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Does a Nonstandardized Lactulose Administration Practice affect Hepatic Encephalopathy in Patients with Liver Disease in the Acute Care Setting?

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Does a Nonstandardized Lactulose Administration Practice affect Hepatic Encephalopathy in
Patients with Liver Disease in the Acute Care Setting?

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College of Nursing

Fall 2018

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Dedication

This DNP project is dedicated to my husband and my children. My husband's support during my school career has been tremendous. For as long as I have known him, he has always pushed me to do my best and be my best. He has supported me through the ups and the downs during the last 4.5 years and he has always been there for me. He has given me the encouragement to succeed in the program. I want to show my children that hard work is an important quality to have in life and to never give up. I hope that I can show them that they should always follow their dreams and goals in life, no matter what life throws them or challenges that may come in their way. There is never an excuse for lack of time for anything in life.

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Abstract

PURPOSE: The purpose of this study is to examine whether inpatients with liver disease at University of Kentucky Hospital receiving lactulose are meeting the protocol of 2-4 bowel movements per day. Research shows that lactulose is the medication of choice used to treat and prevent hepatic encephalopathy (HE). Additional lactulose interventions, a patient's MELD score, and GCS score will be examined in this study as well. This information would be beneficial to providers and nurses because it would provide data on patients who might require more lactulose interventions than others.

METHODS: Retrospective chart reviews of 70 inpatients with liver disease receiving lactulose at the University of Kentucky from January 1, 2017 to December 31, 2017 were performed. Number of daily movements, MELD score, GCS score, PRN lactulose administration, lactulose enema administration, and narcotic administration were examined during the first five days of hospitalization.

RESULTS: In the sample, a higher percentage of patients (>50%) did not meet the protocol of 2-4 daily bowel movements during the first five days of hospitalization. There was no association shown for patients who had a higher MELD score ≥ 25 on whether or not they met the goal of 2-4 bowel movements per day or received additional lactulose interventions. Those who had a GCS of ≤ 14.5 were more likely to receive lactulose enemas on day 1 and 2 (p=0.0021, 0.0063) and no significance was shown for the remaining days or PRN lactulose. Narcotic administration did not affect this group, as there was no association shown between GCS and narcotic administration.

CONCLUSIONS: More than 50% of patients were not meeting the goal of 2-4 daily bowel movements during the first five days of hospitalization. Those who are confused seem to require

additional lactulose during the early initial days of hospitalization. This information can help

nurses and physicians better understand lactulose titration and administration in the hospital

setting.

Does a Nonstandardized Lactulose Administration Practice affect Hepatic Encephalopathy in Patients with Liver Disease in the Acute Care Setting?

Introduction

Liver disease is prevalent in the United States. In 2015, the number of adults diagnosed with liver disease was 3.9 million (Centers for Disease Control and Prevention [CDC], 2017). In 2014, there were 38,170 deaths from liver disease (CDC, 2017). In the state of Kentucky, liver disease falls in the top fifteen causes of death for patients aged 45 to 75 (Kentucky Life Expectancy, 2017).

According to the American Liver Foundation (2017), over 17,000 Americans are on the waiting list for a liver transplant. A patient's Model for End-Stage Liver Disease (MELD) score helps prioritize patients who are waiting for a liver transplant. The MELD score is numeric scale that ranges from 6 (less ill) to 40 (severely ill) and the score determines how urgent the liver transplant is needed within the next three months (Sutter Health, 2014). The Liver Specialists of Texas (2011) stated that the higher the MELD score, the more ill the patient is. Most transplant programs are performing liver transplants with a MELD score of >25. The components utilized to measure a MELD score include whether or not a patient has had dialysis twice in the past week and the specific lab values: creatinine (Cr), total bilirubin, sodium (Na), and the international normalized ratio (INR), (MD Calc, 2016). The MELD score has been validated since 2001 and applied to numerous clinical situations (Tsang & Admed, 2013). Since its implementation, use of it has led to a sharp reduction in waiting list registrations and reduced mortality on the liver transplant waiting list without affecting post-transplant outcomes (Tsang & Admed, 2013).

