oncology Patients

Cancer patient population is at high risk of multiple Emergency Department ED visits and hospitalizations due to high clinical demands. Often however, these clinical demands can be resolved on an outpatient aspect and do not always require ED visits or hospitalizations. We did a retrospective chart review of Henry Ford oncology patients who were seen in the ED between July 2013 and Dec 2014 and to determine whether ED visits were preventable.

We found 59 patients who visited the ED, of those 17 ED visits were thought to be preventable and 9 were possibly preventable. Many cases presented after regular outpatient hours. Four ED visits needing transfusion and re-hydration were thought to be preventable. And another 3 cases needing tracheostomy care were thought to be preventable as well.

We propose Extended hours clinic to address re-hydration/ antiemetic and transfusion needs, we also proposed collaboration with ENT for extended hours tracheostomy care clinics.

Oral: 5

Category: Research

Institution: Henry Ford Health System – Detroit

Director: Sean Drake, MD, FACP

Presenter: Scott Lawler

Additional Authors:

Short-Term Prognostic Utility of Low, Intermediate and High HEART Scores in Patients Presenting to the ED with Possible AMI

Background: The HEART Score (HS) is a risk-stratification tool that predicts the risk of major adverse cardiac events (MACE) in patients evaluated for possible acute myocardial infarction (AMI) in the Emergency Department (ED). It incorporates the patient's history, ECG, age, risk factors and cardiac troponin (cTn) level at presentation. We sought to determine the short-term prognostic utility of the HS in patients with a low (0-3), intermediate (4-6) or high (7-10) HS.

Methods: A prospective single-center study of 569 patients evaluated for possible AMI in the ED from 5/2013 to 4/2015 was conducted. Patients that had an ECG that led to immediate reperfusion therapy were excluded. Patients were followed for MACE (death/AMI) within 30 days. Diagnosis of AMI was adjudicated by 2 independent physicians in accordance with the universal definition of AMI using all clinical information and required cTnI > 0.04 ng/ml (Siemens Ultra-cTnI). When there was discordance between adjudicators, a third non-biased Cardiology adjudicator reviewed the case for final determination.

Results: At 30 days, 9.5% (54/569) of patients had a MACE (47 non-fatal AMIs, 2 fatal AMIs and 5 non-AMI deaths). The MACE rate was 1.8% (6/326) for low HS, 18.0% (42/233) for intermediate HS and 60.0% (6/10) for high HS ($p < 0.001$).

Conclusions: The HS was able to distinguish between low, intermediate, and high-risk patients evaluated for possible AMI in the ED. Patients at lowest risk could be considered for early discharge from the ED.

Oral: 6

Category: Clinical Vignette

Institution: Hurley Medical Center/MSU – Flint

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Additional Authors: Joseph Kannarkatt, Anas Al-Janadi

Metastatic Prostate Adenocarcinoma of the Gallbladder Presenting as Cholecystitis

Introduction

Prostate cancer usually metastasizes to the bone, lymph nodes, lung, and liver. Other rare metastatic sites reported before testis, paranasal sinuses, stomach pituitary and the superior vena cava. Metastatic prostate adenocarcinoma to the gallbladder is extremely rare.

Case presentation

A 64 years old Lebanese male with a history of castrate metastatic prostate cancer for 12 years. He had prostatectomy and radiation therapy at the time of the diagnosis. He stopped his androgen deprivation therapy shortly after that against medical advice. He presented to the emergency department with intermittent abdominal pain, fatigue and significant weight loss for the last 6 months. On examination, he had right upper quadrant tenderness with positive murphy's sign. His laboratory investigations revealed prostate specific antigen was 230 ng/ml, total testosterone was undetectable. Computed tomography of the abdomen and pelvis with contrast showed extensive lymphadenopathy and also showed features suggestive of cholecystitis.

The patient had cholecystectomy eventually. Histopathological examination showed metastatic adenocarcinoma of prostatic origin. He was then started on abiraterone then enzalutamide. But after a brief period, he refused treatment and elected for palliative care and he passed away a few months later.

Conclusion

Although it is very rare, prostate cancer can metastasize to the gallbladder and mimic clinical and radiology presentation of cholecystitis. Generally, the gallbladder is an unusual site of metastasis. The most common origins of cancers that metastases to the gallbladder are melanomas, stomach, pancreas, bile ducts, colon, and breast.

Oral: 7

Category: Research

Institution: Hurley Medical Center/MSU – Flint

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Venous Thrombosis Associated with Peripherally Inserted Central Catheters: A Retrospective Analysis at the Hurley Medical Center

Background

Peripherally Inserted Central venous Catheters (PICCs) appear to have a similar prevalence to that of centrally inserted catheters with a prevalence ranging from 3 to 58 percent. At Hurley Medical Center (HMC), an accurate prevalence measurement of upper extremity DVT in PICCs patients was needed. In addition, a re-evaluation of DVT-associated risk factors to determine if changes in PICCs standards of care are needed.

Method

This is a cross sectional study. Study population consisted of 255 hospitalized patients at HMC who had PICCs and met our inclusion and exclusion criteria. Bivariate analysis was performed to determine associations between PICCs and other suspected risk factors such as age, sex, duration of PICC, presence of malignancy, catheter laterality. Symptoms and signs of DVT in PICC examined were pain, fever, and swelling. Multivariate logistic regression analysis was conducted to estimate adjusted odds ratio and 95% confidence intervals for the factors mentioned above.

Results

Prevalence of DVT in patients with PICC at HMC was 40%. Previously identified factors were not found to be statistically significantly related to the formation of DVT. Similarly, symptoms and signs studied were not associated with the development of DVTs.

Conclusion

The prevalence of DVT in patients with PICC at HMC patients falls at the higher range when compared to previous studies. Alternatives for other intravenous accesses such as central line or med-line should be considered as well. Additional studies need to be conducted to confirm our result and identify DVT-related risk factors.

