Hypertonic Saline for the Management of Cerebral Edema and Increased Intracranial Pressure

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Background: All brain injuries, including traumatic, subarachnoid hemorrhage, intracranial hemorrhage, and stroke may be complicated by life-threatening increased intracranial pressure (ICP), cerebral edema, and brain swelling, leading to global ischemia and brain herniation. Hypertonic saline is a hyperosmolar agent commonly used in the management of cerebral edema and increased intracranial pressure (ICP). Although hypertonic saline is often considered an effective treatment, current scientific evidence is not strong enough to provide recommendations on the use, concentration, and method of administration in the adult population. Furthermore, there is concern for potential serious adverse events with the use of hypertonic saline. The purpose of this study is to characterize the role of 3% hypertonic saline and assess the safety of its use at the Cleveland Clinic, which may guide further treatment recommendations.

Objective: 1) To evaluate the change in ICP during 3% hypertonic saline therapy. 2) To evaluate the correlation of serum sodium and ICP. 3) To evaluate the correlation of serum sodium and 3% hypertonic saline therapy 4) To assess the incidence of adverse effects associated with 3% hypertonic saline administration.

Methodology: Retrospective chart review of adult patients admitted to the Neurological Intensive Care Unit or General Neurology, Neurosurgery or Stroke Services at the Cleveland Clinic between June 1, 2006 and December 31, 2008. Patients with an order for 3% hypertonic saline with at least one dose administered with concomitant continuous ICP monitoring were included in the study. Patients were excluded from the study if they were less than 18 years of age or received hypertonic saline for any other indication other than increased ICP or cerebral edema. Collected data included, patient demographics, admitting diagnosis, Glasgow Coma Scale scores, 3% hypertonic saline dose, ICP and CPP values hourly, laboratory data, other interventions use in the management of ICP and cerebral edema, and adverse events associated with hypertonic saline therapy. A Microsoft Access database will be used for data collection. Data were analyzed using descriptive statistical techniques with Microsoft Excel and SPSS. This study was approved by the IRB committee at the Cleveland Clinic.

Results and conclusions: Results to be presented.

References:

Background: Roughly 40% of all annual hospitalizations with a diagnosis of *Staphylococcus aureus* (*S. aureus*) in the US are related to methicillin-resistant *S. aureus* (MRSA)\(^1\). Nasal carriage of *S. aureus* is thought to be a risk factor for subsequent infection\(^2\). To minimize the spread of nosocomial infections, topical antibiotics have been used to eradicate MRSA colonization. Currently, intranasal mupirocin is the agent of choice; however, mupirocin-resistant MRSA strains have emerged\(^3\). A National VA Initiative began on 10/1/07 whereby all patients are screened for MRSA colonization upon admission or discharge from a hospital unit. If MRSA positive, these patients are placed on contact precautions. Mupirocin use and resistance have not been evaluated in the setting of this initiative.

Objectives: To evaluate the overall use of mupirocin since the introduction of the MRSA Initiative and to report the incidence of mupirocin resistance among previously collected *S. aureus* blood cultures.

Methodology: A retrospective chart review was conducted on all patients who received mupirocin from 10/1/06-10/31/08. Data collected include patient demographics, reason for admission, microbiology data, and mupirocin prescription information. To evaluate mupirocin resistance, *S. aureus* isolates will be analyzed at three separate time periods: six months prior to the start of the MRSA initiative (4/1/2007 to 9/30/2007), six months during the initiation (10/1/2007 to 3/31/2008) and six months after the initiation (4/1/2008 to 10/31/2008). Mupirocin resistance will be determined according to CLSI standards. All statistical analyses will be performed using descriptive statistics.

Results and conclusions: A total of 248 patient charts were reviewed. Of these, 291 treatment courses were completed. About 38% of overall mupirocin use was for MRSA nasal decolonization and 58% of the non-nasal use was for wound care. Eighty percent of the intranasal courses did not adhere to current guidelines. Results of mupirocin resistance testing are pending. In conclusion, the majority of intranasal use of mupirocin were not adherent to current recommendations. Areas for improvement and potential cost-saving measures were identified.

References:
Improving Efficiency and Profitability in a Point-of-Care Testing Anticoagulation Clinic by Employing Lean Production Principles

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Background: The Cleveland Clinic Pharmaceutical Care Clinic (PCC) manages the anticoagulation of 2,100 enrolled patients via point-of-care testing (POCT). In 2008, the PCC faced challenges of unfavorable reimbursement, too few available POCT appointment slots, and a need to improve interdepartmental communications among six distinct PCC locations. To address these needs, a Cleveland Clinic productivity specialist suggested that three teams of employees from among the PCC staff and finance personnel utilize Lean Production Principles.

Objective: To improve efficiency and profitability, decrease waste and engage employees to ultimately improve the patient experience.

Methodology: The PCC developed departmental metrics to accurately measure current efficiency. A value stream map was then created to identify inefficient processes. Three teams, each consisting of 2 to 8 staff members and a productivity specialist, evaluated best practices, staff and schedule utilization and new patient education. Each team met at regular weekly intervals (FasTrac©) or in day-long sessions (Kaizen method) to outline specific goals and recommendations. Approval of team recommendations occurred no later than October 2008. After implementing approved recommendations, the teams have continuously monitored follow-up metrics.