Patients with liver disease are at risk for developing hepatic encephalopathy (HE), which causes changes in an individual's mental status that can range from mild confusion to a comatose state. Numerous factors contribute to the pathophysiology of HE, which plays a role in altering the function of neuronal cells. The common agents that are thought to cause HE include inflammatory cytokines, benzodiazepine-like compounds (i.e. gamma-amino butyric acid), manganese deposition in the basal ganglia, and ammonia—the most studied agent. Ammonia, a gut-derived nitrogenous toxin, is produced by bacterial metabolism of urea from proteins ingested from an individual's diet. The liver metabolizes ammonia and it is cleared by the kidneys. When patients have liver damage, the metabolism of ammonia is impaired. Portal hypertension causes shunting of ammonia rich blood to the systemic circulation without detoxification. Ammonia crosses the blood brain-barrier and is metabolized in the astrocytes by glutamine synthetase. As a result, ammonia and glutamate are converted to glutamine. The increase of glutamine in the brain causes an osmotic gradient that produces astrocyte swelling and generation of reactive oxygen species, which plays role in the cerebral dysfunction associated with HE. (Elwir & Rahimi, 2017)

Diagnosis of HE can be challenging and tends to be a clinical diagnosis (Elwir & Rahimi, 2017). There are numerous tools that can be used to help diagnose HE including the West Haven Criteria, the International Society for Hepatic Encephalopathy and Nitrogen Metabolism (ISHEN), Full Outline of Unresponsiveness (FOUR), the Glascow Coma Scale (GCS), Hepatic Encephalopathy Scoring Algorithm (HESA), Clinical Hepatic Encephalopathy Staging Scale (CHESS), and the Spectrum of Neurocognitive Impairment in Cirrhosis (SONIC). The West Haven Criteria is the most popular tool used for diagnosing HE. However, the GSC can be used for individuals with severe encephalopathy. When diagnosing HE, a provider must rule out other

causes such as medications, electrolyte disorders, infection, withdrawal, hypoglycemia, or hypercapnia. (Hepatitis C Online)

HE treatment targets the gut bacteria due to the hyperammonia state in the body. Lactulose, a nonabsorbable disaccharide, is used to prevent and treat HE. This drug is metabolized by the colonic microbiota and forms short chains organic acids. The creation of an acidic environment helps prevent the growth of ammonia producing bacteria and support the growth of favorable microorganisms. In an acidic environment, ammonia converts to ammonium, which is not absorbed and lowers the ammonia load. Lastly, the laxative effects of lactulose help remove nitrogen-containing substances from the gastrointestinal tract. Lactulose can be administered orally or rectally and needs to be titrated to a goal of 2-4 bowel movements/day. (Elwir & Rahimi, 2017)

Lactulose is the drug of choice for preventing and treating HE. Research shows that lactulose administration needs to be titrated for the patient to have 2-4 bowel movements a day. In the hospital setting, some patients may not meet the goal of 2-4 bowel movements a day, increasing their risk of becoming encephalopathic. Often times, an additional dose of lactulose or a lactulose enema is ordered to promote a bowel movement. The purpose of this study is to perform a retrospective chart review to examine whether or not inpatients with liver disease at University of Kentucky Hospital receiving lactulose for liver disease etiologies are meeting the protocol of 2-4 bowel movements per day. Additional lactulose interventions and a patient's MELD score and GCS score will be also be examined in this study. If these patients are not meeting the protocol of 2-4 bowel movements per day, a standardized order set could be beneficial in this patient population that would help improve nurse-provider communication about titrating bowel movements to lactulose administration.

This study is important because it will provide information regarding whether or not patients with liver disease receiving lactulose are meeting the protocol of 2-4 bowel movements per day in the hospital setting. Examining an individual's MELD score could show that a higher MELD score may require additional lactulose interventions. Examining an individual's GCS could show that a score ≤ 14.5 may require additional lactulose interventions. Providers at UK hospital do not document the West Haven Criteria for diagnosing HE. Consequently, GCS will be the variable used for assessing level of conscious (LOC) in this population because it is assessed at least two times a day by the nursing staff at UK. This information would be beneficial to providers because it would provide patients at risk for developing HE and those who need more lactulose interventions than others.

