| Resident | Primary Investigator | Co-Investigators | Project Title | Results and Findings |
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| Zoona Ahmad<br>PGY1 Pharmacy | Jessica Ward | Benjamin Hohlfelder<br>Anthony Zaki, M.D.<br>Chase Donaldson, M.D. | Evaluation of routine post-cardiothoracic surgery bowel care at a major surgical center | Gastrointestinal (GI) complications after cardiac surgery carry risk of significant morbidity and mortality. This research project's objective was to evaluate the safety and efficacy of the current post-cardiac surgery bowel regimen. This was a retrospective, observational cohort study. All adult patients (>18 years or older) who received the post-cardiac surgery orderset between July 2022 and July 2023 were included. Descriptive analyses were performed on all collected data. Of the 3,531 patients screened, 3,457 were analyzed. Common reasons for exclusion include missing data (n=50), no standard bowel regimen doses administered within 48 hours (n=15), and colostomy, ileostomy, or fecal management system (FMS) before surgery (n=9). The incidence of post-operative constipation was 66.1% with a median time to first bowel movement of 86.6 hours. The incidence of post-operative ileus was 3%. On average, 3.31 bowel regimen adjustments were made before the first bowel movement. Overall, there was a high incidence of constipation but a low incidence of post-operative ileus. Multiple adjustments were required before the first bowel movement. The most common intervention was the addition of polyethylene glycol 17 grams daily (82.8%). This study showcased the need for the current orderset to be optimized. Based on these results, we are in the process of changing our current orderset to add polyethylene glycol 17 grams daily to the orderset and increase the senna dose to two tablets twice daily. |
| Kata Bes<br>PGY1 Pharmacy | Benjamin Hohlfelder | Stephanie Ciapala, Maureen Converse | Safety and Effectiveness of continuous infusion neostigmine for post-operative ileus | This was a retrospective chart review conducted at Cleveland Clinic Main Campus evaluating adult patients who underwent lung transplantation between May 1, 2022 to October 31, 2022 (pre-bowel protocol group) and May 1, 2023 to October 31, 2023 (post-bowel protocol group). Fifty patients were evaluated from each group. The primary outcome of this study was the incidence of ileus within 30 days of lung transplant. Ileus was defined as radiographic documentation of ileus on X-ray or CT within 30 days of lung transplantation. The primary outcome of incidence of ileus was not found to be significantly different between groups (27 (54%) vs 35 (70%), RR 1.2; 95% CI [0.9-1.8.] More patients in the pre-group failed to have a bowel movement within 96 hours post-operatively (34% vs. 16%, p = 0.038). The median time to first bowel movement was also longer in the pre-group, 84.1 hours vs. 58.8 hours in the post-group. When evaluating time to radiographic resolution of ileus, 5 patients in the pre-group (19%) experienced treatment failure compared to 0 patients in the post-group (0%), P-value 0.007. In addition, we ran a subgroup analysis within the post-group to determine the difference of time to first bowel movement between patients who did receive continuous infusion neostigmine compared to those who did not. The average time to first bowel movement for patients who received neostigmine was 52.3 hours (19 patients) compared to 63.5 hours (31 patients) in those who did not receive neostigmine. Additionally, there were no significant differences in safety between groups. Further studies are warranted to optimize post-operative bowel care after lung transplant to prevent ileus. |
| Reegan Cotey<br>PGY1 Pharmacy | Jessica Wesolek | Nick Herbst, Matthew Campbell, Gretchen Sacha | Efficacy of 10 units versus 5 units regular insulin for hyperkalemia in the emergency department | This was a retrospective study of a large database of patients with renal dysfunction presenting to Cleveland Clinic Emergency Departments for hyperkalemia. Cleveland Clinic updated their hyperkalemia order set on 12/31/2019 to recommend reduced dose insulin (5 units) for patients with renal dysfunction. There is limited available literature to support this recommendation. 1,966 patients were included, 1247 patients received reduced dose insulin and 719 received standard dose insulin. The primary outcome of this study was hyperkalemia resolution. Patients who received reduced dose insulin demonstrated a 9% decreased likelihood to achieve hyperkalemia resolution compared to standard dose insulin [RR 0.91, 95% CI (0.85-0.97)]. Patients who received reduced dose insulin were 26% more likely to experience hypoglycemia compared to standard dose insulin recipients (RR 1.26, 95% CI 1.16-1.37). There was no difference in severe hypoglycemia between groups. Patients who received reduced dose insulin experienced smaller reductions in their serum potassium compared to patients who received standard dose insulin. he multivariable logistic regression for the primary outcome demonstrated that patients who received reduced dose insulin experienced less resolution of hyperkalemia compared to standard dose insulin after adjustment for eGFR, diabetes, concomitant hyperkalemia medications, initial potassium value and weight [adjusted OR 0.80, 95% CI (0.65 – 0.98)]. Additionally, a second multivariable logistic regression demonstrated no difference in hypoglycemia between reduced and standard dose insulin after adjustment for baseline blood glucose and eGFR [adjusted OR 1.21, 95%CI (0.85 – 1.73)]. In conclusion, standard dose insulin may be more efficacious and safe in patients with renal dysfunction that present to the emergency department for hyperkalemia. |

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| Rachel Dittrich<br>PGY1 Pharmacy | Katie Rivard | Pooja Cerrato, PharmD<br>Gretchen Sacha, PharmD<br>Adam Keating, MD | Meningococcal B Vaccination Rates in Relation to Health Disparities | Meningococcal disease is caused by *Neisseria meningitidis* and serotypes A, B, C, W, X, and Y most commonly cause disease. ACIP recommends vaccination against Meningococcal (MenB) based on a shared clinical decision-making (SCDM) to adolescents and young adults 16-23 years of age when the benefits of vaccination do not outweigh potential harms, including harms related to cost-effectiveness and health equity. In 2018, ACIP reported that only 17.2% of 17-year-olds received at least 1 dose of the MenB vaccine series, and less than 50% completed the series. The purpose of this study is to evaluate the percentage of Cleveland Clinic Northeast Ohio Ambulatory Primary Care patients who were vaccinated with the MenB vaccine before their 24th birthday and to compare characteristics of vaccinated and unvaccinated individuals. This retrospective study included over 6,600 patients who turned 24 years old in the year 2022 and found that only 17.5% of our study population had received at least one dose of the MenB vaccine. The data we have collected regarding vaccination rates will be utilized to influence prescribers to improve MenB vaccination rates within Cleveland Clinic practice in NE Ohio. |