Results and conclusions: Measurable outcomes include a 36% increase in available appointment slots, 20% reduction in appointment no-shows and cancellations and greater than 15% increase in quarterly revenue. In addition, time from receipt of referral to first contact with patient decreased 64%. Lean Production principles were successfully applied to improve efficiency and profitability in a point-of-care testing anticoagulation clinic.
Impact of a Pharmacy Resident at a Large Academic Medical Center

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Background:
There have been a multitude of studies demonstrating the benefit of clinical pharmacy services. But, there is very little literature regarding pharmaceutical care provided specifically by pharmacy residents. Also there is little published data dealing with the financial impact of pharmacy residents.

Objective:
The primary objective was to assess the financial impact of pharmacy resident positions and to describe the role of the pharmacy resident. Secondarily, to examine physician evaluation of pharmacy residents as members of the medical care team.

Methodology:
In a four month, prospective, observational study the activities and interventions of one resident were followed. All interventions were assigned a direct cost savings value or cost avoidance value based on the type of intervention. Interventions classified as cost saving interventions were assigned a value based on direct drug expense. Interventions classified as potentially preventing an ADE were evaluated based on the cost of an ADE and the probability of ADE occurrence if the intervention had not been made. All interventions were logged in the pharmacy intervention tracking system and classified by type. To determine the financial impact of the pharmacy resident position, the benefits were compared with the costs. Benefits included cost avoidance and cost savings coupled with any reimbursement from Medicare, while the costs included resident stipend, benefits, and the costs of the preparation and teaching time by preceptors. To further establish the role of the pharmacy resident, the number of drug information requests and any inservices given were tallied. An estimate of teaching time by preceptors is also included. Surveys evaluating the resident and the value of having a pharmacy resident on rounds were administered to members of each medical team the resident worked with.

Results and conclusions:
When accounting for all costs and benefits of the pharmacy residency program, for one resident, the program had a positive financial impact of $52,664 for the four month study period. This extrapolates to a one year financial benefit of $167,465. The results of the survey administered were positive, favoring including a pharmacy resident on rounds. In addition the pharmacy resident provided pharmaceutical care to an average of 15 patients a day, answered drug information questions, and provided educational inservices for the pharmacy department.

References:
Clinical Impact of Temporary Therapy Interruptions on Anticoagulation Control

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**Background:** Warfarin is the most commonly prescribed anticoagulant in the world. Many variables affect anticoagulation control with warfarin and most of these are well described in the literature. One variable that is not well described, but may affect anticoagulation control, is a temporary interruption in warfarin therapy. It is important to explore this variable’s effect as it is estimated that 250,000 patients per year require a temporary therapy interruption.

**Objective:** To describe the clinical impact of temporary therapy interruptions on anticoagulation control in patients receiving warfarin.

**Methodology:** Retrospective chart review of patients seen at the Internal Medicine Center of Akron Anticoagulation Clinic from 2002 through 2008. Patients were included if they were maintained on a stable dose of warfarin and underwent a planned interruption in therapy. Patients were excluded if they received vitamin K or were started on medications known to interact with warfarin during the interruption. Data was analyzed for patients with a single interruption and also patients with an extended interruption. The primary endpoint was change from weekly pre-interruption stable maintenance dose to weekly post-interruption stable maintenance dose of warfarin. Secondary endpoints included: time to reach a therapeutic INR post-interruption; number of clinic visits, dose adjustments, and time to reach a stable dose post-interruption; and direct financial costs associated with reaching a stable dose post-interruption.

**Results and conclusions:** This study evaluated 199 patients for a total of 31 interruptions in the single interruption group and 34 interruptions in the extended interruption group. In the single interruption group, 58% of patients required a dose change with a mean absolute change in dose from baseline of 2.03mg ± 2.79 (p<0.003). In the extended interruption group, 56% of patients required a dose change with a mean absolute change in dose from baseline of 1.96mg ± 2.72 (p<0.002). Of patients needing a dose change, 50% required an increase in dose and the majority of patients required <10% dose change.

**References:**

Intravenous Levetiracetam Drug Use Evaluation

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Background: Levetiracetam is approved for use by the FDA as adjunctive therapy for treatment of partial onset, myoclonic and generalized tonic-clonic seizures. Although not indicated for treatment of status epilepticus, retrospective case series support the use of oral and intravenous (IV) levetiracetam to stop seizure activity or reduce seizure frequency as adjunctive therapy in refractory non-convulsive status epilepticus. Levetiracetam has several advantages over other antiepileptic medications, including fewer drug interactions, simplified dosing, rapid titration and no requirement for therapeutic drug monitoring. Oral levetiracetam is 100% bioavailable with rapid absorption and peak plasma levels achieved within 1 hour of administration. A bioequivalent IV formulation was later introduced for patients unable to take levetiracetam by mouth. There has been a trend towards increased use of IV levetiracetam at our institution associated with a significant increase in annual drug cost. The oral and IV dosage forms of levetiracetam have similar bioavailability and effects on treating seizures, thus the oral form is preferred whenever feasible. Use of IV levetiracetam is limited to Neurology and Neurosurgery departments for patients with acute seizures or status epilepticus that are unable to receive oral medications. By evaluating current use of levetiracetam at our institution and comparing this use to formulary restrictions currently in place, we may be able to identify ways to improve physician prescribing patterns for this medication.