Oral: 8

Category: Research

Institution: Hurley Medical Center/MSU – Flint

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The Role of Pharmacological DVT Prophylaxis in PICC Line Related Thrombosis

Background: Peripherally inserted center catheter (PICC) is associated with many complications including thromboembolism. The role of pharmacological prophylaxis in prevention of PICC line related thromboembolism is controversial. In our study, we assessed the role of pharmacological prophylaxis in prevention of PICC line thromboembolism.

Methods: We reviewed the medical records in our center for Patients who had an ultrasound at the site of PICC line insertion and age ranges from 18-65 years old. The population sample size consists of 227 patients who was included in the retrospective analysis. The population mean age was 57.3 ± 18.5 . Female constitutes 145 (64 %), and males were 82 (36%). 140 patients (62%) had ultrasound confirmed venous thrombosis at the site of PICC line insertion. 50% of the patients had either deep venous thrombosis (DVT) or both DVT and superficial venous thrombosis, 28% had superficial thrombosis only, and 38% had no thrombosis. Pharmacological DVT prophylaxis in the form of heparin or enoxaparin was given to 128 patients (56 %). A multivariate logistic regression model was used to analyze the data.

Results: Using multivariate logistic regression model and after adjusting for other variables (Age, sex, BMI, ABO blood group and smoking history). Patients who had DVT prophylaxis had 50% lower chance of developing PICC- related thrombosis compared to those without pharmacological DVT prophylaxis. Adjusted OR= 0.49, 95% CI (0.278-0.87 5) with a P value of 0.016.

Conclusions: Our study points out the importance of pharmacological DVT prophylaxis in preventing DVT in patients with PICC line insertion.

Oral: 9

Category: Clinical Vignette

Institution: Hurley Medical Center/MSU – Flint

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Benign but Not So Innocent! A Case of Lipomatous Atrial Septal Hypertrophy

Introduction:

Lipomatous atrial septal hypertrophy (LASH) is a rare and benign tumor-like condition with massive fatty deposition on interatrial septum. However, it may lead to supraventricular arrhythmias, AV block, right atrial inflow obstruction and sudden cardiac death.

Case presentation:

A 59 year-old Caucasian female with past medical history of hypertension and COPD presented with severe abdominal and left lower extremity pain associated with mottling, numbness and weakness for 12 hours duration. On presentation, patient was diaphoretic and in severe pain. She was tachycardiac and tachypneic. Chest and heart examination were unremarkable, however, abdomen was tender at left lower quadrant. There was no pulse palpable at dorsalis pedis, anterior and posterior tibial and popliteal arteries. EKG was unremarkable. CT angiography showed complete occlusion of left common iliac artery. However, there was contrast opacification of the distal portion of external iliac artery due to collaterals. Distal arteries were not visualized. There was a large 4.9 X 3.8 cm fatty area within right atrium with the base on intraatrial septum. TEE corroborated the given findings. There was no evidence of thrombus. Coagulation profile was normal. Patient was treated with thromboembolectomy and anticoagulation.

Conclusion:

LASH is characterized by >2cm fat deposition in the area of the interatrial septum. It has been associated with advanced age, female gender, obesity and atrial arrhythmias. This could potentially lead to thrombus formation and embolization. Echo, CT and MRI are used to diagnose LASH, although most of the time it is an incidental finding.

Oral: 10

Category: Clinical Vignette

Institution: McLaren Regional Medical Center/MSU – Flint

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A Rare Case of Nitroglycerin-Induced Bradycardia and Hypotension in a Healthy Young Man

Nitroglycerin is used for angina, but can cause headache, nausea, flushing, hypotension, tachycardia and rarely bradycardia.

A 39-year-old male presented with left-sided chest pain triggered by weight-lifting and aggravated by deep inspiration. Physical examination revealed chest wall tenderness. He was hemodynamically stable with a HR of 87, normal EKG and troponin. He was given aspirin and sublingual nitroglycerin. After about twenty minutes, the patient developed lightheadedness and diaphoresis. Vitals showed hypotension and bradycardia. Rhythm strip showed sinus bradycardia with a HR of 41 and a sinus pause of 3 seconds. His blood pressure and HR significantly improved after IV fluids and his symptoms completely resolved. Patient was observed for further episodes of bradycardia or hypotension; nitroglycerin was avoided. He was discharged in stable medical condition.

Generally, nitroglycerin-induced hypotension is associated with tachycardia due to reflex sympathetic stimulation and parasympathetic inhibition; however, coexisting bradycardia and hypotension is rare, with incidence of 5% in the setting of coronary arteriography with nitrates. Possible mechanisms include partial sympathetic failure, increased vagal tone and/or Bezold-Jarisch reflex. Bradycardia and hypotension is usually seen in patients with underlying myocardial ischemia/infarction, particularly those with inferior/right ventricular involvement, but can rarely present in healthy individuals such as our patient triggered by nitroglycerin. Hypotensive bradycardia is resolved by discontinuation of nitroglycerin, leg elevation and atropine administration. Hypotensive bradycardia has been reported in patients both naïve, and previously exposed, to nitroglycerin. We aim to raise awareness of this rare phenomenon which may be life-threatening if not dealt with promptly.

Oral: 11

Category: Research

Institution: Beaumont Hospital – Royal Oak

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To Biopsy or Not to Biopsy: Risk of Surgical Lung Biopsy in Patients with Honeycombing on Chest Imaging

Background: Latest guidelines recommend surgical lung biopsy in patients suspected with “possible”-usual interstitial pneumonia (UIP) pattern or a “non-UIP pattern”. In an earlier analysis, we noted that patients, who had non-elective surgical lung biopsies (SLB), had a higher mortality compared to elective SLB.

Aim/Hypothesis: The specific aim of this study was to identify risk factors related with higher risk in patients, who had non-elective/emergent SLBs. We hypothesized that patients with honeycombing (HC) on CT scan has a higher risk of death with non-elective SLBs.