| Sharon Halliburton<br>PGY1 Pharmacy | Katie Rudzik, PharmD | Emily Wings, PharmD<br>Jennifer Hockings, PharmD, PhD<br>Xhilda Xhemali, PharmD | Risk factors for CMV viremia after valganciclovir primary prophylaxis discontinuation in high risk lung transplant recipients | Guidelines recommend 6-12 months of cytomegalovirus (CMV) prophylaxis in CMV donor positive/recipient negative (D+/R-) lung transplant recipients. It is common in practice to continue primary prophylaxis (PP) beyond 12 months due to concerns for delayed onset CMV. A retrospective chart review was conducted to evaluate CMV PP regimens in CMV D+/R- lung transplant recipients. This is a single center, retrospective cohort study with an included case control of CMV D+/R- adult lung transplant recipients between January 1st, 2015 and December 31st, 2020. The primary objective was to describe CMV PP regimens. Key secondary endpoints including time to CMV viremia after PP discontinuation and comparison of patient characteristics between those that developed CMV after PP discontinuation and those that did not. 174 patients were included in the study. 82 patients did not discontinue PP during the three-year post-transplant study period. 44 patients developed CMV viremia while on PP. 48 patients discontinued PP during the study period, with a median PP duration of 536 days [IQR 381.8-658.8]. Of the patients that discontinued PP, 28 developed CMV viremia within 1 year while 20 did not. The median time to CMV viremia was 41 days [IQR 34.8-58.5] following discontinuation of PP. Patients who developed CMV viremia had a shorter median time from transplant to PP discontinuation at 469.5 days [IQR 372-596.5] versus 638 days [IQR 518.5-793] in those who did not develop CMV viremia. The majority of patients did not discontinue PP at three years post-transplant. Of those that discontinued PP, median time from transplant to PP discontinuation was shorter in patients who developed CMV viremia after discontinuation, as compared to those who did not. No other differences were observed between these two groups. Patients who developed CMV viremia within one year of discontinuation were most likely to become viremic within the first two months after discontinuation. Valganciclovir was inappropriately dosed per renal function at time of discontinuation in 50% of patients. Future studies are needed to assess the best time to discontinue CMV PP post-transplant. |
| Jenna Len<br>PGY1 Pharmacy | Jason Yerke | Stephanie Bass, PharmD<br>Jessica Lum, MD<br>Aanchal Kapoor, MD | Evaluation of empiric use of antifungals and outcomes in a medical intensive liver unit (MILU) | A retrospective single center cohort study with a nested case control was conducted at a large academic medical center. Adults (>18 years of age) admitted to the MILU from June 2020-August 2023 with suspected septic shock were included. Additional analyses were conducted comparing those who received empiric antifungal therapy (cases) vs. those who did not (controls).<br>One-hundred seventy-eight (48%) patients were initiated on empiric antifungal treatment. A higher proportion of patients on secondary vasopressors such as epinephrine (21.4% vs 10.5%), vasopressin (79.8% vs 49.5%), and phenylephrine (52.8% vs 27.6% ) were associated with empiric antifungal use ($p<0.001$). Recent antibiotic use (OR 1.72, 95% CI 1.12-2.64), recent endoscopy (OR 1.62, 95% CI 1.02-2.57), presence of central venous catheters (OR 3.37, 95% CI 2.11-5.41), presence of arterial line~~s~~ (OR 2.35, 95% CI 1.48-3.73), and TPN use (OR 5.14, 95% CI 3.00-8.97) were associated with increased odds of empiric antifungal initiation. |

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| Brigid Perry<br>PGY1 Community | Kristel Geyer | Justin Jakab, Amanda Anderson, Brittiny Robinson, Jatinder Gill, Emily McElhaney, Julianne Fallon, Katherine Russel, Ashley Rohrer | Development and Implementation of an Adherence Packaging Referral Protocol for Heart Failure Patients Receiving Sacubitril/Valsartan | This was a quality improvement project to determine the feasibility of a medication-specific workflow protocol for sacubitril/valsartan prescriptions sent to Cleveland Clinic Adherence Pharmacy and Home Delivery. The protocol involved triaging patients to one of the two service lines based on predetermined patient criteria. There were 114 qualifying prescriptions per the protocol, and 98 of those prescriptions had the appropriate note template used in the patient chart, equating to an 86% compliance rate for the primary outcome. Of the 98 patients included in the workflow protocol, prior authorization was completed by pharmacy staff for 41 patients (41.8%), manufacturer co-pay card was applied for 13 patients (13.3%), 17 patients (17.3%) were enrolled in grant funding programs, and patient assistance program enrollment was initiated for 9 patients (9.2%). These results show that medication-specific workflows may be a feasible option to ensure adherence services are offered to patients with high-risk disease states involving treatment with expensive, branded medications. |
| Anthony Angyal<br>PGY1 Community (Specialty) | McKay Herpel | Kristel Geyer, Karla Caruso, Ngoc Vo, Shubha Bhat, Leighton Boquist, McKay Herpel, Amruth Krishnamurthy | Analysis of Hepatitis B Screening with Oral Anticancer Therapy Initiation Within a Large Academic Medical Center Specialty Pharmacy | Patients with a history of hepatitis B virus (HBV) infection are at increased risk for HBV reactivation once initiated on immunosuppressive medication, such as oral anticancer therapy. The American Society of Clinical Oncology (ASCO), National Comprehensive Cancer Network (NCCN), American Association for the Study of Liver Disease, and Center for Disease Control (CDC) have published HBV screening recommendations, advising completion of screening for all patients prior to initiation of anticancer therapy. A retrospective chart review was conducted to assess the percentage of all CCSP patients screened for HBV prior to initiation of oral anticancer therapy. Secondary objectives included the percentage of HBV screening recommendations made by specialty pharmacists prior to initiation of oral anticancer therapy, in compliance with ASCO's recommendations, and the provider acceptance rate for those recommendations. The percentage of all patients starting oral anticancer therapy that tested positive for HBsAg, HBsAb, and HBcAb was assessed along with the percentage of patients initiated on antiviral prophylaxis therapy for chronic HBV. Out of 483 patients, HBV screenings completed on 84 (17.4%). Specialty pharmacists made screening recommendations on 229 of the 399 without screening, and providers accepted the recommendation 73.4% of the time. These interventions have a strong background of support from ASCO, NCCN, and the universal HBV screening recommendations by the CDC. The pharmacist's role is shown to be very impactful in improving quality of care for these oncology patients. |
| Carter Friedt<br>PGY1 Pharmacotherapy | Stephanie Ciapala | Jess Ward, Ben Hohlfelder, Chase Donaldson | Efficacy and Safety of Ketamine for Post-Cardiac Surgery Pain Management | There is conflicting data showing support for ketamine as adjunct pain management, with minimal data specifically in the cardiac surgery patient population. The results of this study will describe the use of ketamine in the post-cardiac surgery patient population and will elucidate the current mixed evidence of ketamine's association with reduced opioid requirements and pain scores in the surgical population. This will be a retrospective review of adult patients 18 years of age or older who were admitted to the cardiovascular intensive care unit after index cardiovascular surgery and have received continuous infusion ketamine within 24 hours after surgery completion. The primary objective of the study is to evaluate the efficacy of ketamine for pain management following cardiac surgery through evaluation of post-operative opioid requirements. Data will be collected retrospectively starting from September 1, 2023 until 100 subjects are collected. The primary outcomes showed a median cumulative morphine milligram equivalents (MME) of 282mg (IQR 78.75 – 653.25). When comparing pain scores pre and post ketamine, median pain scores were higher after the initiation of ketamine (2.0 vs 3.0, $p = 0.22$). There was a higher opioid consumption after ketamine as seen by a pre-ketamine MME of 0 and post-ketamine MME of 232.75 ($p < 0.001$). However, when assessed individually, sixty-five percent of patients had a decrease in their pain scores and fourteen percent had a decrease in morphine equivalents after the initiation of ketamine. The use of continuous infusion ketamine showed a reduction of pain scores but failed to show a reduction in opioid requirements in patients after cardiac surgery. |