Objective: Primary Objective: To characterize the use of IV levetiracetam in adult patients and determine if current Cleveland Clinic restrictions are being followed.
Secondary Objective: To evaluate potential cost savings of using oral levetiracetam when feasible as an alternative to IV levetiracetam.

Methodology: Retrospective chart review of IV levetiracetam use over five months at the Cleveland Clinic. Inclusion criteria for the study include age ≥ 18 years and administration of at least one dose of IV levetiracetam between July to November 2008. There are no exclusion criteria for this study. Eligible patients were identified via a billing report for this time period, and data was collected from EPIC, the integrated electronic medical record. Data collected included demographic information, primary service, Department of Neurology and Neurosurgery consultations, indication for use, dosage and duration of IV levetiracetam use, use of loading dose or home doses of levetiracetam, and if patients had an oral diet or were receiving medications orally or via a feeding tube. Descriptive statistics were used with a cost-minimization analysis to compare oral to IV levetiracetam use in cases where oral levetiracetam may have been given.

Results and conclusions: Of 179 subjects identified, 100 charts were reviewed and 99 included in analyses. IV levetiracetam was used after Neurology or Neurosurgery consults in 94% of cases, with Neuroscience providers most likely the primary service for patients receiving this medication. Documented seizures were only noted for 47 of 99 patients, three of which had suspected status epilepticus. Patients receiving IV levetiracetam were unable to take medications orally or via feeding tube only 20% of total days of use. Improved enforcement of restrictions on IV levetiracetam use represents a significant potential cost savings.

References:
Memantine as a Neuroprotective Agent in Ischemic Stroke

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Background: Stroke is the leading cause of serious, long-term disability in the United States. Half of patients suffer functional decline. Through its non-competitive antagonism at the N-methyl-D-aspartate (NMDA) receptor, memantine has been shown in animal models to protect against neuronal cell death, and ultimately improve functional outcomes.

Objective: Therefore, the aim of this study was to evaluate the relationship between the use of memantine and functional outcomes in adult patients admitted to the hospital with a diagnosis of ischemic stroke.

Methodology: A retrospective chart review was conducted to evaluate the relationship between the use of memantine and National Institute of Health Stroke Scale (NIHSS), Rankin, and Barthel Index scores. Cases were those patients on memantine prior to admission who had an ischemic stroke. The primary outcome was to determine whether there was at least a ten percent decrease in NIHSS scores from admission to discharge. Secondary outcomes assessed the change in Rankin and Barthel Index scores from admission to discharge.

Results and conclusions: A total of 175 patients were evaluated. A sub-analysis of 139 patients who did not receive a thrombolytic was done as well. Demographic data showed no significant differences between cases and controls except for age and living arrangement prior to admission. Case patients were more likely to live in a nursing home or assisted living facility. Comorbidities were not significantly different between groups except in the following instances: cases were more likely to have dementia and depression, and controls were more likely to use alcohol and tobacco. Significantly more cases received a thrombolytic. Although the primary outcome was not statistically significant, change in Barthel Index and Rankin scores, and NIHSS score on admission and discharge were significantly different between cases and controls. Cases were more likely to have a lower NIHSS score on admission and a score of less than five. Case patients also spent significantly less time in the hospital. These results signify that cases had better functional outcomes post-ischemic stroke, and may indicate less neurological deficits, serious functional decline, and risk of long-term disability. Quicker recovery time, regaining functional capacity, and improved quality of life may be clinically significant in memantine treated patients. Less time spent in the hospital should allow for lower healthcare costs as well. Although the information presented in this study is not currently applicable to medical practice, the study may help to justify the need for memantine to be studied in a randomized, placebo-controlled, double-blind, prospective manner in patients at risk of ischemic stroke.

References:


Parsons CG, Danyasz W, Quack G. Memantine is a clinically well tolerated N-methyl-D-aspartate (NMDA) receptor antagonist – a review of preclinical data. *Neuropharmacology*, 1999;38:735-67.


Fluoroquinolone Prophylaxis in Adult Acute Myeloid Leukemia (AML) Patients Undergoing Consolidation Chemotherapy

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Background 1-3: Patients who receive myelosuppressive chemotherapy are at high risk for neutropenic fever, which requires hospitalization and intravenous antibiotics. Current literature and recommendations on bacterial prophylaxis in this patient population are conflicting. The hematology/oncology physicians at the Cleveland Clinic have been prescribing bacterial prophylaxis to acute myeloid leukemia patients in consolidation phase treatment for approximately four years. This study has been designed to evaluate rates of hospital admissions due to neutropenic fever before and after the initiation of bacterial prophylaxis with fluoroquinolones at the Cleveland Clinic.

Primary Objective: Determine the rate of hospital admissions due to neutropenic fever in patients who received bacterial prophylaxis compared to those who did not receive prophylaxis.

Methodology: This study was conducted by a non-interventional, retrospective chart review using the electronic medical record. Patients were included if they meet the following criteria: a diagnosis of AML between 1/1997-12/2008, age $\geq 18$, complete remission after induction chemotherapy, and received HDAC chemotherapy regimen (6 doses) for consolidation phase treatment. Patients were excluded if they were not discharged from the hospital after consolidation chemotherapy or if they were receiving antibacterial prophylaxis with any antibiotic other than a fluoroquinolone. The following data was collected from the patients medical record: age, gender, diagnosis, previous chemotherapy, receiving prophylaxis, drug used for prophylaxis, dose and frequency of drug used, allergy to fluoroquinolone, readmission during neutropenia with $T_{\text{max}} > 38^\circ\text{C}$, day of cycle patient readmitted, ANC (from admission to discharge), hospital length of stay, adverse reactions to prophylaxis, indwelling central line, colony stimulating factor administration. Study data was entered into a Microsoft Access database and analyzed with descriptive statistics for the primary and secondary outcomes.