Methods: We reviewed SLB performed at an academic health system from Jan 2011 to Dec 2016. All CT scans of included patients prior to biopsy were re-reviewed for the presence of HC. 113 SLBs were included for analysis.

Results: 54 patients (52%) had biopsies done on an emergent basis (non-elective). A non-UIP pattern was seen on CT scan of 87 patients (76%), but HC could be visualized only in 40 patients (35%). Non elective biopsy was associated with higher mortality compared to elective SLB (28% vs. 7%, $p=0.04$). When delineating patients, who had non-elective vs. elective SLBs, neither UIP pattern on CT scan or on pathology was associated with increased 30-day mortality. Multivariate ordered logistic regression analysis showed an older age and presence of HC on CT were associated with a higher risk of death after non-elective biopsies.

Conclusion: Our series indicates that in patients undergoing SLBs on an emergent basis, presence of HC on CT scan is associated with higher 30-day mortality.

Oral: 12

Category: Research

Institution: Beaumont Hospital – Royal Oak

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Obesity-Acute Respiratory Distress Syndrome Paradox: Truth or Myth

Background

APPS score is a risk prediction tool of mortality in patients with moderate and severe ARDS. This 9-point scale uses Age, PaO₂/FiO₂ ratio and Plateau pressure measured at 24 hours after diagnosis of ARDS to classify patients into low, moderate and high mortality risk groups. We looked at the association between obesity and in-hospital all-cause mortality in patients with moderate and severe ARDS (per Berlin definition) belonging to moderate mortality risk group (per APPS score).

Methods

Retrospective chart review identified patients with moderate and severe ARDS managed by ARDSnet protocol in medical and surgical ICUs of a tertiary care hospital over 3-year period. APPS score was calculated for each patient. For patients with moderate APPS mortality risk, association of obesity (BMI >30) and mortality was assessed.

Results

42 patients met the entry criteria of moderate and severe ARDS (per Berlin definition) with a moderate APPS mortality risk. All-cause in-hospital mortality was 47.6%. Twenty patients had BMI >30 and had a mortality of 65.2% (p=0.012)

Discussion

Some studies have shown that obesity is associated with decreased mortality in ARDS. This inverse association between obesity and ARDS mortality has been termed obesity-ARDS paradox. An attenuated inflammatory response in obese patients may be responsible for this. Other studies have refuted this. Our study demonstrates that within ARDS patients matched for their mortality risk, mortality is higher in obese patients. Our results echo the findings of studies that have questioned the concept of obesity- ARDS paradox

Oral: 13

Category: Clinical Vignette

Institution: Beaumont Hospital – Royal Oak

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Central Nervous System Vasculitis? Better Reverse the Course

Introduction: Reversible cerebral vasoconstriction syndrome (RCVS) refers to a group of cerebral vasculopathies that result in reversible constrictive changes of cerebral arteries. It is a largely under-recognized condition, given the lack of validated diagnostic criteria. The sudden onset of excruciating “thunderclap” headache may be the only presenting symptom, leading to a broad differential diagnosis. Risk factors include amphetamines use, stress, female gender, and post-partum state.

Case presentation: A 29-year old post-partum female presented to the emergency room after the sudden onset of a severe headache. Physical exam was unremarkable. CT head revealed a small subarachnoid hemorrhage over the left frontal and temporal convexity and within the left Sylvian sulcus. An arteriogram demonstrated areas of irregular narrowing and slight dilation of the posterior and middle cerebral arteries bilaterally. Findings were concerning for vasculitis.

Laboratory workup revealed normal TSH, ESR, CRP, rheumatoid factor, VDRL, ANA, ANCA, complement fractions, cryoglobulins, protein electrophoresis, and hepatitis B and C. Drug testing was positive for amphetamines. Lumbar puncture was unremarkable. A diagnosis of RCVS was established. Symptoms resolved and the patient was subsequently discharged.

Discussion: This case illustrates a unique, under-recognized entity that should be considered in the differential diagnoses when evaluating for intracranial vasculitis. Failure to recognize this entity may lead to unnecessary immunosuppressive therapy, additional arteriograms and invasive diagnostic procedures such as brain biopsy. The location of SAH and the angiographic pattern, combined with a negative rheumatologic workup, made RCVS the most likely diagnosis.

Oral: 14

Category: Clinical Vignette

Institution: Beaumont Hospital – Royal Oak

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Alteplase Induced Angioedema: A Case of a Life-threatening Adverse Effect to a Life-Saving Medication

A sixty-eight year old female with history of hypertension presented to the emergency department with one hour of right hemianopsia with right-sided numbness and weakness. Vital signs were significant for hypertension at 209/63. Physical exam revealed a right facial droop, decreased right visual field, weakness of the right extremities, decreased sensation of right extremities, and limb ataxia. Computed tomography (CT) of the head showed no acute intracranial hemorrhage. With concern for ischemic stroke, patient received alteplase after administration of labetalol and hydralazine to lower her blood pressure. Thirty minutes after administration of alteplase, she developed upper lip, tongue, and facial swelling and soon thereafter developed stridor. She was given diphenhydramine and solumedrol and was subsequently intubated for airway protection. She was admitted to the intensive care unit and ultimately underwent tracheostomy due to persistent laryngeal edema.

Orolingual angioedema occurs in one- to five-percent of patients treated with alteplase. When it does occur, it is usually mild and transient. In this case, however, the patient had severe orolingual angioedema which necessitated emergent airway protection. Treatment for severe orolingual angioedema includes antihistamines, corticosteroids, and intubation in patients that develop stridor. Patients taking angiotensin converting enzyme (ACE) inhibitors who also receive alteplase may be at higher risk. In this case, she was also on an ACE inhibitor which may have contributed to the severity of her angioedema. Here, we present a rare and severe adverse effect to a life-saving medication.