| George Chalil<br>PGY1 HSPAL | Anthony Boyd | Mitchell Blewett | Assessment of Automation of JW/JZ Modifiers | |
| Lauren Osadczuk<br>PGY1 HSPAL | Michael Rudoni | Meghan Lehmann, Daniel Lewis | Evaluation of a pharmacist-led dose optimization service | |

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| Maybeth James<br>PGY2 HSPAL | Rachel Carroll | Erin Koepf, Holley Boren, Elizabeth Schlosser (St. Elizabeth Physicians and University of Cincinnati) | Implementing a Process for Technician Driven Medication Adherence STAR Measures Outreach Across a Multi-site Health System | A technician-driven medication adherence outreach process was successfully developed, deployed, and measured in a manner that can be scaled to expand to additional Medicare Advantage payer contracts. Resources and education have been developed to support the addition of dedicated FTE to medication adherence outreach and value-based care efforts. For high impact outreach data across savable patients and the master list, average percentage of high impact outreach was inputted into a process behavior chart. The diabetes measure had the highest average percentage of patients receiving high impact outreach over time (37% of savable patients). Thirty-nine to 41% of master list patients in the diabetes measure received high impact outreach from technicians or navigators respectively. The hypertension measure had, on average, 25% of savable patients documented to receive high impact outreach across time. Thirty-one to 35% of patients on the hypertension master list received high impact outreach from technicians or technicians and navigators respectively. Twenty-nine percent of savable patients in the cholesterol measure received high impact outreach, while 37-39% of patients in the master list received high impact outreach from technicians or technicians and navigators respectively. Spread of high impact outreach was reported for the diabetes measure but patterns remain the same across all three measures. The spread was variable across reporting time periods, due to controllable and uncontrollable factors. Overall, variability due to uncontrolled factors was largely contained due to the early recognition of phone issues and implementation of additional high impact outreach characterizations. |
| Gilnou Pamphile<br>PGY2 HSPAL<br>Large | Jonathan Williams | Tyler Tomasek<br>Jordan Long | Optimization of the Narcotic Reconciliation Process within the Anesthesia Practice | The operating room (OR) provides a unique environment that can be exploited by providers who wish to divert narcotic medications. Atypical transactions such as high use and wastage of controlled substances, mismatched dispense location to administration, transactions on canceled patient cases or late transactions from the automated dispensing cabinet (ADC) typically indicate diversion in a normal hospital nursing unit. Within the Cleveland Clinic (CC) Main Campus OR, anesthesiology providers utilize ADCs and the anesthesia narcotic reconciliation module built into the electronic medical record (EMR) in tandem to procure and document controlled substances administered to patients. Before using the embedded anesthesia module in the EMR, CC anesthesia providers used a homegrown system to document the narcotics used and administered to patients in the OR. In the current anesthesia workflow, patients are profiled into the ADCs where the anesthesia provider can select all medications to be used within the procedure. This study was a retrospective review of narcotic medications used during surgical cases by anesthesia providers in the Heart, Vascular, and Thoracic Institute (HVTI) ORs at the Cleveland Clinic Main Campus from January 1, 2023 to June 30, 2023. The initial data report identified 54,371 contact-type transactions combined into 8401 individual cases. From these cases, 5726 auto-reconciled and 2675 cases remained unreconciled with some kind of discrepancy. Of the 300 cases manually chart reviewed, 158 of these discrepancies could be accounted for due to missing dispense information in the data report extracted from the EMR database. This study provided valuable insights into narcotic medication reconciliation practices within the ORs. Critically, it revealed that human error is not the primary culprit behind narcotic medication discrepancies. The root cause of most unreconciled cases reviewed in this study lies in a lack of understanding regarding data storage within the CC EMR system and most importantly, how to appropriately extract this data. |

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| Minlang (Claire) Lin<br>PGY2 Pharmacotheray - Large | Brad Williams | Sara Ward; Katie Rudzik; Keith Anderson | Safety and efficacy of GLP1 agonists in solid organ transplantation | Type II diabetes is one of the most significant comorbid conditions after solid organ transplant and poorly controlled diabetes is associated with negative effect on graft survival, cardiovascular morbidity, and all-cause mortality. Glucagon-like peptide-1 receptor agonist (GLP-1 RA) is widely used in the general population for management for diabetes but evidence for its use in the transplant population is limited. This single center retrospective matched cohort study included adult patients with type II diabetes who had underwent solid organ transplantation from January 1st, 2020, to May 31st, 2023. Patients with multi-organ transplant, re-transplantation, intestinal or pancreas transplantation, cystic fibrosis and those who were transplanted at an outside hospital were excluded. During the study period, 94 patients were included in the treatment group and 135 in the comparison group. Treatment with GLP-1 RA was associated with significant HgA1c reduction of 0.8% (95% CI 0.5-1.1) at 6 months and reduction of 0.95% (95% CI 0.6-1.35) at 6 months. GLP-1 RA was also associated with reduced routine insulin use and decreased total daily dose of insulin among patients who remain on insulin routinely. Treatment with GLP-1 RA was also associated with significant weight reduction at 6 months that was sustained at 12 months. Graft rejection occurred in 10 (10.6%) patients within treatment group and 23 (17.2%) in the comparison group, among which 8 (80%) and 17 (73.9%) were acute cellular rejection respectively. Median time from transplant to first rejection was 7.9 (IQR 5.2-12.9) months for treatment group and 5 (IQR 1.3-12.6) months for comparison group. Most common side effect of the agent was gastrointestinal toxicity leading to dose reduction or medication discontinuation, occurring in 18 (19.1%) patients with 2 (2.1%) with diagnosis of gastroparesis on gastric emptying study. GLP-1 RA use including dulaglutide and semaglutide is associated with sustained improvement in glycemic control, insulin requirements and weight. The beneficial effect persisted for up to 12 months of follow-up, suggesting it is valuable as a long-term treatment option. |