Background

Lactulose is the primary drug used for preventing and treating HE in patients with liver disease. HE occurs when ammonia levels rise due to diffuse brain edema and structural brain injury resulting in neuronal dysfunction (Wijdicks, 2016). The rise of ammonia levels causes mental status, behavioral, and motor changes (AACN, n.d.). Consequently, drug therapies to prevent and treat HE are aimed toward lowering ammonia levels (Wijdicks, 2016). Lactulose works by removing the nitrogen containing substances from the gastrointestinal tract and can be given orally or rectally to achieve 2-4 bowel movements daily (Elwir & Rahimi, 2017). As a result, ammonia is eliminated from the body through bowel movements. If an individual does not have 2-4 bowel movements per day, ammonia levels can accumulate in the body and cause mental status changes. The National Organization for Rare Disorders (2011) states that the exact incidence of HE is unknown but it is most often associated with cirrhosis. The organization found that 70% of individuals with cirrhosis develop symptoms of HE. In 2003, HE related

hospitalizations cost over 930 million dollars (The Hepatology Center for Educational Expertise, 2012). Morgan, Jenkins-Johns, Radwan, Conway, and Currie (2014) found that HE increased the mortality risk in patients with liver disease. The study found that in 551 patients with HE, 304 (55.2%) died during the follow up period.

Research indicates that lactulose is the gold standard of treatment for HE. A study by Sharma, Sharma, Agrawal, and Sarin (2009) found that 19.6% of patients who were administered lactulose suffered from HE while 46.8% of patients in the placebo group suffered from HE. Sharma, Sharma, Agrawal, and Sarin (2012) showed that 6 (11%) out of 55 patients who received lactulose developed HE while 14 (28%) out of 50 patients who did not receive lactulose developed HE. This study also proved that lactulose improved minimal hepatic encephalopathy (MHE) in 66% of patients who were given lactulose. Lactulose administration significantly lowered abnormal neuropsychological tests, reduced the risk of no improvement, and decreased the time to complete a number connection test when compared to a placebo or no intervention (Luo, Li, Lu, & Cao, 2011). Similarly, Prasad et al. (2007) showed that the mean number of neuropsychological tests decreased after a 3-month course of lactulose administration compared to no lactulose treatment for 3 months. The mean number of abnormal psychometric tests decreased significantly when patients were given lactulose compared to no lactulose administration (Dhimen et al., 2000). The evidence shows that lactulose prevents HE from occurring in patients with liver disease. Therefore, it is essential that all inpatients taking lactulose are meeting the goal of 2-4 bowel movements per day.

When research was done about the role of lactulose and other drugs, most showed that lactulose is the drug of choice of treatment for HE. Mittal, Sharma, Sharma, and Sarin (2011) studied the effects of lactulose, probiotics, l-ornithine l-aspartate (LOLA) and no treatment on

HE. They found that lactulose had the strongest results among the three interventions through significance in neuropsychological test improvement, decreased blood ammonia levels, and the SIP questionnaire (this tool assesses the effect of HE on daily functioning). Lactulose, either alone or in combination with Rifaximin, is the treatment of choice for HE (Zhan & Stremmel, 2012). Tapper, Jiang, and Patwardhan (2015) examined the effects of existing and evolving therapeutic treatment for HE and found that lactulose is the first line of therapy for HE compared to other medications.

According to Kamath & Kim (2007), A patient's MELD score can be used to predict survival in patients with different levels of liver disease and their severity. MELD scores were initially calculated to predict the patient survival rates following the placement of transjugular intrahepatic portosystemic shunts (TIPS). However, the MELD score has become an acceptable way to predict long-term survival in patients with cirrhosis, variceal bleeding, Hepatitis C-cirrhosis, alcoholic hepatitis, fulminant hepatic failure, other chronic liver diseases, and hepatic cellular carcinoma. MELD scores are also used for liver transplant purposes. According to the United Network for Organ Sharing, the higher the MELD score, the more urgently a patient needs a liver transplant. Patients with a higher MELD score will always be considered first before those who have a lower MELD score, regardless of how long they have been on the waiting list.