Results and Conclusions: Patients receiving fluoroquinolone prophylaxis had a 31% absolute reduction in hospital admissions due to neutropenic fever compared to the historical control group (50.7% vs 84%; $p<0.001$). Patients in the treatment group also had a shorter average hospital length of stay compared to the control group (7.9 days vs 10.5 days; $p=0.007$) and fewer hospital days per chemotherapy cycle (4.2 days vs 8.9 days; $p<0.001$). There were no significant differences in the number of hospital admissions between patients who received ciprofloxacin compared to levofloxacin (52.1% vs 52%; $p=0.998$).

Microbiology outcomes demonstrated a 19% reduction in the incidence of blood stream infections in the treatment group compared to the control group (23% vs 42%; $p=0.009$), however patients receiving fluoroquinolones had a statistical significant increase in developing resistant gram-negative and gram-positive infections.

References:

Impact of Pharmacist-Based Discharge Medication Counseling on Hospital Readmission Rates in General Medicine Patients

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Background: Nearly 30% of hospital admissions are due to drug-related morbidity, and approximately half of these could have been prevented with improved patient education.\(^1\)\(^2\) Patient education prior to discharge improved medication knowledge, increased compliance, decreased hospital readmissions, and decreased unplanned doctor visits.\(^3\)\(^4\) Pharmacist-led education improved drug regimens, increased patient knowledge, and improved medication compliance.\(^3\) The effect of pharmacist-based education on the rate of hospital readmission has not been elucidated. We hypothesize that a pharmacist-based discharge medication counseling program will decrease 30-day hospital readmission rates by 10%.

Objective: To assess the impact of pharmacist-based discharge medication counseling program on 30-day hospital readmission rates. Medication knowledge and patient satisfaction scores were assessed as secondary endpoints.

Methodology: This was a single center, prospective, randomized, un-blinded study designed to assess the impact of pharmacist-based discharge medication counseling on hospital readmission rates. The primary endpoint was to demonstrate a 10% change in readmission rate. The control group received nurse-based discharge counseling. The study group was educated by a pharmacist regarding their medications and disease states upon discharge. Readmission rate was determined using the My Practice®/EPIC computer system. Secondary endpoints, including medication knowledge and patient satisfaction, were assessed during a 30-day follow-up phone call using standard questionnaires. The primary endpoint was analyzed by the Chi square test. Secondary endpoints and baseline demographics were analyzed using Wilcoxon rank sum, Chi square, and t-tests.

Results and Conclusions: Data collection is currently ongoing. Sixty patients have been recruited for the study and 53 have completed the study (7 drop-outs due to follow-up phone call). Patients were predominantly female (71.7%) and Caucasian (81.1%) with an average of 8 comorbidities. The average age of the patients was 66.2 years old. Three patients were readmitted in the treatment group (n = 28 patients) and 7 were readmitted in the control group (n = 25). This result was not statistically significant (p = 0.162) but may indicate a positive trend towards decreased readmission rates with pharmacist discharge counseling. Patients in the treatment group had higher medication knowledge scores (27.5 out of 30 possible points versus 25.2, treatment and control groups respectively; p < 0.001) and satisfaction scores (5.7 out of 6 points versus 4.3, treatment and control groups respectively; p < 0.001). Both of these results were statistically significant and validated the previous literature. Final results and conclusions will be reported after data collection is completed.

References
Impact of a Clinical Pharmacist on Emergency Medicine Services

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Background: Medication safety in the emergency department (ED) is a unique challenge due to the high prevalence of verbal orders, predominante use of intravenous medications, and incomplete patient records that are associated with a higher risk of adverse events. Despite these risks, currently less than 4% of EDs have consistent pharmacist involvement in patient care.

Objective: To design, implement and assess the impact of an emergency medicine clinical pharmacist pilot program on optimizing medication safety and efficacy and minimizing healthcare costs at St Elizabeth Health Center.

Methodology: This study was conducted as a prospective evaluation of clinical pharmacy services provided to patients in the ED of St. Elizabeth Health Center during the month of January 2009. A pharmacy resident was present in the ED during the peak hours of patient admissions to perform medication reconciliation and provide clinical pharmacy services to improve the safety and efficacy of drug therapy. Pharmacist performed medication reconciliation was compared to ED staff medication reconciliation for discrepancies (accuracy and/or completeness). The primary outcome is the number of medication reconciliation discrepancies avoided when performed by a pharmacist in the ED. Secondary outcomes include number and category of pharmacist interventions, recommendation acceptance rate, adverse drug events reported and prevented, cost savings, and the ED’s perception of the value of an emergency medicine pharmacist. Physicians and nursing staff completed a survey before and after the pilot study to evaluate the perceived value of a clinical pharmacist in the ED.