| Minlang (Claire) Lin<br>PGY2 Pharmacotheray - Small | Nicole Palm | Alyssa Chen, Bethany Mocas | Blood is Not An Option (Jehovah's Witness) Order Set Evaluation | Patients may be unable to receive blood products either based on their religious beliefs, such as Jehovah's Witnesses, or if they have significant autoantibodies and no blood is available. This poses unique challenges for the management of acute anemia, active bleeding, and perioperative care. At our institution, the "Blood is Not an Option" order set was developed with a combination of erythropoiesis-stimulating agents (ESA), intravenous iron supplementation and vitamins to offer treatment options for this patient population. The purpose of this project is to characterize the clinical practice with this order set and evaluate adherence. The order set was used 69 times among 64 patients during the review period. Twenty-five patients were male, 58 were Jehovah's Witness, 50 required ICU admission at order set initiation and 6 were on ECMO awaiting lung transplant. With regards to indication, 30% were for pre-op optimization, 13% for post-op/standard care, 20% for acute major bleeding and 36% for critical anemia. Indication was selected appropriately in 80% of uses, with 57% utilizing default regimen. Common reasons for deviation from standard include hemoglobin >5 and selecting critical anemia, and use for minimally invasive procedures (e.g. line placement). Deviation from order set default was most commonly a difference in ESA dosages. Median doses of non-default orders were 20,000 unit 3 times weekly for epoetin alfa and 100 mcg weekly for darbepoetin alfa. Median hemoglobin prior to order set initiation was 6.1 g/dL (IQR 5.4-7.4). with nadir hemoglobin of 5.4 g/dL (IQR 4.5-6.3) at a median of 2 days after order set initiation. Eleven patients received blood product and 11 separate patients received antifibrinolytics during their admission. No patients received HBOC or PCC. For pre-operative optimization patients, 62% received surgery and 58% subsequently received post-op medications through this order set. For most order set usage, the correct order set indication was selected. Critical anemia had lower adherence compared to the other indications due to not meeting criteria of hemoglobin < 5 g/dL at order set initiation, however the severity of symptoms was not collected. Most deviations from order set default utilized lower doses of ESA. Opportunity exists to incorporate antifibrinolytics into the major bleeding category to align with current practice. |

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| Logan Hunkus<br>PGY2 Ambulatory Care - Large | Diana Isaacs | Kevin Borst, MD, Kevin Malloy, PharmD, Stacey Ehrenberg, MD, Paloma Rodriguez, MD, Neeharika Nandam, MD | A Retrospective Review of Hybrid-Closed Loop Insulin Pump Therapy in Pregnancy | A retrospective review of The Cleveland Clinic Health System electronic health record (EHR) and Tandem software platform (T:Connect) was completed to collect and analyze the primary, secondary, and exploratory objectives with descriptive statistics. A total of 27 index pregnancies that occurred and delivered between January 2020 and December 2023, utilizing Tandem t:slim insulin pump, and managed by Cleveland Clinic Endocrinologists or Endocrine Pharmacy Specialists were included. The mean percentage of time spent in target range two weeks prior to week 12, 24, and 34 was 63.8% (±15), 60.9% (±14), and 59.6% (±16), respectively. The Tandem t:slim X2 insulin pump with Control-IQ is an effective approach to the management of type 1 diabetes in the pregnant population, despite non-parallel findings between the time spent in target range and average glucose compared to observed improvements in hemoglobin A1c, glucose management indicator, and time below range. |
| Rachel Larmer<br>PGY2 Ambulatory Care – Large | Jennifer Hockings | Gina Elder, Alayna Kehr | Impact of Pharmacist Collaborative Practice Agreement on Pharmacogenomic Implementation for Patients Referred from Geriatric Medicine | This retrospective cohort study aimed to describe the effects of a pharmacist-led PGx service for older adults referred from an ambulatory geriatric clinic. This study included adults of age 60 years and older referred by CGM for PGx testing, and excluded patients who did not complete the initial visit. The patient populations pre- and post-CPA were similar with a mean age of 77 years, predominantly female (71%), and white/Caucasian race (83%). Over 90% of patients in the post-CPA period were prescribed a psychotropic medication at time of referral, with the most common belonging to the SSRI or SNRI class (69%). The primary objective was to compare the turnaround times between referral placement and initial visit with the PGx pharmacist before (5/1/2019-10/31/2021) and after (1/1/2022-5/31/2023) CPA implementation and showed a 46% reduction (63.8 vs. 34.5 days, $p<0.05$). The turnaround time from initial visit to results sharing increased slightly by 12% (24.7 vs. 27.6 days, p-=0.03). Low rates of clinical score (GDS, GAD, and PHQ) documentation were observed in the six-month post-test period, which is an opportunity for the department to improve in the future. The rates of patient agreement to pursue testing remained high (99% vs. 98%) as well as the successful completion of testing (100% vs. 93.8%) when comparing the pre- and post-CPA periods. Within six months after PGx results, 29% of potentially inappropriate medications were discontinued. |
| Gabby Lorusso<br>PGY2 Cardiology - Large | Keith Anderson | Stephanie Ciapala; Maureen Converse, Ben Hohlfelder | Safety of midodrine for persistent hypotension after heart transplantation | **Results**: After matching, 92 patients met inclusion criteria. Midodrine use was not associated with an increase in ICU free days at 30 days after adjusting for cardiopulmonary bypass time and administration of angiotensin-converting enzyme inhibitor, angiotensin receptor blocker, or angiotensin receptor blocker/neprilysin inhibitor prior to surgery (17.6 vs 21.1 days; β-coefficient 4.08 [95% CI 0.3-7.9]). Patients who received midodrine also had longer cumulative time on vasopressors (11.1 vs 5.5 days, median difference -5.9 [90% CI -12.1 to 0.31]), with no difference in adverse events or mortality between groups.<br>**Conclusions:** Midodrine did not increase ICU free days in patients who underwent heart transplantation, but its use was not associated with an increase in adverse events or mortality. |
| Gabby Lorusso<br>PGY2 Cardiology – Small | Katie Greenlee | Serena Magni | Colchicine dosing in pericarditis | **Results:** The study included 51 patients. Dose adjustments on initial order occurred in 21 (41.2%) patients, with 7 (33.0%) due to pharmacist intervention. Subsequent dose changes after initial order occurred in 20 (39.2%) patients, with 8 (40.0%) due to pharmacist intervention. The most common reasons for adjustments were decreased renal function in 8 (38.0%) patients and DDIs in 7 (33.3%) patients. Amiodarone was the most adjusted for DDI, occurring in 5 (71.4%) patients. Colchicine was discontinued in 4 (7.8%) patients. Additional safety results are in progress and will be completed February 2024.<br>**Conclusions:** Dose adjustments for colchicine in pericarditis were observed in this analysis. The most common reasons for dose adjustments were reduced renal function and DDIs. Pharmacists intervened on many colchicine orders; however, this study was unable to account for all instances of pharmacist intervention, with the expected number to be higher. With observed dose adjustments, there was a small number of patients that discontinued colchicine. |

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| Emily Wagner<br>PGY2 Critical Care - Large | Heather Torbic | Eduardo Mireles, Gretchen Sacha, RT | Ketamine for acute asthma exacerbation | Results: Of the 135 patients screened, 50 were included for analysis. Patients were 60% female, and the median age was 39 (28-48) years old. The median starting rate of ketamine was 0.7 mg/kg/hr (0.3-1.0), and the median maximum rate was 1.2 mg/kg/hr (0.8-1.5). The median pCO2 before and after ketamine initiation was 63.5 (55-75) mmHg and 64 (56-76) mmHg, respectively (p=0.64). The median pH before and after ketamine initiation was 7.25 (7.14-7.33) and 7.27 (7.18-7.32), respectively (p=0.25). The median set respiratory rate before ketamine was 20 (14-26) breaths/minute and 18 (12-22) breaths/minute after. There were no other significant differences in ventilator settings. Tachycardia occurred in 50% of patients, and hypotension occurred in 40% of patients. The rate of emergence reactions was 14%.<br>Conclusions: Continuous infusion ketamine was not associated with an improvement in pCO2. Ketamine may have utility for SAEs as an adjunctive sedative agent. |