The GCS has been in healthcare since the 1980s. According to Nickson (2017), this scale is the most widely recognized of all conscious level scoring systems in the world. The scale measures the mental status of patients according to three categories: verbal response, motor response, and eye response. For eye response, the patient is scored based on (1) no eye opening, (2) eye opening to pain, (3) eye opening to verbal command, and (4) eyes opening

spontaneously. For verbal response, the patient is scored based on (1) no verbal response, (2) incomprehensible sounds, (3) inappropriate words, (4) confused, and (5) oriented. For motor response, the patient is scored based on (1) no motor response, (2) abnormal extension to pain, (3) abnormal flexion to pain, (4) withdrawal from pain, (5) localizing pain, and (6) obeys commands. The GCS can range from 3-15 and the total of these scores add up to 15, which indicates the patient is alert and oriented. Using GCS has been accepted as a mental status assessment method in the hospital setting. For this study, GCS scores are used for the mental status assessment in patients receiving lactulose. (Jain & Iverson, 2018)

Lactulose is given to inpatients at University of Kentucky of hospital that have liver disease and it is important that they are meeting the protocol of 2-4 bowel movements per day to prevent changes in mental status from occurring. If a patient becomes encephalopathic, additional interventions are needed such as an additional dose of lactulose or a lactulose enema. This results in increased costs and length of stay for patients. There is an economic burden associated with HE. From 2005-2009, the total costs of hospitalizations increased by 55.1%. The average length of stay increased from 8.1 days in 2005 to 8.5 days in 2009 for patients with HE. Patients who had HE during hospitalization, had increased costs due to increased resource utilization, increased number of inpatient procedures, and an increased average length of stay. The total costs went from $4.68 billion in 2005 to $7.25 billion in 2009 for patients who suffered from HE while hospitalized. (Flamm, 2018)

The conceptual framework guiding this study is the Logic Model. The *purpose* of the study is to examine the number of bowel movements patients with liver disease who are receiving lactulose are having each day and assess whether or not additional lactulose interventions are required. The *context* of this study is to examine the Internal Medicine inpatient cohort at UK

hospital. The *inputs* will be Sunrise Clinical Manager, which is the charting system at UK

hospital, to collect the raw data which will then be entered and stored on REDCap. The *activities*

will be statistical analysis on SPSS version 25 of data to see if the protocol of 2-4 daily bowel

movements is being met. The *outputs* will be the results of the study, specifically the percentage

of patients who are meeting the protocol of 2-4 daily bowel movements and whether or not they

required additional lactulose interventions. The *effects* of this study will be what the author does

with the results and what further studies can be performed to help meet this protocol in the

inpatient setting. (Community Tool Box, 2018)

Purpose

The literature shows that Lactulose is the drug of choice for prevention and treatment of HE

in patients with liver disease. The purpose of this study was to examine whether inpatients with

liver disease at University of Kentucky Hospital receiving lactulose are meeting the protocol of

2-4 bowel movements per day. Additional interventions (administration of PRN doses of

lactulose or lactulose enemas) and a patient's MELD score and GCS score will be examined in

this study as well.

The specific objectives are:

OBJECTIVE 1: To determine the proportion of patients with liver disease receiving

lactulose at UK hospital are meeting the protocol of 2-4 bowel movements per day, and

examine the demographic differences among the sample population in the study.

OBJECTIVE 2: To assess if inpatients with liver disease receiving lactulose at UK

hospital with a MELD score ≥ 25 are meeting the goal of 2-4 bowel movements per day

during the first five days of hospitalization and how often they are requiring additional

lactulose interventions.

OBJECTIVE 3: To assess if inpatients with liver disease receiving lactulose at UK

hospital with a GCS ≤ 14.5 are meeting the goal of 2-4 bowel movements per day during

the first five days of hospitalization, how often they are requiring additional lactulose

interventions, and whether or not they received narcotics.