Results and conclusions: Medication reconciliation was completed on 71 patients with a total of 802 discrepancies avoided by the pharmacist. Avoided discrepancies included: 95 omitted medications, 8 extra medications, 213 omitted doses, 221 omitted frequencies, 243 omitted routes, 4 wrong medications, 6 wrong dosage forms, 3 wrong doses, and 9 omitted allergies. The pharmacist’s intervention recommendation acceptance rate was 97 percent. The top four interventions by number were drug information, initial antibiotic choice, initial dose calculation, and medication reconciliation, respectively. Total cost savings for the month was $21,495. The perceived value of pharmacy services in the emergency department had improved according to the post survey. Presence of a clinical pharmacist in the ED improved the accuracy and completeness of drug and allergy documentation during the medication reconciliation process. Pharmacy presence in the ED promoted safe medication use with an associated cost savings.

References:
Comparison of Intramuscular Antipsychotic Medication: Impact on Length of Stay, Total Utilization, and Cost Analysis

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**Background:** For non-cooperative patients, treatment with a short-acting intramuscular (SAIM) antipsychotic may be utilized for rapid stabilization of acute agitation. Currently there is a lack of data that directly addresses the impact of acute agitation stabilization on length of stay. Retrospective studies have made general assessments about length of stay in patients receiving SAIM antipsychotics without differentiating between specific agents. In one study, early use of SAIM antipsychotics led to a more rapid stabilization of acute symptoms, reduced hospital resource utilization, and decreased length of stay. In another study, a greater average length of stay was observed in hospitalized patients with schizophrenia or schizoaffective disorder initially treated with SAIM antipsychotics.

**Objective:** To determine if there is an association between specific SAIM antipsychotics used for acute agitation and length of stay.

**Methodology:** This study is a retrospective chart review. Patients with a diagnosis of schizophrenia and schizoaffective disorder admitted to psychiatric units between January 1, 2006 and December 31, 2007 at Akron General Medical Center who were billed for at least one dose of a SAIM antipsychotic were evaluated. Patients were placed in one of four groups based on initial SAIM antipsychotic received. Patient demographic information including age, weight, and sex were collected. Also, select co-morbidities, schizophrenia subtype, admitting Global Assessment of Functioning score, adjunct psychiatric medications, admission source, and disposition were collected. Each patient meeting inclusion/exclusion criteria were assessed for total length of stay and SAIM antipsychotic length of stay. Mean length of stay and SAIM length of stay between the haloperidol group versus other SAIM antipsychotic groups were analyzed with a 2 sample t-test. Average length of stay, SAIM length of stay across all groups, drug utilization, and cost were analyzed with descriptive statistics.

**Results:** There were 136 patients enrolled in this study. It was found when comparing the haloperidol group (n=49) to the SGA group (n=87), there was no statistically significant difference between groups, 16.98 ± 9.56 days versus 17.59 ± 11.52 days (p=0.75), respectively. This was also true when looking at SAIM antipsychotic length of stay. There was a statistically significant difference in both cost and number of injections, which favored the haloperidol group.

**Conclusions:** Patient specific characteristics should be evaluated when determining which agent to use to treat acute agitation. However, since we do know each agent is not inferior to haloperidol, other factors should also be evaluated; including impact on length of stay, impact on utilization of hospital resources, and cost. Finding no difference in length of stay, this study indicates that haloperidol is an appropriate choice for the treatment of acute agitation.

**References:**
- Marder SR. A review of agitation in mental illness: treatment guidelines and current therapies.
Evaluation of Medication Reconciliation at the Time of Progressive Care Unit Admission and Discharge

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Background: Each year 1.5 million Americans suffer injuries related to medication errors.1 In accordance with Joint Commission National Patient Safety Goal #8, hospitals across the country have implemented medication reconciliation systems to minimize the impact of medication errors.2 At the Louis Stokes Cleveland Veterans Affairs Medical Center (LSCVAMC), a new pharmacist-driven medication reconciliation program began in August 2008.

Objective: To determine whether the creation of a position for a Progressive Care Unit (PCU) medication reconciliation clinical pharmacist has enhanced the medication reconciliation process on admission and discharge.

Methodology: Retrospective chart review to compare patients who did or did not have medication reconciliation completed by the PCU pharmacist on admission. To qualify for the study, patients had to be over 18 years of age, admitted to the PCU from August 1, 2008 to October 31, 2008 and spend at least 24 hours inpatient. Patients were excluded if they were not taking any outpatient medications on admission, used a different VAMC as their primary site for medical care or were admitted from or discharged to a nursing home. This study was approved by the LSCVAMC Institutional Review Board.

Results and conclusions: Of the 66 patients who were seen by the PCU pharmacist on admission, 51 met the inclusion criteria. The PCU pharmacist identified 132 discrepancies in 44 of these patients or an average of 3 discrepancies per patient. Obsolete orders identified by the PCU pharmacist accounted for 43 discrepancies in 21 patients. Other common types of discrepancies included errors of omission, therapeutic duplications and reported changes in allergies. On average, the number of active prescriptions increased from 15.4 on admission to 16.1 on discharge. Overall, the PCU pharmacist identified discrepancies in 86% of patients, with the most common type of error involving inappropriate continuation of obsolete orders.