| Emily Wagner<br>PGY2 Critical Care - Small | Stephanie Ciapala | Jack Lukas, Ben Hohlfelder, Mike Militello | Evaluation of Factor Concentrate Utilization in Non-Intracranial Hemorrhage Indications at Cleveland Clinic Main Campus | Factor product concentrate orders for 170 unique patients were evaluated for indications, compliance with restriction criteria, and dose appropriateness. Of the 72 orders for emergent reversal prior to surgery, 48 were for Kcentra (72.3% dosed correctly), 23 were for FEIBA (87% dosed correctly, and 1 was for Humate-P. Of the 37 orders for peri-operative bleeding, 36 were for Kcentra and 1 was for FEIBA. Of the 15 orders for GI bleeds, 5 were for Kcentra (80% dosed correctly), and 10 were for FEIBA (90% dosed correctly). Of the 18 orders for critical site bleeding, 10 were for Kcentra (80% dosed correctly), 7 were for FEIBA (85.7% dosed corectly), and 1 was for Novoseven. Of the 6 orders for hemophilia, 1 was for Novoseven, 4 were for Advate, and 1 was for Eloctate. Of the 20 orders for a factor deficiency, 5 were for Advate, 10 were for Humate-P, 4 were for Vonvendi, and 1 was for Novoseven. There were 170 orders total, and 110 complied with restriction criteria. There were 57 orders that did not comply with restriction criteria, and 3 for which the indication could not be determined. There were 4 orders for Kcentra and 4 for FEIBA that did not meet criteria for emergent surgery. There were 5 orders for Kcentra that did not meet criteria for critical site bleeding. There were 29 Kcentra orders that did not meet criteria for perioperative bleeding. These mostly did not meet criteria due to an inadequate amount of blood products being administered prior to Kcentra. All 15 orders for GI bleeding technically did not meet criteria, as GI is not a listed site that required emergent reversal of anticoagulation. All doses were correct, unless otherwise noted. In summary, the restriction criteria for Kcentra use in emergent surgery and the number and types of blood products required could be clarified. Additionally, the orders for GI bleeding could be further investigated to determine why emergent reversal was deemed necessary. |
| Anis Tai<br>PGY2 EM - Large | Matt Campbell | Janet Wu, Michael Phelan, additional ED pharmacist and lab, ID, and urology physicians | Introduction of Urinalysis with Reflex Culture Orders and Association with Screening and Diagnosis Practices for Urinary Tract Infections in the Emergency Department | A urinalysis (UA) with reflex urine culture was introduced throughout the Cleveland Clinic EDs in October 2022, and a UA would be processed into a urine culture by the laboratory if more than 10 WBC/hpf were present. The primary objective of this retrospective, multicenter, cohort study was to analyze the number of urine culture orders in patients with a negative UA, defined as 10 or less WBC/hpf on the UA. Secondary objectives analyzed the initiation of empiric antibiotics, urine culture orders prior to UA results, UTI-related visits within 7 days, clinically appropriate urine cultures, and incidence of ED pharmacist intervention through the culture callback program. Of the 26685 ED patients with UA orders, 14859 patients were included in the pre- and 11826 were included in the post-implementation groups. 2478 (16.7%) versus 1841(15.6%) patients in pre- and post-implementation groups had abnormal UAs, and 5551 versus 2632 patients were ordered urine cultures in those groups respectively. Urine culture orders despite a negative UA decreased from 30.7% pre-implementation to 9.3% post-implementation (RR 0.3, 95% CI 0.28-0.32). Empiric outpatient antibiotic also decreased from 15.3% to 8.8% respectively between the cohorts (RR 0.57, 95% CI 0.53-0.61). In patients with urine culture orders, 3381 (60.9%) in pre-implementation versus 478 (18.2%) urine cultures were ordered before the availability of UA results (RR 0.30, 95% CI 0.27-0.32). In a random subset of patients with UA and urine culture orders, a 14.8% increase in clinically appropriate urine culture was observed in the post-implementation cohort (RR 1.51, 95% CI 1.12-2.03). Implementation of a UA with reflex culture in the ED was associated with decreased urine culture ordering and processing, decreased empiric antibiotic prescribing, and increased clinical appropriateness of urine cultures. |

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| Anis Tai<br>PGY2 EM - Small | Nick Herbst | Jessica Wesolek | Chlamydia treatment practices in the emergency department | Chlamydia is a highly prevalent STI among patients under 25 and can cause complications like epididymitis, pelvic inflammatory disease, and infertility. Per the CDC 2021 guideline update, doxycycline is the treatment of choice due to literature showing increased treatment failure with azithromycin among the male population. A multicenter, retrospective review of all adult patients with a positive chlamydia test from Northeast Ohio Cleveland Clinic emergency departments was conducted from July 2022 to July 2023. Of the 1459 patients, 901 (61.8%) patients received doxycycline for treatment. A total of 783 (53.7%) patients were treated empirically and 438 (30%) of those patients received azithromycin. Opportunities for improvement exist and will be proposed via provider education and order set optimization to help improve adherence to treatment guidelines. |
| Trate DeVolld<br>PGY2 ID - Large | Janet Wu | Matt Campbell, Hannah Wang (lab), ED provider, ID provider | Impact of STI screening panel on extragenital gonorrhea/chlamydia screening rates in ED patients | To focus on increasing extragenital screenings within Emergency Departments (EDs), the Cleveland Clinic Health System updated an ED STI order panel to include extragenital screening recommendations in April 2023. The purpose of this study was to evaluate the effectiveness of this update. This was a non-interventional, retrospective cohort study to assess extragenital screenings pre- and post- implementation of the updated order panel. All adult patients with any GC/CT test ordered in a Cleveland Clinic ED were included. Tests from locations not fully integrated into the health system's electronic medical record or not utilizing the most current laboratory testing platforms were excluded. The pre-group included patients with tests ordered between January 1, 2023, and March 31, 2023, and the post-group between September 1, 2023, and November 30, 2023. The primary outcome was the difference in the proportion of patients receiving extragenital screenings. A total of 3,373 patients in the pre-group and 3,406 patients in the post-group were included. There were no statistically significant differences in demographics, with the majority of patients tested identifying as Black/African American (68.8%) and using Medicaid as a primary payor (56.3%). Proportions of extragenital screenings were low in both cohorts at 1.6% and 2.1%, respectively. A trend towards an increase in extragenital screening rates in the post-group was noted but did not reach statistical significance (RR: 1.36; 95% CI: 0.96-1.94). No differences in positive GC (5.7% vs 5.8%; P=0.84) or CT (10.1% vs 9.4%; P=0.32) tests were found. Following the implementation of updates, order panel use increased from 85.3% to 89.1% across all provider types (RR: 1.05; 95% CI: 1.03-1.07). Adding extragenital STI screening recommendations into an order panel within the ED of a large academic health system did not significantly increase the proportion of extragenital screenings ordered. Rates of extragenital screenings remain low with or without order panel modifications and additional provider education is needed to appropriately screen and test patients. |
| Trate DeVolld<br>PGY2 ID - Small | Xhilda Xhemali | TBD | Real-World Experience with C. auris | |