Oral: 15

Category: Clinical Vignette

Institution: Sinai Grace Hospital - DMC – Detroit

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Additional Authors: Farah Daneshvar, DO; Geetha Krishnamoorthy, MD; Camelia Arsene, MD, PhD, MHS.

A Healthy Young Female with Severe Coronary Heart Disease

Introduction: Acute Myocardial Infarction (AMI) occurs at a frequency of 1/1000 person years in African American women aged 35-44. The risk of death is higher in young women after AMI. We present a case of severe CHD in a young female without significant risk factors.

Case Report: A 36-year-old athletic female with a history of well controlled hypertension without medications, and occasional cigarette smoking presented with acute severe chest pain. EKG showed ST elevation in V2, V3 and initial troponin was normal. She underwent defibrillation 8 times for ventricular fibrillation. Three drug eluting stents were placed during emergency cardiac catheterization, 2 in LAD (100% proximal occlusion) and 1 in RCA (100% mid segment occlusion). ECHO showed an LVEF of 20%. She had LDL cholesterol of 69, HDL of 55 and triglyceride of 49, done on presentation. TSH, homocysteine, and HbA1C were normal. There was no hypercoagulable state, endocarditis, oral contraceptive use, family history of premature CHD, or connective tissue disease. After 16 days of hospitalization, the patient was discharged on optimal medical treatment of CHD and CHF and lifest.

Discussion: Although not common, this case shows a low risk young female with severe CHD. Risk factors in young women include hypertension, smoking, dyslipidemia, type 2 diabetes, obesity, depression, spontaneous coronary artery dissection, hypercoagulable states, connective tissue diseases and psychosocial stressors. Despite the low incidence, AMI should always be excluded in a patient with chest pain. The quick, simple and cost effective EKG should be done in such patients.

Oral: 16

Category: CQI/EBM

Institution: Sinai Grace Hospital - DMC – Detroit

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Intra-Cranial Pressure Monitoring for Patients Listed for Liver Transplant Presenting with Hepatic Encephalopathy: Boon or Bane?

Introduction: Cerebral edema is the leading cause of death in patients with grade III-IV hepatic encephalopathy. It causes neurologic deterioration due to raised intracranial pressure (ICP) and reduced cerebral perfusion. ICP Monitoring (ICPM) can assist us to make an early intervention in managing the raised ICP but can also lead to fatal complications like intracranial hemorrhage especially in the prevalence of severe coagulopathy.

Methods: An evidence-based review was conducted in Ovid Medline, using the key words "hepatic encephalopathy", "liver transplantation", and "intracranial pressure monitoring". Combination of search phrases resulted in 47 studies, 2 of which were relevant for this topic.

Results: In a multi-centric study, 332 patients with grade III-IV hepatic encephalopathy were selected, amongst which 28% underwent ICP monitoring. There was no difference in the 30-day survival post-Liver Transplant (LT) in monitored and non-monitored groups. Amongst a group of 58 patients with ICP monitoring, intracranial hemorrhage was reported in 10.3% of the cohort. In another study with 629 patients (ICPM; n= 140), the 21-day mortality was similar (ICPM patients 33% vs. controls 38%; p=0.24). In patients listed for LT, there was no association between ICP monitoring and overall mortality (ICPM 29% vs controls 20% ; p=0.10); the same outcome was presented for transplant free mortality at 21 days.

Conclusion: Lack of evidence supporting mortality benefits in patients listed for liver transplant admitted with grade III-IV encephalopathy and association with fatal side-effects due to its invasive nature, makes the use of ICP monitoring questionable at this point.

Oral: 17

Category: CQI/EBM

Institution: St. Joseph Mercy - Ann Arbor

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Reducing Use of Free T4 to Monitor Levothyroxine Therapy

Background:

Primary hypothyroidism is commonly treated in primary care clinics. American Thyroid Association (ATA) and American Association of Clinical Endocrinologists (AACE) guidelines recommend using only thyroid stimulating hormone (TSH), and not free thyroxine (FT4), to adjust thyroid hormone doses. Nevertheless, FT4 is still commonly ordered in this setting. In 2016, the Medicare reimbursement for FT4 was \$12.28 per test.

Objectives:

We aimed to reduce unnecessary FT4 testing in adjusting therapy for hypothyroidism via education/awareness interventions targeting Internal Medicine resident physicians.

Methods:

Multiple modalities were used to boost resident physician awareness and understanding about ATA/AACE guideline recommendations regarding adjusting levothyroxine therapy. This included verbal briefings during educational conferences and residency program update “huddles.” Additionally, cost information and guideline recommendations were distributed via email and hospital-based social media, and were posted in visible locations in the primary care clinic. Pre-intervention was compared to post-intervention data using test of 2 proportions utilizing Minitab 17.1.0.

Results:

In the 7 months pre-intervention, FT4 was checked 33 times for every 77 times that TSH was checked. In the 7 months post-intervention, FT4 was checked 31 out of 111 times. Concomitant orders for T4 and TSH decreased by 15% post intervention (95% CI: 1-29%; P=0.035).

Discussion:

Adherence to established guideline recommendations regarding thyroid hormone testing can be improved with relatively simple measures to boost awareness. Reducing unnecessary tests saves money. This intervention can be modeled in other clinic settings to promote high-value care.

Oral: 18

Category: CQI/EBM

Institution: St. Joseph Mercy - Ann Arbor

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Weight and Other Outcomes after Farm Voucher (WAFER) Program: Does Access to Free Healthy Food Options Improve Outcomes?

Introduction:

Obesity and related conditions contribute to significant national healthcare costs of an estimated \$147 billion yearly (2008 dollars). 60% of adults in Washtenaw County, Michigan reported as either obese or overweight. The objective of this study was to determine if free vouchers for healthy foods for obese and/or poor patients changed weight, systolic blood pressure (SBP) or diabetes control (HbA1c) at an academic Internal Medicine resident clinic.