References:
**Effectiveness of Hemoglobin A1c Monitoring in Patients with Schizophrenia Treated with Atypical Antipsychotics**

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Background: The prevalence of diabetes has been estimated to be 1.5-2 times higher among individuals with schizophrenia than in the general population. Lifestyle factors including poor diet, lack of exercise, and obesity have been shown to contribute to this problem. In addition, the use of second generation atypical antipsychotic medications has been linked to the development of metabolic side effects. The incidence of new onset glucose abnormalities, including diabetes, has been shown to increase significantly in the first three months after starting or switching to a second generation atypical antipsychotic medication. At the Louis Stokes Veterans Affairs Medical Center a new clinical order reminder to monitor hemoglobin A1c in patients receiving atypical antipsychotics was recently implemented.

Objective: To evaluate the effectiveness of the hemoglobin A1c clinical order reminder in the monitoring of patients with schizophrenia taking atypical antipsychotics and to characterize interventions aimed at attaining hemoglobin A1c goals.

Methodology: Retrospective chart review of patients age 18-99 years, diagnosed with schizophrenia, who have filled a prescription for an atypical antipsychotic in the time period after the new clinical order reminder was implemented will be included in this study. Patients who did not have a hemoglobin A1c measured will be excluded. The following data will be collected: age, gender, weight, presence of diabetes diagnosis, number and type of antidiabetic medications, name of atypical antipsychotic. For patients with a hemoglobin A1c elevation interventions aimed at improving glucose control will be recorded. Descriptive data analysis will include the assessment of demographic data and the type and frequency of interventions aimed at addressing an elevated hemoglobin A1c. This study was reviewed by the IRB.

Results and conclusions: Three patients met study criteria as approved by the IRB. Modification of protocol submitted to IRB to generate larger sample size.

References:
Risk of acetaminophen toxicity in hospitalized patients

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Background: Acetaminophen (APAP) has been used as an antipyretic and analgesic agent for many decades and is considered safe at recommended therapeutic doses. APAP is found in countless combination products and can lead to hepatotoxicity, particularly if taken in amounts greater than 4 grams daily. In 2003, an Institute for Safe Medication Practices report revealed that among 307 unintentional APAP overdoses, 25 percent of these patients were taking more than one APAP-containing product. This report also cited findings in one hospital in which an average of one patient daily was exceeding the 4 gram per day limit despite a printed warning not to exceed 4 grams of APAP in a 24-hour period on all APAP-containing orders. Many patients admitted to our hospital have more than one order containing APAP on their medication profile. The purpose of our study was to evaluate the total possible APAP daily in hospitalized patients. Additionally, if patients did receive more than 4 grams of APAP daily, liver test results were assessed in these patients.

Objective: To determine the number of orders written which would have potentially allowed for more than 4 grams daily of APAP to be administered and to determine the number of patients who received more than 4 grams of APAP in one day during their hospital stay.

Methodology: This retrospective chart review included all adult patients admitted to the Cleveland Clinic between June 1 and June 30, 2008 who received at least one dose of an APAP-containing product. Of the patients who received one dose, a 10% sample was evaluated for the presence of multiple APAP-containing orders which would potentially allow for more than 4 grams of APAP per day. The following data were collected: age, gender, length of stay, admission diagnosis, admission service, orders containing APAP, including indication and frequency, duration of the medication order, total grams of APAP possible per day and total amount of APAP received. In patients who received more than 4 grams of APAP in one day during their hospital stay, liver enzyme test results and risk factors for toxicity were collected. Descriptive statistical analysis of the data was performed. This study was approved by the Institutional Review Board through the Medical Records Review Process.

Results and conclusions: A total of 2,698 patients were identified to have received at least one dose of an APAP-containing product during the month of June 2008. Among patients in the sample group (n=270) that were evaluated, 83.3% of this group who received at least one dose of an APAP-containing product had the potential to receive more than 4 grams of APAP during at least one day of their hospital stay. Of those patients who received at least one dose of an APAP-containing product during their hospital stay, 0.41% (11/2698) received more than 4 grams of APAP. None of the patients, in which liver enzyme tests were ordered, had elevation of their liver enzyme tests or risk factors for APAP toxicity noted during their hospital stay. Although many patients have the potential for administration of more than 4 grams of APAP per day during their hospital stay, very few patients are exceeding the recommended daily limit.

References:
Impact of *Candida albicans* Peptide Nucleic Acid Hybridization (PNA FISH) on Antifungal Usage at Cleveland Clinic

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**Background:** Yeast has emerged as a significant cause of nosocomial bloodstream infections (BSIs). *Candida albicans* is the most frequently isolated organism in patients with candidemia, however there has been an increase in non-*albicans* species. Empiric therapy is often started in patients in whom blood cultures reveal yeast or if there is a high suspicion of fungemia. The antifungal of choice for empiric therapy often depends on the clinical status, co-morbid conditions, and prior history. Choices of antifungal therapy range from broad spectrum agents (i.e. amphotericin B or micafungin) to agents with a narrower spectrum of activity (i.e. fluconazole). Standard laboratory identification of some *Candida* species could take greater than five days. Therefore, the microbiology laboratory at Cleveland Clinic implemented the use of a Peptide Nucleic Acid Fluorescence In Situ Hybridization (PNA FISH), which can rapidly (< 3 hours) differentiate *albicans* from non-*albicans* species. Rapid identification of *Candida* species can decrease the time to de-escalation of therapy or result in the quicker initiation of targeted therapy, thereby improving patient outcomes and potentially provide healthcare savings.