| Meleah Collins<br>PGY2 IM - Large | Ramara Walker | Dr. Daniel Rhoads, Dr. Chris Attaway, Andrea Pallotta, ChungYun Kim, Megan Ramsey, Kaitlyn Rivard | Evaluation of the impact of rapid methicillin susceptibility determination on antimicrobial stewardship in respiratory infections caused by Staphylococcus aureus | In May 2022, the Cleveland Clinic Main Campus microbiology laboratory began routine use of the PBP2a antigen test on *Staphylococcus aureus* (SA) isolates from respiratory samples. The aim of this study was to evaluate whether implementation of PBP2a testing resulted in patients with MSSA pneumonia receiving one less day of MRSA-targeted therapy. Of the 23 eligible patients, there were 12 assigned to the pre-group and 11 to the post-group. The median total duration of MRSA-targeted therapy was 35 (19-66) hours in the pre-group and 31 (7-55) hours in the post-group. The median hospital length of stay was 12 (6-13) days in the pre-group and 6 (5-13) days in the post-group. There were 7 readmissions in the pre-group and 3 in the post-group. The remaining secondary outcomes were similar between groups. Episodes of AKI occurred in 3 patients in the pre-group and 2 patients in the post-group, with all having been administered concomitant nephrotoxins, such as piperacillin-tazobactam, diuretics, and/or iodinated radiocontrast. The results of this present study did not demonstrate a 24-hour difference between groups pre and post implementation of PBP2a testing. The lack of a difference seen can be attributed to insufficient sample size and conduction of rapid nasal PCR testing to detect SA, as its high negative predictive value enables even more rapid de-escalation of therapy. Exploration of clinical scenarios in which PBP2a testing on respiratory cultures is most useful is recommended. Additional research is needed to determine whether implementation of PBP2a testing on respiratory samples will yield faster antibiotic de-escalation compared to standard testing. |

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| Meleah Collins<br>PGY2 IM - Small | Allie Brant | Mary Pat Bulfin, Ryan Zabrosky | Evaluation of fentanyl patch prescribing and usage | The goal of this study was to characterize fentanyl patch patterns and assess appropriateness of use in the internal medicine and surgical setting. Previously, the dot phrase used on fentanyl patch orders required verification that the patient is not opioid naive. A new i-vent has gone live that has transitioned to verifying that the patient is opioid tolerant, receiving at least 60 morphine milliequivalents daily for a minimum of 7 days. Of the 158 patients eligible for inclusion, 88.6% met criteria for opioid tolerance. Of the 64 patients being newly started on a fentanyl patch, 72% met criteria. About 11% of patients were documented to have been inappropriately started on a fentanyl patch to manage acute/post-operative pain. 85.4% of patients were started on the appropriate dose based on the oral MME conversion, with the incorrect conversions being an underestimate that was not eventually titrated. Of the 34 patients with inappropriate orders, 33 were new starts. Consult services were following on 25 of these orders, and 16 of these orders were i-vented by pharmacists. There were 22 documented adverse events, such as respiratory depression or excessive sedation, with no deaths (n=4) directly contributable to the fentanyl patch. The most frequent primary services associated with errors were surgery, oncology, and general internal medicine. Potential strategies to rectify the problems identified include pharmacy re-education on the i-vent and updated criteria emphasizing the 7-day component, requiring selection of exposure status and indication within the order with prompts/hard stops if inappropriate selections are made, and prompts for i-vent documentation at the time of order verification. Additionally, naloxone can be considered as a linked order when a fentanyl patch is ordered to increase patient safety. |
| Megan LoFaso James<br>PGY2 Oncology - Large | Matt Brignola | Sowmya Takkelepati, Emily Chheng, Anthony Boyd, Joslyn Rudoni, Maddie Waldron | PD-1 Product Placement at a Large Academic Medical Center | Out of 311 evaluable patients, 95% received pembrolizumab as monotherapy or in combination with chemotherapy. The other 5% of patients received atezolizumab, cemiplimab or nivolumab plus ipilimumab. Eighty-eight percent of patients were treated in accordance with institutional CarePaths. The most common reason for discordance was treatment with ICI monotherapy where combination with chemotherapy would have been indicated (PD-L1 status <50%). Lastly, the cost of ICI therapies was compared utilizing suggested wholesale price (SWP) and showed that nivolumab plus ipilimumab was the most expensive and that the cost per one year of therapy would be the most affected if the entire population were to be switched to or from nivolumab plus ipilimumab. Other transitions would yield no more than an 11% cost difference. |
| Megan LoFaso James<br>PGY2 Oncology - Small | Catie Pierson | Lexi Plutt | Evaluating adherence to serum asparaginase assay protocol in pediatric patients | |
| Aphrodite Palazis<br>PGY2 Oncology - Large | Heena Kurish | Jessi Edwards | Remission Rates at End of Induction with Modified Larson vs. HyperCVAD in Adult Acute Lymphoblastic Leukemia (ALL) patients | In patients with acute lymphoblastic leukemia (ALL), intensive chemotherapy regimens have improved complete remission (CR) rates to 80-90% and long-term survival of 30-40% in all age groups. Despite these improvements, patients can still have measurable residual disease (MRD) after completion of induction chemotherapy. Persistent MRD is a poor prognostic factor and associated with worse relapse-free survival, event-free survival, and overall survival (OS) compared to patients who achieve MRD negativity (MRD-). HyperCVAD and CALGB 19802 are two recommended frontline regimens adult ALL, but it remains unclear which therapy, patient, or disease-state characteristics are associated with MRD- CR. The purpose of this study was to evaluate and compare end of induction MRD- CR rates of HyperCVAD compared to CALGB 19802 chemotherapy regimens in patients with newly diagnosed ALL. This study was a single center, retrospective chart review of adult patients with newly diagnosed ALL who received HyperCVAD or CALGB 19802, induction chemotherapy from January 1, 2014 through August 31, 2023. The primary objective, end of induction MRD- CR rates, was assessed according to National Comprehensive Cancer Network (NCCN) guidelines. Secondary objectives included end of induction overall CR rates, safety outcomes, and identification of patient and disease state characteristics at diagnosis potentially associated with MRD- CR rates. Descriptive and statistical analysis were utilized to analyze results. A total of 78 patients were identified in this retrospective review; 14 patients received HyperCVAD and 64 patients received CALGB 19802. 24 patients (31%) obtained MRD- CR (p=0.10). Of the patients who received HyperCVAD induction, 8 (57.1%) achieved MRD- CR compared to 26.7% (n=16) of patients who received CALGB 19802. Overall CR rates were observed in 73% of the total population with approximately 37% of those patients displaying consistent measurable residual disease positivity (MRD+) at end of induction. Higher incidence of MRD+ CR was observed in patients who received CALGB 19802 induction compared to HyperCVAD (41.7% vs 28.6%). In conclusion, HyperCVAD induction was associated with higher MRD- CR rates compared to CALGB 19802. Both groups had comparable incidence of overall CR. Additionally, we found HyperCVAD was associated with fewer toxicities compared to CALGB 19802. |