Methods:

Patient population included Washtenaw County residents who participated in the 2015 'Prescription for Health' voucher program. This was a retrospective quasi-experimental study comparing 6-month before implementation of vouchers to 6-month post intervention using paired t-tests. Primary outcome was change in weight; secondary outcomes included comparison of SBP and HbA1c.

Results:

For the 37 patients, mean weight pre-intervention was 223.56 lbs and post-intervention 225.16 lbs with mean difference -1.59 lbs (p-value 0.371, 95% CI -5.17, 1.99). Secondary outcomes included: (1) mean HbA1c pre-intervention was 7.909 and post-intervention was 8.859 with mean difference -0.950 (p-value 0.052, 95% CI -1.911, 0.011); (2) mean SBP decreased by 0.31 mmHg (p-value 0.925, 95% CI -7.00, 6.38).

Discussion:

Food vouchers for obese and/or poor patients in the resident clinic did not result in a significant difference in weight and SBP. Surprisingly, there was a trend towards higher HbA1c which may be attributed to increased caloric intake. While this study does not support stand-alone usage of food vouchers, future directions of research can include utilizing vouchers in conjunction with weight management counseling.

Oral: 19

Category: Clinical Vignette

Institution: Wayne State University - DMC - Detroit

Director: Jarrett Weinberger, MD, Member

Presenter: Amjad Kanj

Additional Authors: Nadine Abdallah, Hibah Ismail

A Case of PR3-ANCA Positive Renal-Limited Vasculitis

Pauci-immune necrotizing glomerulonephritis is a subgroup of rapidly progressive glomerulonephritis, characterized by absence of immunoglobulins on immunofluorescence microscopy. It is usually part of multi-organ involvement in patients with granulomatosis with polyangiitis (GPA) or microscopic polyangiitis (MPA). Rarely, it can present as renal-limited vasculitis (RLV).

A 37-year-old African American man presented with cola-colored urine of few days. He had mild hypertension and trace pedal edema on exam. Labs showed normocytic anemia, hypoalbuminemia and Cr:3.2 (BUN:34). Urinalysis showed 3+ proteins, dysmorphic RBCs, oval fat bodies and RBC casts. 24-hour urine protein was 3.2g (subnephrotic range proteinuria). Ultrasound of the kidneys showed bilateral parenchymal disease. Serologic testing was positive for PR3-ANCA. Renal biopsy was consistent with Pauci-immune necrotizing glomerulonephritis with 50-60% sclerosis. Chest X-ray was negative and nasopharyngolaryngoscopy showed no lesions. The patient was diagnosed with PR3-ANCA RLV. He received three days of methylprednisolone and cyclophosphamide and was discharged home on prednisone.

In patients with RLV, renal biopsy tends to show more sclerosis than in GPA or MPA, likely because they present late in the course of disease due to absence of extra-renal manifestations. This highlights the need for early recognition and timely treatment of this condition. A systematic approach should be followed. This starts with a thorough history and physical exam, followed by basic labs, urinalysis with microscopy, targeted serologic testing and renal biopsy. Also, patients with RLV should be made aware of the extra-renal manifestations of GPA and MPA as they might appear later in the course of disease.

Oral: 20

Category: Clinical Vignette

Institution: Wayne State University - DMC - Detroit

Director: Jarrett Weinberger, MD, Member

Presenter: Jasleen Kaur

Additional Authors: Ravinder Bhanot M.D., Chetna Jinjuvadia M.D.

Saturation gap' - Key to Diagnosis of Rasburicase-Induced Methemoglobinemia in a Previously Unrecognized G6PD Deficient Patient

Rasburicase is commonly used in patients with hematologic malignancies for tumor lysis syndrome (TLS) prophylaxis and management. Methemoglobinemia is a rare but serious adverse effect of Rasburicase, more common in patients with Glucose-6-Phosphate Dehydrogenase (G6PD) deficiency.

We report a case of a 48-year-old African American man with relapsed chronic myeloid leukemia (CML) in blast crisis who was admitted for chemotherapy. He developed TLS and therefore received Rasburicase treatment. Although he was asymptomatic, yet his oxygen saturation on pulse oximeter (SpO₂) consistently remained low (80's). Interestingly, he had normal PaO₂ and oxygen saturation on ABG analysis (SaO₂-99%) revealing the so-called 'Saturation Gap'. This prompted the suspicion for methemoglobinemia, an important albeit uncommon cause of low SpO₂, and lab work did reveal high methemoglobin levels (8-12%; Normal<1%). He recovered uneventfully with conservative measures including supplemental oxygen and packed red cell transfusion. He was presumed to be G6PD deficient (later on confirmed with the G6PD quantitative lab test) and thus methylene blue was avoided as it can further worsen methemoglobinemia in these patients.

In conclusion, Rasburicase-induced methemoglobinemia is a potentially serious concern, especially in African-American patients, who are at risk for G6PD deficiency. Knowledge of this side effect and a high index of suspicion for diagnosis, especially in the presence of a "saturation gap", is important in early diagnosis and successful management of this condition. Also, patients from ethnicities in which G6PD deficiency is prevalent should be screened prior to administration of Rasburicase where practical.

Oral: 21

Category: Clinical Vignette

Institution: St. John Hospital and Medical Center - Grosse Pointe

Director: Raymond Hilu, MD, FACP

Presenter: Farman Ali

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Post-Nephrectomy Metastatic Renal Cell Carcinoma to Duodenum Leads to Massive Gastrointestinal Bleed

Introduction:

Life-threatening upper gastrointestinal bleed due to malignancy is relatively uncommon, with the duodenum being the least frequently involved site. Renal cell carcinoma (RCC) may metastasize to almost any site; duodenal metastasis is especially rare in renal cell carcinoma. Early detection, especially in the case of a solitary mass, helps in planning further therapy. We describe a case of duodenal metastasis from renal cell carcinoma, one of only a handful that have been previously described in the literature.