Methods

A retrospective chart review was conducted including patients that were admitted to

University of Kentucky Hospital with a history of or diagnosis of HE on the Internal Medicine

service line. Data was collected through a sample from January 1, 2017 to December 31, 2017 of

75 randomly selected charts from the electronic medical records (EMR) gathered by the CCTS

from the KMSF database. The principle investigator (PI) collected data from the EMR and

entered and stored them on REDCap's protected server. MRNs were entered on REDCap, but

not exported into SPSS for the data analysis. Once the data was collected and entered into the

data collection tool, the de-identified data was uploaded into SPSS version 25 statistical software

for data analysis with statistical significance to be a p-value of <0.05.

Setting

The study took place at University of Kentucky (UK) hospital in Lexington, Kentucky. UK

hospital is committed to the pillars of academic health care—research, education, and clinical

care (UK Healthcare). The hospital is dedicated to the health of Kentucky to provide the most

advanced patient care and serve as an information resource (UK Healthcare). The 9th and 10th

floors in Pavilion A and the 5th floor and two wings on the 6th floor in Pavilion H make up the

Internal Medicine cohort at UK hospital with 122 beds.

Sample

Patient inclusion criteria were: 1) patients aged at least 18 years old; 2) patients with history

of or diagnosis of HE; 3) Length of stay ≥ 5 days. Patient exclusion criteria were: 1) patients

aged less than 18 years; 2) patients receiving lactulose for non-liver disease etiologies (i.e.

constipation); 3) Length of stay ≤ 5 days. Demographic variables will be extracted for each

individual in the study including age, sex, race, and admitting diagnosis. We reviewed all

patients' charts that were identified with a history or diagnosis of hepatic encephalopathy from

January 1, 2017 to December 31, 2017. Seventy-five charts were reviewed. We excluded 5

patients as not meeting criteria leaving 70 patients who met the inclusion and exclusion criteria.

Data Collection

Approvals from the University of Kentucky Institutional Review Board (IRB) and the

University of Kentucky Nurse Research Board were obtained prior to the collection of data. This

study was based on a retrospective chart review. Patient charts were collected from the KSMF

electronic patient database. Seventy-five randomly selected charts were identified using the

ICD10 CM coding scheme with diagnosis or history of hepatic encephalopathy ICD-10 code

K72.90**.** During data collection, patient records were accessed using the patient medical record

number (MRN), data was abstracted based on listed variables in Table 1, and data was entered

stored on REDCap, a protected data collection server. Please refer to Table 1 for a list of

variables that were reviewed, which included demographic variables (length of stay, age, race,

sex, admitting diagnosis), the number of daily bowel movements in 24 hours for the first give

days of hospitalization, daily PRN oral lactulose administration, daily lactulose enema administration, admit MELD score, average daily GCS score, and daily narcotic administration. Specific laboratory values were collected on day one of hospitalization to calculate the admit MELD score: INR, Cr, Na, total bilirubin, and whether or not the patient received dialysis twice in the past week. The MELD score was then calculated by using the MD Calc website. Please see table 2 for the list of narcotics patients received in this study.

Data Analysis

Descriptive statistics, including frequency distributions, means, percentages and standard deviations (SD) were used to describe patients' demographic measures and whether or not the protocol of 2-4 bowel movements were met. The chi-square test of association was used to test for associations between categorical variables. The categorical variables in the study were: patients with a MELD score $\geq$ 25 and whether or not they met the criteria of 2-4 daily bowel movements (yes/no), and whether or not they received additional lactulose interventions (yes/no for lactulose enema or PRN lactulose administration) and patients with an GCS $\leq$ 14.5 and whether or not they met the criteria of 2-4 daily bowel movements (yes/no), and whether or not they received additional lactulose interventions (yes/no for lactulose enema or PRN lactulose administration) and whether or not narcotics were administered (yes or no). All analysis was conducted using SPSS version 25; an [*alpha*] level of .05 was used for statistical significance in all analysis

Results

Sample Characteristics

A total of 70 patients who met the inclusion/exclusion criteria were included in this study. Five patients did not meet the criteria because lactulose was not ordered for them until after five days of hospitalization. The average age of patients was 57.6 (SD=10.7; see Table 3), with the majority of the patients being White (95.7%) and male (51.4%). The median length of stay (LOS) was 11.5 days with a range of 6-20. The majority of patients had an admitting diagnosis of non-liver disease etiology (62.9%).