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| Aphrodite Palazis<br>PGY2 Oncology - Small | Mikhaila Rice | Josyln Rudoni | Identification and management of hypocalcemia in patients with multiple myeloma receiving denosumab | In patients with newly diagnosed multiple myeloma (MM), up to 80% of patients will develop detectable bone disease which increases the risk of skeletal-related events (SREs). In these patients who present with SREs, mortality increases by 20-40%. The standard of care in managing bone health in these patients includes calcium and vitamin D supplementation, and bone-modifying agents. Denosumab (Xgeva®) is a human monoclonal antibody that binds to and inhibits the interaction between RANK and RANKL pathway responsible for bone resorption via osteoclast activation and bone disease in MM. Given its mechanism of action, common adverse effects to monitor and may affect a patients' treatment include hypocalcemia. The goal of this study was to assess current practices in patients receiving denosumab to determine rates of hypocalcemia, identify gaps in care, and create opportunities for standardization of protocols. This was a single-center, retrospective review chart review of adult patients with a confirmed diagnosis of MM who received denosumab for at least 6 months from January 1, 2018 through January 31, 2023. The primary objective, rates of grade ≥2 hypocalcemia within 6 months as defined via Common Terminology Criteria for Adverse Events (CTCAE). Secondary objectives included time to first hypocalcemia event, admissions for hypocalcemia, and rates of primary versus secondary prophylaxis in patients on calcium and vitamin D supplementation. Descriptive and statistical analysis were utilized to analyze results. 78 patients were identified in this retrospective review. Grade ≥2 hypocalcemia occurred in 36% of all patients. In patients with underlying renal dysfunction (CrCl ≤30 mL/min) or on dialysis, 69% of patients experienced a hypocalcemia event. The median time in days to the first hypocalcemia event was 22.5. 1 (4%) of patients had an admission due to a hypocalcemia event. 49 (63%) of patients started on primary prophylaxis; 13 (81%) of patients with underlying renal dysfunction or dialysis. Of the patients started on primary prophylaxis, 26 (53%) were on calcium ≥ 500 mg + vitamin D ≥ 400 IU daily. Overall, 19 (68%) of patients on primary prophylaxis experienced a hypocalcemia event with 9 (47%) of patients on calcium ≥ 500 mg + vitamin D ≥ 400 IU daily. Secondary prophylaxis was initiated in 6 (21%) of patients who experienced a hypocalcemia event. Denosumab was held in 46% of patients with the majority of cases due to hypocalcemia. Possible interventions include updating Beacon plans to reflect the following; treatment parameter "hold denosumab in patients with corrected calcium < 8 mg/dL prior to treatment", nursing communication "RN to draw calcium and albumin prior to each dose if no results are available in the last 7 days" and "confirm patient is taking calcium and vitamin D supplementation and is on patients medication list. If not, okay to proceed with treatment, but notify provider."; include order for calcium and vitamin D supplementation in the Beacon plan |

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| Andrea Banner<br>PGY2 Pediatrics - Large | Andrea Blum | Nicole Woodrich | Pediatric Epilepsy Outpatient Seizure Rescue Medications | Prolonged seizures are more likely to develop into status epilepticus, seizures lasting greater than 5 minutes. Benzodiazepines are effective first line therapy for the treatment of status epilepticus, but it is imperative that the doses are optimized based on age and weight in the pediatric population. The purpose of this project was to analyze current outpatient seizure rescue prescribing practices of pediatric epilepsy providers to identify opportunities for pharmacist intervention. This was a retrospective chart review of pediatric patients prescribed seizure rescue therapy at Cleveland Clinic Main Campus Pediatric Epilepsy Clinic between July 1, 2020, and July 1, 2022. The primary outcome of this project was the frequency of appropriate weight-based dose at the initial and current orders. Secondary outcomes included the frequency of patients eligible for switch to commercially available intranasal formulations of midazolam or diazepam, the frequency of intranasal, rectal, and buccal formulations, and the frequency of each formulation stratified by age. During the study period, 1192 patients were screened, and 140 unique patients were included. The frequency of inappropriate doses decreased from 39.5% at the initial order to 27.8% at the current order. From the initial to current order, 56% of patients transitioned to a commercially available intranasal product. Patients eligible for transition to a commercially available intranasal product decreased from initial order (53.5%) to current order (40.7%). Rectal diazepam was the most common formulation of the initial orders at 71.4%. In contrast, for the current orders, rectal formulation frequency decreased (32.4%) with a corresponding increase in intranasal formulation (54.5%). The frequency of buccal formulation had a minimal change over time (13-14%). Rectal formulation was the most frequently used in all age groups except for patients 12 years of age and older at both timepoints. When compared to the initial orders, there was an increase in the number of patients in the 6-11 years group that used intranasal formulations (12.2% vs. 38.9%). The frequency of use of intranasal formulations in the ≥12 years group was greater than the frequency of use of rectal formulation in the current orders (42% vs 9%). There was a decrease in use of buccal formulation in all age groups except ages 2-5 years for which there was no change and age ≥12 years for which there was an increase in use. In summary, there was a decrease in inappropriate doses and an increase in the use of commercially available intranasal products from initial to current orders; however, these rates could be improved further. Possible interventions to improve prescribing practices would be directed at the provider level during prescription ordering, such as including a Best Practice Alert (BPA), building order instructions to guide appropriate dosing, or building a dosing algorithm. |
| Andrea Banner<br>PGY2 Pediatrics - Small | Andrea Blum | Erica McDonald | Pediatric Status Epilepticus Protocol and Order Set | The Cleveland Clinic Children's Hospital and regional care centers do not currently have a protocol and associated order set for the treatment of status epilepticus. The absence of a protocol and order set may lead to delay in treatment of status epilepticus, inappropriate choice of medication to treat seizures, and increase risk for selecting the wrong dose when ordering medications in an emergent situation.<br>This project focused on the creation of an internal standardized protocol and order set to be implemented at Cleveland Clinic Main Campus, regional hospitals, Main Campus Emergency Department, and the freestanding Emergency Departments to provide guidance for treating pediatric seizures at any site that may care for a pediatric patient. The protocol was developed by an interdisciplinary team of stakeholders including pharmacists and physicians. The protocol was approved by Main Campus Pediatric Epilepsy and Neurology departments. Information in the protocol included tiered medication recommendations, dosing and infusion guidance, timeline for medication administration, and important information for individual medications. First line medication options included intravenous lorazepam or intranasal/intramuscular midazolam. Second line medication options included levetiracetam, fosphenytoin, and valproate. Third line medication options included lacosamide and phenobarbital in addition to second line options not previously used. Fourth line medication options included continuous infusions of midazolam, pentobarbital, and/or ketamine.<br>Currently, the team is working with healthcare providers in Pharmacy Informatics and the Emergency Department to determine the most effective way to create the order set and facilitate implementation into the hospitals and Emergency Departments. |