Case Description:

An 80-year-old female presented with progressively worsening shortness of breath, fatigue and generalized weakness for three months. She reported black tarry stools for 3-4 days prior to admission. She denied previous use of NSAIDs. Her past medical history was significant for hypertension and right renal cell carcinoma status post nephrectomy 12 years earlier. On physical exam, she was orthostatic and appeared pale. Laboratory tests on admission were significant for a microcytic, hypochromic anemia - hemoglobin of 7 g/dl, hematocrit 16.8%. Esophagogastroduodenoscopy showed a bleeding 4cm irregular, polypoid, ulcerative mass in the duodenal bulb, and a biopsy was taken.

Discussion:

Gastrointestinal tract metastases are a very rare cause of gastrointestinal bleeding. Small bowel involvement by metastatic tumors is rare and has been reported in only 1-2% of autopsy cases. RCC metastases account for 7.1% of these lesions. Solitary duodenal metastasis from RCC is very rare and most frequently involves the periampullary region or the duodenal bulb. Appropriate awareness, recognition and aggressive work-up in post nephrectomy for RCC are of utmost importance

Oral: 22

Category: Clinical Vignette

Institution: St. John Hospital and Medical Center - Grosse Pointe

Director: Raymond Hilu, MD, FACP

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A Case of Osteonecrosis in a Sickle Cell Trait Patient

Introduction: Sickle cell trait (SCT) is present in up to 8% of African Americans. SCT has been associated with multiple medical conditions including renal papillary necrosis, sudden death, medullary renal cancer and deep vein thrombosis (DVT). Osteonecrosis is far less common and limited data exist about it.

Case report: We report a case of a 68 year-old African American woman with history of end-stage kidney disease on peritoneal dialysis, unprovoked right popliteal DVT, hypertension, ischemic stroke without residual weakness and chronic reactive thrombocytosis. She presented with progressive bilateral leg pain for two months. On physical examination, she had bilateral pitting edema, erythema and tenderness of the shins. Bilateral doppler ultrasound was negative for DVT and X-ray of both extremities was negative for fracture but suggestive of bone infarction. MRI showed avascular necrosis of the distal femur and proximal and distal right tibia. On admission, CBC was significant for anemia and platelet count of 585,000 per cubic milliliter. Comprehensive thrombophilia work-up was negative, including negative prothrombin gene and factor V gene mutations. Due to thrombocytosis, JAK2 mutation and calreticulin were checked and were negative. Bone marrow biopsy showed cellularity of 20-30% with mildly increased myeloid precursors and megakaryocytes.

Discussion: While complications of sickle cell disease such as osteonecrosis and bone infarction are well-documented, data regarding comorbidities of SCT remain limited. Osteonecrosis in SCT patients is infrequent. Thus, diagnosis and treatment are often delayed due to the rarity of the presentation.

Oral: 23

Category: Clinical Vignette

Institution: St. John Hospital and Medical Center - Grosse Pointe

Director: Raymond Hilu, MD, FACP

Presenter: Bassent Botros

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Acquired Hypocupremia: A Rare, but Preventable Neurologic Complication of Bariatric Gastric Bypass Surgery

Copper is a trace mineral and essential cofactor that is absorbed in the stomach and proximal small intestine. Genetic disorders of copper metabolism including Wilsons and Menke's disease are well established. Acquired copper deficiency is rare and associated with zinc supplementation, malabsorptive conditions and gastric surgery. We present a case of acquired copper deficiency 10 years after bariatric surgery.

Case: A 41-year-old female with history of gastric bypass surgery (2006) presented with decubitus ulcer, progressive vision loss, worsening weakness and paresthesia in her extremities. She lost the ability to ambulate over a four month period and is currently bedbound. Physical examination revealed optic nerve pallor concerning for optic neuropathy, quadriparesis suggestive of peripheral neuropathy, decubitus ulcer, areflexia and painful paresthesia in the lower extremities extending to the thighs bilaterally. Decreased vibratory sensation and proprioception were observed. Initial myeloneuropathy work-up revealed normal Folate, Riboflavin and Vitamin B12 levels. MRI of the spine showed small central disc herniation at C4-6 and disc bulging at L4-S1. Further investigation revealed severe copper, zinc and vitamin B6 deficiency. She was started on vitamin B6 and copper replacement.

Discussion: Gastric surgery is associated with neurologic complications due to vitamin and mineral deficiency. 10% of patients who undergo bypass bariatric surgery manifest symptoms of copper deficiency and present with anemia and neurological abnormalities including ataxia, myelopathy, and peripheral neuropathy. Copper supplementation is the treatment of choice. While hematologic complications resolve within months of treatment, neurologic manifestations may persist or require a longer duration of treatment.

Oral: 24

Category: Research

Institution: St. John Hospital and Medical Center - Grosse Pointe

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Additional Authors: Szpunar S., Zein R., Ghannam S., Garg R., Tsao D., Attallah J., Saravolatz L., Kafri Z., Hadid T.

Neutrophil-to-Lymphocyte Ratio and Platelet-to-Lymphocyte Ratio as Predictive Markers for Unprovoked Deep Vein Thrombosis

Neutrophil to lymphocyte ratio (NLR) and platelet to lymphocyte ratio (PLR) are emerging markers for thrombotic disorders. Multiple studies have shown an association between NLR, PLR and thrombus formation. NLR and PLR have not yet been established as markers of unprovoked deep vein thrombosis (DVT).

We conducted a retrospective chart review of 700 patients who presented with lower extremity swelling. Patients who had a diagnosis of DVT confirmed via ultrasound Doppler were analyzed (DVT group) and compared to patients who had a negative one (Control group). NLR and PLR was calculated based on a CBC done on the same day of the Doppler study. NLR ≥ 3.4 is considered positive; PLR ≥ 260 is considered positive. D-dimer was also assessed; values ≥ 500 ng/dl were considered positive.

The sensitivity of NLR was 90.2%, specificity was 80.4%, PPV 82.1% and NPV 89.1%. The sensitivity of PLR was 62.8%, specificity 98.0%, PPV 97.0% and NPV 72.5%. On the other hand, the sensitivity of D-Dimer was 88.2%, specificity 35.3%, PPV 57.7%, NPV 75.0%.

Based on this study, both NLR and PLR are better predictors of the presence or absence of DVT compared to D-Dimer. NLR can be useful to rule-out DVT when it is negative; whereas PLR can be useful in ruling-in DVT when its positive. NLR and PLR ratios offer a new powerful, affordable, simple and readily available tool in the hands of clinicians to help them in the diagnosis of unprovoked DVT.

Oral: 25

Category: Clinical Vignette

Institution: St. John Hospital and Medical Center - Grosse Pointe

Director: Raymond Hilu, MD, FACP

Presenter: Matthew Wilkins

Additional Authors: Matthew Wilkins, M.D., Kyle Wilson, MSIII, Michael Kern, M.D., St. John Hospital and Medical Center, Detroit, Michigan

DRESS: Return of the Three-Week Sulfasalazine Syndrome...

Introduction: Drug Reaction with Eosinophilia and Systemic Symptoms (DRESS) is a medical emergency due to drug-induced hypersensitivity. If not promptly recognized, it carries a mortality rate of 5-10% due to hepatotoxicity. We present a case of Sulfasalazine-induced DRESS presenting as the classic Three-week sulfasalazine syndrome.

Case report: A 21 year-old female with a past medical history significant of ulcerative colitis presented with a one week history of fever, sore throat and rash despite antibiotic therapy. On examination, she was afebrile with facial edema, cervical lymphadenopathy and a diffuse maculopapular rash. Blood work demonstrated leukocytosis and elevated liver enzymes. She denied recent travel, excessive alcohol intake/IVDA or sexual activity. Further history revealed the initiation of sulfasalazine three weeks prior. Despite the discontinuation of sulfasalazine the patients liver function tests worsened. Infectious and autoimmune causes of hepatobiliary pathology were excluded, peripheral smear and CBC with differential demonstrated atypical lymphocytes and eosinophilia. The patient was started on methylprednisolone with improvements of her liver functions and discharged on oral prednisone.

Discussion: Three-week sulfasalazine syndrome is a rare drug-induced hypersensitivity reaction characterized by a pentad of fever, lymphadenopathy, dermatitis, hematological abnormalities and hepatitis around the third week of treatment. Majority of cases can resolve with discontinuation of the drug, however, due to its sepsis-like presentation removal of the offending agent is often delayed. Awareness of this syndrome is prudent not only because it can be fatal, but also its ability to present as a great imitator.

Oral: 26

Category: Clinical Vignette

Institution: St. John Hospital Providence - Southfield

Director: Robert Bloom, MD, FACP

Presenter: Jordan Ciuro

Additional Authors: Adam Forman MD, Leo Reap DO, Susan Lyons MD

Double Expressor Lymphomas are Common, Aggressive and Overlooked

Diffuse large B cell lymphoma (DLBCL) is the most common subtype of non-Hodgkin lymphoma. With advancing molecular diagnostics, two subsets of DLBCL have been identified. Double Hit Lymphoma (DHL) is diagnosed with FISH detection of gene rearrangements. DHL is well described in literature and has a poor prognosis. Double Expressor Lymphoma (DEL) is diagnosed by overexpression of proteins via immunohistochemistry (IHC). DEL is less researched and is also associated with a poor prognosis. Presented is a case of aggressive DEL that could have been undetected had clinical suspicion not been high...

A 59-year-old woman with a history of abdominal aortic aneurysm presented with worsening abdominal pain. Imaging to evaluate her AAA demonstrated diffuse lymphadenopathy suspicious for malignancy. Pending biopsy results, severe dyspnea developed requiring immediate reimaging which displayed substantial progression of extensive adenopathy. Pathology confirmed diagnosis of DLBCL. Initial FISH testing was negative so IHC was requested due to her clinical deterioration, which confirmed DEL. The aggressiveness and poor prognosis of this subtype would have been missed without additional non-standard immunohistochemistry.

DHL and DEL are aggressive subtypes of DLBCL with shorter progression free survival and inferior outcomes with standard chemotherapy. Despite this, testing for these molecular entities is not routine and there is a lack of uniform cut-off for IHC protein expression. This case highlights the importance of standard IHC to assist with treatment decisions. This is a rapidly changing field of study - and improved survival of these patients starts with recognizing them at the time of diagnosis.

Oral: 27

Category: Clinical Vignette

Institution: St. Joseph Mercy - Oakland - Pontiac

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Hyperkalemia: Building a Wall to Keep Pacing Impulses Out

INTRODUCTION:

Changes in cellular membrane potential due to electrolyte imbalance can be life threatening. Severe hyperkalemia may affect a pacemaker's sense and capture mechanisms resulting in adverse consequences.

CASE:

A 67-year-old lady presented to the emergency department with weakness and dyspnea for one day. She had a medical history significant for chronic kidney disease, cardiomyopathy, and placement of a dual chamber pacemaker for symptomatic bradycardia. Recently her physician changes her diuretic from torsemide to metolazone. She also takes digoxin and potassium chloride. On presentation her heart rate was 40 bpm; ECG revealed atrial pacemaker spikes without capture, a wide QRS complex and peaked T-waves. Her serum potassium level was 7.9mEq/L. Calcium gluconate, insulin and glucose, sodium bicarbonate and furosemide were given. After treatment, ECG revealed good atrial and ventricular capture with a baseline rate of 70 bpm, within the parameters of her device. Repeat serum potassium level was 4.9 mEq/L.

DISCUSSION:

Hyperkalemia in patients with cardiac pacemakers may cause dysfunction of these devices by raising the membrane potential above the pacing threshold of the device. This leads to failure in pacemaker's sensing and capturing mechanisms. The likelihood of developing hyperkalemia increases in patients with kidney disease and those who take potassium as a supplement to the use of loop diuretics.

CONCLUSION:

Patients who present with apparent pacemaker failure should be assessed for hyperkalemia. Rapid correction of hyperkalemia in these patients leads to correction of the bradyarrhythmia by restoring normal function to the pacemaker device.

Oral: 28

Category: Clinical Vignette

Institution: St. Mary Mercy Hospital - Livonia

Director: David Steinberger, MD, FACP

Presenter: Fatima Asif

Additional Authors: Faizan Shaikh, Harmesh Naik, James Kruer, Preeti Misra

Virchow's Node, a Trojan Horse

Introduction:

Metastasis to the Virchow's node is usually associated with Gastric malignancies. Only a few cases of prostate cancer metastasized to Virchow's node are reported. Prostate cancer frequently metastasizes to regional lymph nodes and bones. We present a rare case of prostate cancer with an initial presentation of left supra-clavicular lymphadenopathy.

Case Description:

A 59-year-old Caucasian male presented with a neck lump, hematemesis, abdominal pain, and weight loss of 20 pounds. Physical exam was remarkable for palpable left supra-clavicular lymphadenopathy. Labs revealed creatinine of 15.6 . Endoscopy showed bleeding gastric ulcer. Biopsy was unremarkable. CT Abdomen/Pelvis showed multiple hepatic lesions, retroperitoneal lymphadenopathy, obstructive uropathy, enlarged lobular prostate with invasion of bladder, and sclerotic bony lesions. PSA was 128. Biopsy showed prostate adenocarcinoma , Gleason score of 4+5. PSA stain was positive in left supra-clavicular nodes. Patient underwent TURP and was started on Bicalutamide and Goserelin. PSA trended down and metastatic lesions decreased in size. Patient received multiple sequential treatments and is asymptomatic and doing well after 48 months of therapy.

Discussion:

This was a unique case of Virchow's node as an initial presentation of prostate cancer which was at first spuriously suggestive of gastric malignancy. Further investigations led to a diagnosis of prostate cancer. Carcinoma of the prostate can metastasize to left supra-clavicular lymph nodes, however, this has been reported in $\leq 0.5\%$ of cases. Presence of Virchow's node is traditionally associated with very poor prognosis, yet, our patient continues to survive at 48 months.

Oral: 29

Category: CQI/EBM

Institution: St. Mary Mercy Hospital - Livonia

Director: David Steinberger, MD, FACP

Presenter: Utibe Effiong

Additional Authors: David Steinberger, MD; Preeti Misra, MD

Alternatives to Proton Pump Inhibitors for Patients with Past or Current Clostridium Difficile Infection

Introduction: The incidence of Clostridium difficile-associated diarrhea (CDAD) has steadily increased over the past decade and appears to be proportional to increased use of gastric acid suppression therapy (GAST). Our literature appraisal aimed to find alternatives PPIs that may reduce the incidence of recurrent C. difficile infection (rCDI).

Methods: A Pubmed literature search was conducted and 678 articles were reviewed. These included 53 systematic reviews and 38 randomized controlled clinical trials. Two studies, one systematic review and a large ten-year retrospective analysis, were selected for appraisal.

Results: The systematic review was a meta-analysis of 33 studies (n=18,530) which found that the most frequent independent risk factors associated with rCDI were age (RR 1.63; P=.0005), additional antibiotics use (RR 1.76; P<.00001), use of PPIs (RR 1.58; P=.008), renal insufficiency (RR 1.59; P=.007) and previous fluoroquinolones use (RR 1.42; P<.00001). The retrospective analysis found that appropriate indication for GAST was not apparent in majority (69.4%) of study patients with CDAD, the inappropriate use of GAST was more prevalent in medical (86.1%) than on surgical services (13.9%) (P< 0.001) and there were more cases (67.6%) of inappropriate use of GAST in noncritical care than in critical care areas (37.4%) (P< 0.001).

Conclusion: At present, there are no alternatives for GAST that significantly reduce the incidence of rCDI or CDAD. There is an urgent need for practice guidelines on GAST for non-ICU patients given the cost of CDI treatment or readmission and the confounding effects of age, antibiotic use and renal insufficiency.

Oral: 30

Category: CQI/EBM

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Additional Authors: Pranay Korpole, MD

Supine vs Prone Positioning Effect on Mortality in ARDS

Introduction: Acute respiratory distress syndrome (ARDS) has around 45% mortality in severe cases. Various treatment modalities improve oxygenation but only few decrease mortality. Can prone position (PP) in ARDS patients reduce 30 and 60 days mortality when compared to supine position (SP)?

Methods: Pubmed yielded 137 systematic reviews and 7 meta-analyse, 3 published in the last 5 years. A meta-analysis of 9 randomized control trials (2242 patients) was done to help answer this question. Primary outcome was 28-30 day mortality and secondary outcome was ICU mortality, 60 day mortality and 90 day mortality. This meta-analysis revealed that, compared with SP, PP decreased the 28-30-day mortality of ARDS patients with a ratio of partial pressure of arterial oxygen/fraction of inspired oxygen ≤ 100 mmHg ($n = 508$, risk ratio (RR) = 0.71, 95 confidence interval (CI) = 0.57 to 0.89; $P = 0.003$). PP was shown to reduce both 60-day mortality ($n = 518$, RR = 0.82, 95% CI = 0.68 to 0.99; $P = 0.04$) and 90-day mortality ($n = 516$, RR = 0.57, 95% CI = 0.43 to 0.75; $P < 0.0001$) in ARDS patients ventilated with PEEP ≥ 10 cmH₂O. Moreover, PP reduced 28- to 30-day mortality when the PP duration was >12 h/day ($n = 1,067$, RR = 0.73, 95% CI = 0.54 to 0.99; $P = 0.04$).

Conclusion: It was determined that PP improves mortality in patients with severe ARDS and receiving relatively high positive end expiratory pressure (PEEP) levels for prolonged duration.