**Objective:** This study determined the impact of PNA FISH on time to de-escalation of therapy and the initiation of targeted therapy in patients with candidemia. Further assessment of an expanded PNA FISH platform was conducted to predict any additional benefits on antifungal utilization.

**Methodology:** A retrospective chart review of all candidemic patients between January 2007 and May 2008 was performed. Patients included were 18 years of age or older and had at least one positive *Candida* blood culture. Data collected included: demographics, admission and discharge dates, medical conditions, culture results, initial antifungal agent, time of initiation of therapy, start and stop dates of antifungals, and rationale for therapy changes. This data was entered into a Microsoft Access database and analyzed using descriptive statistics. The study has been IRB approved.

**Preliminary Results and Conclusions:** Eighty-six episodes of candidemia occurred in eighty patients. More than 70% of the candidemic episodes were due to *C. albicans* and *C. glabrata* (39% and 34%, respectively). Other species included *C. parapsilosis* (13%), *C. tropicalis* (6%), and rare cases of *C. krusei*, *C. dubliniensis*, and *C. lusitaniae*. PNA FISH was beneficial in 34% of these episodes; 10 through the de-escalation of therapy saving 3 days of broad-spectrum antifungal usage and 19 through initiation of targeted antifungal therapy starting an average of 2 days earlier in patients with a more resistant Candida species (i.e. *C. glabrata*). Use of the expanded PNA FISH platform could provide further benefits (46%) by de-escalating therapy sooner in twice as many patients as the original method and initiate target therapy within the first day in patients with a more resistant species. Overall, this could improve patient care and significantly impact the cost associated with antifungal therapy.

**References:**

The Effect of P-Glycoprotein Inhibition on desloratadine in the CNS

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Background: P-glycoprotein (PGP) is emerging as a possible source of reported drug-drug interactions as well as a mechanism of drug resistance. Numerous compounds have been identified as inhibitors of PGP (verapamil, quinidine, ritonavir, ketoconazole) and have the potential to interact with compounds that are PGP substrates1.2. PGP inhibitors may interact with PGP substrates leading to higher substrate concentrations in the CNS and therefore, more adverse events1,3.

Objective: To determine if there is a clinically significant interaction between the PGP inhibitor verapamil and the PGP substrate desloratadine

Methodology: This is a double-blind, placebo-controlled, randomized, cross-over pilot study with 10 healthy, non-smoking subjects. Subjects will be randomized to receive either regular-release verapamil or placebo three times daily for 2 days. On study day 3, subjects will receive one dose of desloratadine 7.5 mg along with a final dose of either verapamil or placebo. Sedation will be assessed prior to the administration of these medications using the Stanford Sleepiness Scale (SSS) as a screening method. Subjects will receive a single dose of desloratadine 7.5 mg followed by a dose of immediate-release verapamil 80 mg or placebo. Subjects will complete 3 assessments of sedation, the VAS, the Continuous Performance Test (CPT), and the Digit Symbol Substitution test (DSST). Blood samples will be drawn at 0, 1, 2, 4, 8, 12, 24 and 48 hours after the desloratadine dose to assess desloratadine blood levels. After a 2 week washout period, the subjects will cross over into the other treatment arm.

Results and conclusions: IRB approval is still pending.

References:
The Benefit and Safety of Calcium and Magnesium Infusions to prevent Oxaliplatin-Induced Peripheral Neuropathy

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Background: Peripheral neuropathy can be a significant and potentially debilitating side effect of chemotherapy. Oxaliplatin (Eloxatin®) is an antineoplastic agent used in various chemotherapy combinations to primarily treat metastatic/advanced stage colorectal cancer. It is specifically responsible for 2 types of neuropathy: acute and chronic. Calcium/magnesium (Ca/Mg) infusions showed promising results in terms of preventing peripheral neuropathy.1,2 However, the CONCePT* trial, a phase III clinical trial, was terminated early in June 2007 because patients receiving the FOLFOX (leucovorin, 5-FU, oxaliplatin)/bevacizumab regimen and Ca/Mg infusions showed decreased response rates. After further radiology review, an ASCO 2008 update has concluded that Ca/Mg infusions did not decrease the efficacy of the chemotherapy regimen.3 Though also terminated early, a second trial specifically studying the effects of Ca/Mg infusions on oxaliplatin-induced peripheral neuropathy (OIPN) was able to conclude that the infusions do have neuroprotective effects.4 With this data, it is important to gain further information about Ca/Mg infusions to assess both benefits and safety for OIPN.

Objective: The objectives are to determine the benefit of Ca/Mg infusions to decrease OIPN and to assess the safety of Ca/Mg infusions at MetroHealth Medical Center (MHMC).

Methodology: A retrospective chart review will be conducted pre- and post-implementation of Ca/Mg infusions. Approximately 30 patients for each group (control vs. Ca/Mg infusions) will be studied. Demographic, chemotherapy, peripheral neuropathy, and safety data will be gathered. Descriptive statistics will be used to analyze the results. All data will be collected on a standardized form and documented on a Microsoft Excel spreadsheet.