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| Pamela Vega Rios<br>PGY2 Pediatrics - Large | Holly Hoffmaster | Chanda Mullen | Evaluation of a lamotrigine calculator for pediatric patients with epilepsy | Lamotrigine is an antiseizure medication that carries a black box warning for serious skin rashes. To avoid the risk of rash, the manufacturer recommends a multiple week, weight-based dose titration dependent on age and concomitant medications. The primary objective of this study was to determine if implementation of a pediatric epilepsy lamotrigine dosing calculator increased prescriber adherence to the recommended titration schedule and improved patient safety. This was retrospective cohort study of pediatric patients with epilepsy started on lamotrigine by a pediatric epilepsy provider. The primary outcome was the proportion of patients with an appropriate new start lamotrigine dosing regimen. The secondary outcome was frequency of rash leading to lamotrigine therapy discontinuation in the first eight weeks of therapy. A total of 104 patients were included with 51 in the pre-calculator implementation group and 53 in the post-group. An appropriate new start lamotrigine regimen was documented for 33 patients (65%) in the pre-calculator group compared to 40 patients (75%) in the post-calculator group (RR 1.17; 95% CI 0.91 – 1.5, p = 0.230). In the post-calculator group, 32 patients (60%) had documented calculator use, of which 29 (91%) had an appropriate regimen (RR 1.4; 95% CI 1.11 – 1.77, p = 0.08). Three patients in the pre-calculator group had a rash that lead to lamotrigine therapy discontinuation compared to 1 patient in the post-calculator group (RR 0.22; 95% CI 0.03 – 1. 45, p = 0.190). When the pediatric epilepsy lamotrigine dosing calculator was utilized, regimens were 40% more likely to match the recommended dose escalation . No differences were observed in the incidence of rash between both cohorts. |
| Pamela Vega Rios<br>PGY2 Pediatrics - Small | Erica McDonald | Casey Moore, Danielle Thomas, Laurel Brown | Pediatric TPN/Electrolyte Guidance | Serum electrolyte abnormalities are serious sequalae of many disease states and can be associated with poor clinical outcomes and pediatric intensive care unit (PICU) admissions. Common electrolyte abnormalities encountered include hypo/hypernatremia, hypo/hyperkalemia, hypomagnesemia, hypo/hypercalcemia, and hypophosphatemia. Electrolyte abnormalities should be corrected to prevent serious adverse events such as arrhythmias, seizures and/or altered mental status. Multiple routes of administration for each electrolyte exist. Electrolytes may be replaced both enterally or intravenously, and the choice can depend on diet status and severity of electrolyte abnormality. In addition, multiple formulations and electrolyte salts will vary for each electrolyte. For example, options to replace serum potassium can include potassium chloride or potassium acetate. Choice of which potassium salt to utilize will depend on other serum electrolytes and patient's diet. There are no current internal guidelines stating the best way to replete and replace each electrolyte. An electrolyte guidance document was created detailing IV electrolyte replacement for the following electrolytes: sodium, potassium, magnesium, calcium, phosphate, and custom fluids. Dosing ranges, administration rates, concentrations and available drug products were included within the document. An anonymous, optional 5-question survey was created and sent to pediatric pharmacists to evaluate satisfaction and offer a chance to provide feedback on the document. |
| Haley Nelson<br>PGY2 SOT - Large | Katie Rudzik | Kushal Naik, Maureen Converse, Ben Hohlfelder | Anti-thymocyte globulin induction versus no induction in adult lung transplant recipients | Data surrounding induction immunosuppression for lung transplant recipients (LTRs) are conflicting; therefore, its impact on rejection, infection, and overall mortality remains unclear. This study aims to evaluate the clinical efficacy and safety of rabbit anti-thymocyte globulin (rATG) versus no induction (NI) for LTRs. A single-center, retrospective analysis of 215 adult LTRs from June 1, 2020 to June 30, 2022 was conducted. The primary outcome was time to first acute cellular rejection (ACR) episode within one year. Key secondary outcomes included incidence of antibody-mediated rejection (AMR), infection and mortality. One hundred ninety (88%) patients met inclusion criteria. Seventy-two (38%) patients received rATG and 118 (62%) patients received NI. Twenty-six patients (36%) in the rATG group experienced at least 1 episode of ACR within 1 year of transplant compared to 80 patients (68%) in the NI group ($p < 0.001$). For secondary outcomes, more patients experienced at least 1 infection in the rATG group (71%) compared to those who received NI (53%), p=0.017. There was no difference in mortality (15% rATG vs 9% NI, p = 0.147) or AMR (17% rATG vs 9% NI, p = 0.132) within 1 year between groups. Patients who received rATG had a lower incidence of ACR compared to NI induction; however, patients were more likely to develop infections. There was no difference in incidence of AMR or mortality between groups within 1 year from transplant. The decision to utilize rATG vs. NI should be patient-specific and determined based on risk factors for infection and rejection. |

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| Haley Nelson<br>PGY2 SOT - Small | Maureen Converse | Katelyn Rudzik, Xhilda Xhemali | Posaconazole and Voriconazole therapeutic drug monitoring in patients on ECMO | Extracorporeal membrane oxygenation (ECMO) may interfere with the pharmacokinetic properties of azole antifungals due to being highly protein bound and lipophilic. There is limited and conflicting data for the management of azole antifungals while patients are on ECMO. Some studies concluded that more patients on ECMO had subtherapeutic azole concentrations compared to those not on ECMO. Other studies concluded that ECMO did not appear to influence azole exposure. At Cleveland clinic, patients are generally given loading doses at the start of ECMO cannulation and are on intravenous therapy until the first therapeutic level after steady state is achieved. This project's goal was to evaluate the effect of ECMO on plasma levels of posaconazole, voriconazole, isavuconazole, and itraconazole. Patients were included if they were adults patients who received posaconazole, voriconazole, or isavuconazole, or itraconazole while on ECMO for ≥ 24 hours from 1/1/19 to 9/1/23. Patients were excluded if they did not have ≥ 1 plasma trough concentration of the included azoles. The primary objective was the incidence of subtherapeutic drug concentrations of posaconazole, voriconazole, isavuconazole, and itraconazole in patients on ECMO. Secondary objectives were time to reach therapeutic levels, time in therapeutic range, and the dosing strategies for posaconazole, voriconazole, isavuconazole, and itraconazole in patients on ECMO. There were 42 patients included in this project with median age of 55 [44-64], 55% female, and 81% underwent a lung transplantation. The majority of patients were on veno-venous ECMO (98%). Regarding the choice of azole, most patients received posaconazole while on ECMO (71%). For the primary outcomes, the incidence of subtherapeutic concentrations while on ECMO occurred in 23 patients (55%). For secondary outcomes, the number of patients requiring a dose change while on ECMO occurred in 17 patients (41%). The median time in therapeutic range while on ECMO was 83% [13-100] and median time to reach therapeutic plasma concentrations while on ECMO 7 days [5-10], however, there were 10 patients who never reached therapeutic plasma concentrations while on ECMO. Based on the results of this project, it was concluded that ECMO may cause lower trough concentrations of azoles. Those with longer durations of ECMO were seen to have lower trough concentrations and higher dosing requirements needed. Strategies, such as loading doses and IV formulations may assist with reaching goal azole trough concentrations while on ECMO. More frequent trough levels may be warranted if assessing therapy while on ECMO. |

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