Bowel Movements

Patients were defined as meeting the criteria each day if the number of daily bowel movements was recorded as 2-4. Of the five days, the highest percentage of patients not meeting the criteria was day 1 (77.36%; see Table 4). Greater than 50% of patients did not meet the criteria on the four additional days.

MELD Score

Patients who presented with a MELD score ≥ 25 on the first day of admission were analyzed specifically. There was no association between a higher MELD score and whether or not the criteria of 2-4 bowel movements were met (see Table 5). Also, there was no association among a higher MELD score and requiring additional lactulose interventions (PRN lactulose or lactulose enema).

GCS Score

Patients who had an average daily GCS score of ≤ 14.5 were analyzed specifically. On day 1 and day 2 of hospitalization, significance was shown for lactulose enema administration (p=0.0021, 0.0063 respectively, see Table 6). There was no association between a confused patient and whether or not the criteria of 2-4 bowel movements were met. Also, there was no association among a confused patient and requiring PRN lactulose or lactulose enemas on days 3, 4, and 5. There was no association between confusion and narcotic administration.

Discussion

This study aimed to better understand lactulose administration for patients with liver disease in the hospital setting. Additional lactulose interventions were examined to see if those with a higher MELD score or confusion required more lactulose. Understanding the findings in this study will help nurses and physicians understand the importance of lactulose titration in the hospital setting.

Research has shown that a goal of 2-4 bowel movements per day helps prevent and treat HE. This study has shown that over half of the patients are not meeting the criteria of 2-4 daily bowel movements during the first five days of hospitalization. Therefore, nurses may not be titrating lactulose administration to bowel movements properly. As a result, patients are at an increased for becoming encephalopathic because they are not clearing the ammonia through the stool. Physicians may not be aware that they their patients have not the met the goal of 2-4 bowel movements until the following day because the nurse did not inform them the prior day. Therefore, better methods of communication need to be established among the nurses and physicians about the number of bowel movements their patients are having.

When examining a patient's MELD score, the severity of a patient's liver disease did not seem to impact whether or not they were meeting the criteria of 2-4 bowel movements daily. This patient population did not require additional lactulose interventions. This indicates that although a patient may have a higher MELD score, lactulose titration does not need to be done any differently.

When examining a patient's GCS score, there was no significance shown for whether or not they are meeting the criteria of 2-4 bowel movements per day. However, on day one and day two of hospitalization, this population was requiring the additional intervention of lactulose enemas. This indicates that upon admission, confused patients may need more lactulose interventions due to their mental status. This allows physicians and nurses to be aware that close titration of lactulose needs to be done for the first few days of hospitalization. Perhaps, ordering a standing order of a lactulose enema would be beneficial for confused patients. Therefore, the nurse could go ahead and administer the enema if the patient has not been stooling enough. There was no significance for this population receiving a PRN lactulose dose or a lactulose enema on days 3, 4, and 5. Lastly, there was no significance in this population among narcotic use. This indicates that narcotic administration does not affect GCS score in this patient population.

Limitations

There were limitations identified in the design of the study. Data was collected through a retrospective chart review. Consequently, there was no way to verify the recorded results. Patients who are independent may have gotten up alone and had a bowel movement without reporting it to the nursing tech or registered nurse to enter into the chart. Nursing techs or

registered nurses might not remember to record every bowel movement their patient has had that day.

Some patients had to be excluded from the study because lactulose was not started until later in their stay. When patients are first admitted, some health care providers do not start all the home medications right away and wait until they are stable to resume home medications. Therefore, some patients were not receiving lactulose until after five days of hospitalization, thus causing them to be excluded and lowering the patient population for the study.

Calculating a MELD score involves getting specific lab values including INR, Cr, Na, and total bilirubin. All of these values need to be collected at the same time to calculate a MELD score. In some patients, the admit MELD score could not be calculated because some of the lab components were missing, specifically the INR value. This resulted in a smaller number of patients included for the MELD score analysis in this study.

Recommendations for Future Studies

Recommendations for future studies would include implementing a standardized lactulose order set for this patient population. This would allow for effective nurse/physician communication about the number of bowel movements the patients are having. The order set would guide nurses throughout the day on when to give scheduled and PRN lactulose. It would also tell nurses under what circumstances and when they should inform the physician if the patient has only had ≤ 1 bowel movement that day. After implementing this order set, the number of bowel movements could be analyzed to see if an increased number of patients are meeting the criteria of 2-4 daily bowel movements. Results of implementation of a standardized

lactulose order set could be compared to this study that does not have any standardization in place. Please refer to Table 7 for an example of a potential standardized lactulose order set.

Another recommendation for future studies could be an assessment of nurse's knowledge when titrating lactulose administration. Surveys could be given to nurses to ask whether or not they are paying attention to the number of bowel movements their patients are having, whether or not they communicate effectively with the nursing techs about the number of bowel movements their patients are having, and how they feel about communicating with the physician regarding the titration of lactulose and number of bowel movements their patients are having. These results could be beneficial to help find ways to improve patient outcomes in meeting the specific criteria for lactulose administration.

Conclusion

The goal of this study was to examine whether or not patients with liver disease receiving lactulose were meeting the goal of 2-4 bowel movements per day in the inpatient setting. Additional factors were analyzed including PRN lactulose and lactulose enema administration. The study population was broken down into those who had a MELD score ≥ 25 and those with daily average GCS of ≤ 14.5. These groups were further analyzed to see if they required additional lactulose interventions and narcotic administration was examined in the GCS group. The study showed that higher percentages of patients were not meeting the criteria of 2-4 daily bowel movements during the first five days of hospitalization. Patients with a MELD score of ≥ 25 did not require additional lactulose interventions. Patients with a GCS of ≤ 14.5 required lactulose enemas on days 1 and 2 of hospitalization, indicating these patients should be closely monitored during the first few days of hospitalization. This knowledge lets physicians and nurses

realize that those who are confused may require additional lactulose interventions upon

admission. Lastly, narcotic use was examined in those with a GCS ≤ 14.5 and it does not

correlate with their mental status.

This study can give providers a better understanding of lactulose titration and administration

in the inpatient healthcare setting and show that not all patients may be meeting the specific

protocol that the research proposes. Implementation of a standardized lactulose order set may

allow for better lactulose titration and could be examined in a future study. Reducing the rates of

HE in the hospital setting can reduce healthcare costs. It is important that nurses and doctors are

monitoring the number of daily bowel movements their patients are having to prevent further

complications from occurring.

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List of Variables per Category	
Category	Variables/Measures
Demographic Measures	
Age	age of participants in years
Race	American Indian/Alaskan Native, Asian, Native Hawaiian or Other Pacific Islander, Black or African American, White, Other, Unknown/not reported
Gender	Male, female
Admitting diagnosis	Diagnosis upon admission to the hospital
Length of stay	Number of days of hospitalization
Process Measures	
Daily PRN oral lactulose administration	Yes or No daily for the first five days of hospitalization
Daily lactulose enema administration	Yes or No daily for the first five days of hospitalization
Admit MELD score	Calculated with admit lab work (day 1 of hospitalization) using Creatinine, International normalized ratio, Sodium, Bilirubin and dialysis frequency; score ranges from 6-40
Average daily GCS score	Average daily GCS for 0800 and 2000 for the first five days of hospitalization, 15 or ≤ 14.5
Daily narcotic administration	Yes or No daily for the first five days of hospitalization
Outcome Measures	
Daily number of bowel movements	Number of daily bowel movements for the first five days of hospitalization
Notes: Length of stay (LOS), Model for End Stage Liver Disease (MELD), Creatinine (Cr), International normalized ratio (INR), Sodium (Na), Bilirubin (bili), Glascow Coma Scale (GCS)	

Table 1: List of variables per category.

Narcotics Administered in this Study	
Generic Name	Brand Name
Propofol	Diprovan
Oxycodone	Oxycontin
Morphine	Duramorph
Hydromorphone	Dilaudid
Hydrocodone/Acetaminophen	Norco
Tramadol	Ultram

Table 2: Narcotics Administered in this Study

	Mean (SD) or *n* (%)
Age	57.6 (10.7)
Sex	
Male	36 (51.4%)
Female	34 (48.6%)
Ethnicity	
Black or African American	3 (4.3%)
White	67 (95.7%)
Admitting Diagnosis	
Liver Disease Etiology	
Non-liver Disease Etiology	26 (37.1%)
	44 (62.9%)
Length of Stay	Median (Range)
	11.5 (6-20)

Table 3. Demographics of patients in the study. (N=70)

	Day 1		Day 2		Day 3		Day 4		Day 5	
	Y	N	Y	N	Y	N	Y	N	Y	N
Meet the goal of 2-4 BM's per day?	22.64%	77.36%	43.64%	56.36%	44.44%	55.56%	41.54%	58.46%	34.38%	65.63%

Table 4. Percentage of patients who met the goal of 2-4 bowel movements (BMs) each day for the first five days of hospitalization.

	Day 1		Day 2		Day 3		Day 4		Day 5	
	Y	N	Y	N	Y	N	Y	N	Y	N
Meet the goal of 2-4 BM's per day?	22.22%	25.81%	52.63%	40.63%	36.36%	51.53%	43.48%	34.21%	43.48%	32.43%
P	1.000		0.4048		0.2638		0.4692		0.3880	
	Y	N	Y	N	Y	N	Y	N	Y	N
Received PRN dose of lactulose?	4.76%	0.00	14.29%	0.00	9.09%	5.41%	8.70%	5.26%	8.70%	2.63%
P	0.3889		0.0536		0.6244		0.6282		0.5507	
	Y	N	Y	N	Y	N	Y	N	Y	N
Received lactulose enema?	4.76%	15.15%	4.76%	12.12%	0.000	5.41%	13.04%	5.26%	4.35%	5.26%
P	0.3863		0.6377		0.5243		0.3559		1.000	

Table 5: Chi square: Percentage of patients with a MELD score of ≥ 25 who met the goal of 2-4 BM's per day, received a PRN dose of lactulose, received a lactulose enema, and received a narcotics each day for the first five days of hospitalization.

	Day 1		Day 2		Day 3		Day 4		Day 5	
	Y	N	Y	N	Y	N	Y	N	Y	N
Meet the goal of 2-4 BM's per day?	66.67%	29.27%	33.33%	41.94%	42.86%	31.43%	37.04%	39.47%	45.45%	40.48%
P	0.0390		0.5149		0.3492		0.8423		0.7017	
	Y	N	Y	N	Y	N	Y	N	Y	N
Received PRN dose of lactulose?	0.000	2.86%	4.55%	5.71%	13.04%	2.50%	16.00%	2.50%	10.71%	2.70%
P	1.000		1.000		0.1338		0.0677		0.3068	
	Y	N	Y	N	Y	N	Y	N	Y	N
Received lactulose enema?	27.27%	0.000	22.73%	0.000	8.70%	0.000	8.00	7.5%	7.14%	2.70%
P	0.0021		0.0063		0.1295		1.000		0.5731	
	Y	N	Y	N	Y	N	Y	N	Y	N
Received Narcotics?	31.82%	38.89%	45.45%	42.86%	43.48%	45.00%	44.00%	45.00%	46.43%	40.54%
P	0.5867		0.8474		0.9068		0.9371		0.6350	

Table 6: Chi square: Percentage of patients with a GCS of ≤ 14.5 who met the goal of 2-4 BM's per day, received a PRN dose of lactulose, received a lactulose enema, and received a narcotic each day for the first five days of hospitalization.

Time	Intervention
0800	Give scheduled 30 mL dose of Lactulose
1200	If patient has not had a bowel movement by this time, give PRN 30 mL dose of lactulose
1400	Give scheduled 30 mL dose of Lactulose
1600	If patient has ≤ 1 bowel movement by this time, notify physician for next intervention.
2000	Give scheduled 30 mL dose of Lactulose

Table 7: Standardized Lactulose Order Set example to implement in future studies.