Results and conclusions: Overall, patients in the Ca/Mg infusion group had 15.7% less peripheral neuropathy than patients in the control group. In the metastatic stage IV population, patients in the Ca/Mg infusion group experienced 26.3% less peripheral neuropathy than the control group. In the non-metastatic population, patients receiving Ca/Mg infusions had 7.8% less neuropathy than the control group. For safety data, there were no reports of toxicity specifically ascribed to Ca/Mg infusions. No calcium/magnesium laboratory values, which were drawn with nadir counts 7-10 days post-oxaliplatin infusion, were above the upper limit of normal. In conclusion, patients who received Ca/Mg infusions experienced less reported neuropathy than those in the control group. There is a trend to benefit specifically in the metastatic population. For safety, Ca/Mg infusions appear to do no harm in patients.

*Combined Oxaliplatin Neurotoxicity Prevention Trial

References:
Outcomes, cost, and feasibility of extended-infusion Piperacillin/tazobactam in the intensive care unit

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Background: Ever increasing resistance among gram negative infections and increasing mortality associated these organisms has led to the reevaluation of the optimal method to administer current antibiotics. Chastre et al. suggested extended-infusion of the carbapenem doripenem was non-inferior to intermittent infusion of imipenem. Lodise and colleagues discovered extended-infusion piperacillin/tazobactam improves outcomes in critically ill patients with Pseudomonas aeruginosa infections. Based on this compelling new research, our institution converted all piperacillin/tazobactam dosing in the ICU to extended-infusion dosing in two phases over the past 18 months.

Objective: To compare the efficacy, safety and cost of extended-infusion piperacillin/tazobactam against alternative effective therapies (cefepime, imipenem/cilistatin, meropenem, doripenem, and piperacillin/tazobactam intermittent-infusion)

Methodology: A retrospective chart review including adult patients admitted to the intensive care unit (ICU) between January 1, 2008 and December 31, 2008 treated with extended-infusion piperacillin/tazobactam or cefepime, imipenem/cilistatin, meropenem, doripenem, or piperacillin/tazobactam intermittent-infusion for more than 48 hours. Patients were identified by ICD-9 codes for treatment for any infection in which Acinetobacter spp., Enterococcus spp., Klebsiella spp., Pseudomonas spp., Serratia spp., E. Coli, or Citrobacter spp. was the causative organism and subsequently received treatment with extended-infusion piperacillin/tazobactam or control medications. Excluded were any patient who received greater than 24 hours of effective antibiotics before the initiation of extended-infusion piperacillin/tazobactam, any patient whose infection is proven intermediate or resistant to initial empiric therapy, or any patient who rotated therapies (de-escalation was permitted).

Results and conclusions: Fourteen-day mortality was decreased from 13% to 9.1% in all ICU patients and in the subset of patients whose APACHE II scores were greater than or equal to 17, 14-day mortality was decreased from 8.7% to 0% (p = 1 for both). There was no significant change in secondary outcomes such as length of ICU stay or length of hospital stay. There was a non-statistically significant decrease in the incidence of serious adverse drug reactions observed from 60.9% to 45.5% (p = 0.66). Drug level costs were shown to be numerically decreased by eleven dollars per patient day. Although this study did not reach statistical power, the observations are similar to those currently published regarding extended infusion piperacillin/tazobactam.

References:
A Retrospective Evaluation of Epoetin Alfa Use in Postoperative Cardiac Surgery Patients

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**Background**: Anemia is frequently observed among post-surgical patients and is commonly treated with blood transfusions. Transfusions, however, carry inherent risks, such as infusion reactions and transmission of diseases. These issues pose a problem with the treatment of post-surgical anemia and illustrate the need for alternative methods. There have been studies evaluating the use of preoperative and postoperative epoetin alfa administration to treat anemia following surgery. The studies did not show a significant difference in recovery of postoperative anemia or a minimization of blood transfusions.

**Objective**: To evaluate outcomes, based on the number of transfusions and hemoglobin levels, of cardiac surgery patients who received epoetin alfa treatment postoperatively compared to those who did not receive epoetin alfa following cardiac surgery. The study will evaluate the efficacy and appropriateness of postoperative epoetin alfa in cardiac surgery patients.

**Methodology**: A retrospective chart review was performed on patients greater than 18 years old who had cardiac surgery between 1/1/07 and 6/30/08 and received at least one dose of epoetin alfa within 72 hours following surgery. Fifty patients with the most recent date of cardiac surgery who met all criteria were included in the evaluation. A matched patient population of cardiac surgery patients during the same time period who did not receive epoetin alfa following surgery was selected based upon age, sex, baseline hemoglobin (Hgb), and serum creatinine (SCr).

**Results and conclusions**: A total of 100 patients were included in the study, 50 who received epoetin alfa (EPO) and 50 who did not (No-EPO). The changes from baseline to postoperative Hgb were not significantly different between the groups. There was also no significant difference between Hgb levels of the groups at 4-6 weeks and 8-12 weeks following surgery. Patients in the EPO group received an average of 2.6 units of packed red blood cells compared to 1.3 units in the No-EPO group (p=0.0071). In the EPO group, patients received an average of 2.3 doses prior to discharge. No patients received iron supplementation prior to surgery or during epoetin alfa administration. Transferrin saturation or ferritin levels were not drawn in 96% of patients. In conclusion, with the current prescribing patterns, administration of epoetin alfa post-cardiac surgery does not improve Hgb levels at any time within 12 weeks, when compared to matched controls. Epoetin alfa administration following cardiac surgery does not decrease the number of blood transfusions needed to correct post-surgical anemia.

References: