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LETTER

Improvements in Care in Acute Pancreatitis by the Adoption of an Acute Pancreatitis Algorithm

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Dear Sir,

Acute pancreatitis is a serious condition that significantly impacts both patients and the healthcare system. The incidence of acute pancreatitis in the United States has been estimated to be 33-80 per 100,000 per year [1, 2]. From 1985-2005, hospitalizations rates for acute pancreatitis have nearly doubled, although case fatality rates have declined, likely attributed to improved therapeutic options and management [2, 3]. Despite a decrease in mortality, acute pancreatitis significantly impacts healthcare cost, with an estimated cost of acute pancreatitis in 2003 being $2.2 billion, approximately $10,000 per patient [4]. Given the significant impact on patient outcomes and healthcare costs, we, at the University of Missouri Hospital and Clinics in Columbia, examined the issue further.

In 1996 and 1997, information was obtained that showed the University of Missouri Hospital and Clinics experienced a higher mortality rate (6.6%) with acute pancreatitis in comparison to similar academic medical centers in the Midwest. Subsequently, in 1997, the newly formed Office of Clinical Effectiveness began to look at ways that care could be delivered safer, better, and more cost-effective, with acute pancreatitis high on the list. Upon further investigation, not only was acute pancreatitis mortality elevated, but was ranked 13 on a list of the diagnoses that the hospital had lost money on in 1995.

At that time, the committee decided that this condition met the five different criteria for institutional improvement focus, but were unclear if anything could be done about improving costs for patients with acute pancreatitis. The criteria used to select pancreatitis as the most favorable diagnosis to make a difference with were as follows: 1) there was a good opportunity for improvement in outcomes such as average length of stay compared with benchmarks that were being used at the time; 2) care of acute pancreatitis crossed multiple services including family practice, internal medicine, and surgery, bringing more expertise to the table; 3) significant variability in the way pancreatitis was being treated at the time (Departments of Internal Medicine, Surgery, and Family Practice were all involved in the care of acute pancreatitis); 4) data from secondary sources was available to measure any change; and 5) a high level of interest in making changes for the improvement of any care and its cost by various customers of the University.

In the initial stages, a series of questions were investigated by the group to determine if there was variation in the care delivery for these patients internally and as compared with other academic medical centers. Subsequently, the committee conducted a search of the literature for guidelines in the treatment of acute pancreatitis and consulted experts in the fields of gastroenterology, critical care, and surgery for recommendations.

Based upon this expertise, it was determined that the most effective changes in the hospital care of acute pancreatitis could be done by initiating two new steps. The first step was to establish an algorithm to be followed upon admission to the hospital for a diagnosis of acute pancreatitis. The second step was to perform daily severity assessments on patients with acute pancreatitis by any one of several accepted methods of evaluation. Physicians were given the option of using one of four assessment scales, including the modified Glasgow scale and Ranson's criteria.

The algorithm was adopted and implemented in 1998 (Figures 1 and 2). Usage of the algorithm was prompted by laboratory notification of an amylase level

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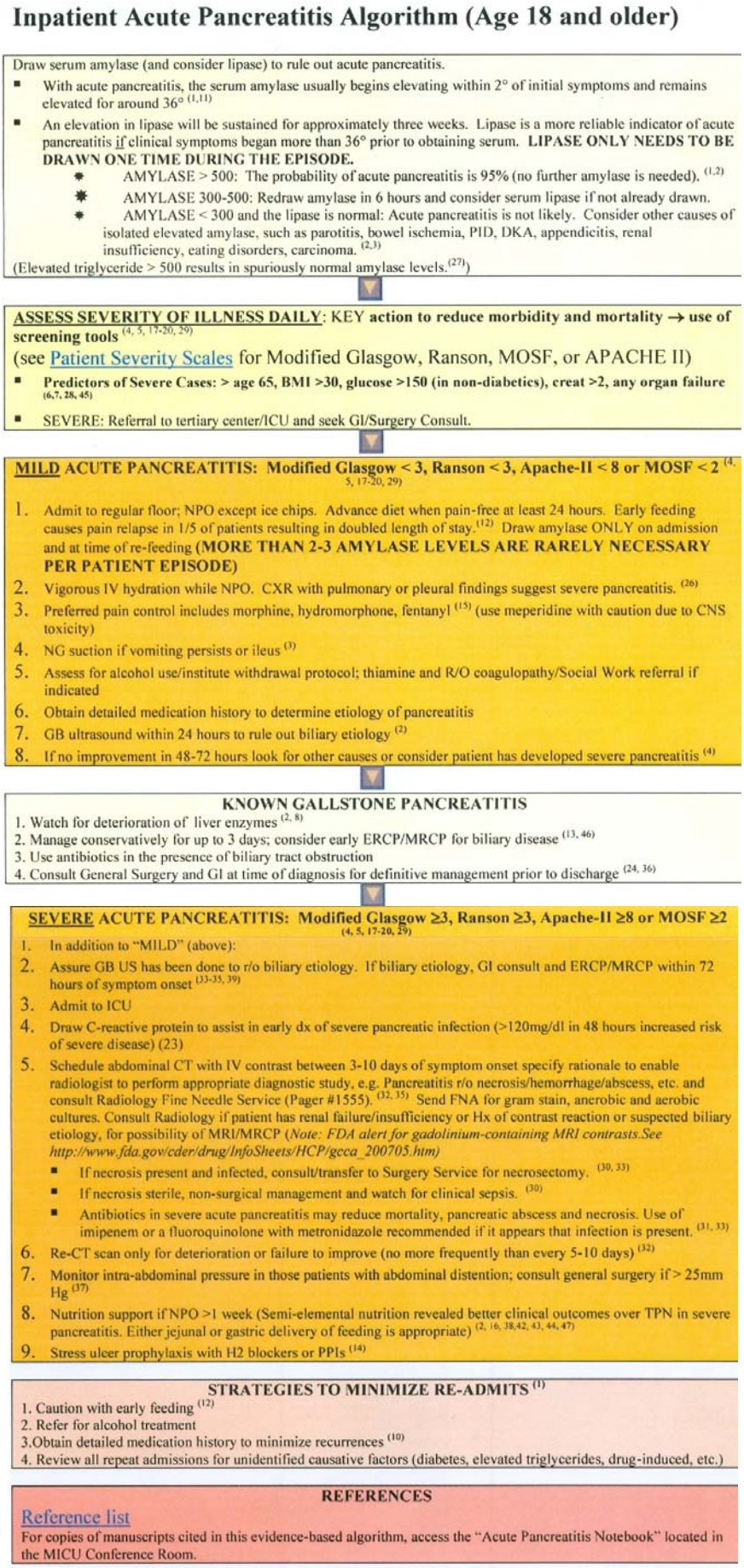

Inpatient Acute Pancreatitis Algorithm (Age 18 and older)

Draw serum amylase (and consider lipase) to rule out acute pancreatitis.

- With acute pancreatitis, the serum amylase usually begins elevating within 2° of initial symptoms and remains elevated for around 36° [1,11]
- An elevation in lipase will be sustained for approximately three weeks. Lipase is a more reliable indicator of acute pancreatitis if clinical symptoms began more than 36° prior to obtaining serum. **LIPASE ONLY NEEDS TO BE DRAWN ONE TIME DURING THE EPISODE.**
  - AMYLASE > 500: The probability of acute pancreatitis is 95% (no further amylase is needed). [1,2]
  - AMYLASE 300-500: Redraw amylase in 6 hours and consider serum lipase if not already drawn.
  - AMYLASE < 300 and the lipase is normal: Acute pancreatitis is not likely. Consider other causes of isolated elevated amylase, such as parotitis, bowel ischemia, PID, DKA, appendicitis, renal insufficiency, eating disorders, carcinoma. [2,3]

(Elevated triglyceride > 500 results in spuriously normal amylase levels.[27])

ASSESS SEVERITY OF ILLNESS DAILY: KEY **action to reduce morbidity and mortality → use of screening tools** [4, 5, 17-20, 29]

(see Patient Severity Scales for Modified Glasgow, Ranson, MOSF, or APACHE II)

- **Predictors of Severe Cases: > age 65, BMI >30, glucose >150 (in non-diabetics), creat >2, any organ failure** [6,7, 28, 45]
- SEVERE: Referral to tertiary center/ICU and seek GI/Surgery Consult.

MILD ACUTE PANCREATITIS: Modified Glasgow < 3, Ranson < 3, Apache-II < 8 or MOSF < 2 [4, 5, 17-20, 29]

1. Admit to regular floor; NPO except ice chips. Advance diet when pain-free at least 24 hours. Early feeding causes pain relapse in 1/5 of patients resulting in doubled length of stay.[12] Draw amylase ONLY on admission and at time of re-feeding **(MORE THAN 2-3 AMYLASE LEVELS ARE RARELY NECESSARY PER PATIENT EPISODE)**
2. Vigorous IV hydration while NPO. CXR with pulmonary or pleural findings suggest severe pancreatitis. [26]
3. Preferred pain control includes morphine, hydromorphone, fentanyl [15] (use meperidine with caution due to CNS toxicity)
4. NG suction if vomiting persists or ileus [3]
5. Assess for alcohol use/institute withdrawal protocol; thiamine and R/O coagulopathy/Social Work referral if indicated
6. Obtain detailed medication history to determine etiology of pancreatitis
7. GB ultrasound within 24 hours to rule out biliary etiology [2]
8. If no improvement in 48-72 hours look for other causes or consider patient has developed severe pancreatitis [4]

KNOWN GALLSTONE PANCREATITIS

1. Watch for deterioration of liver enzymes [2, 8]
2. Manage conservatively for up to 3 days; consider early ERCP/MRCP for biliary disease [13, 46]
3. Use antibiotics in the presence of biliary tract obstruction
4. Consult General Surgery and GI at time of diagnosis for definitive management prior to discharge [24, 36]

SEVERE ACUTE PANCREATITIS: Modified Glasgow ≥3, Ranson ≥3, Apache-II ≥8 or MOSF ≥2 [4, 5, 17-20, 29]

1. In addition to "MILD" (above):
2. Assure GB US has been done to r/o biliary etiology. If biliary etiology, GI consult and ERCP/MRCP within 72 hours of symptom onset [33-35, 39]
3. Admit to ICU
4. Draw C-reactive protein to assist in early dx of severe pancreatic infection (>120mg/dl in 48 hours increased risk of severe disease) (23)
5. Schedule abdominal CT with IV contrast between 3-10 days of symptom onset specify rationale to enable radiologist to perform appropriate diagnostic study, e.g. Pancreatitis r/o necrosis/hemorrhage/abscess, etc. and consult Radiology Fine Needle Service (Pager #1555). [32, 35] Send FNA for gram stain, anerobic and acrobic cultures. Consult Radiology if patient has renal failure/insufficiency or Hx of contrast reaction or suspected biliary etiology, for possibility of MRI/MRCP (*Note: FDA alert for gadolinium-containing MRI contrasts.See http://www.fda.gov/cder/drug/InfoSheets/HCP/gcca_200705.htm)*
   - If necrosis present and infected, consult/transfer to Surgery Service for necrosectomy. [30, 33]
   - If necrosis sterile, non-surgical management and watch for clinical sepsis. [30]
   - Antibiotics in severe acute pancreatitis may reduce mortality, pancreatic abscess and necrosis. Use of imipenem or a fluoroquinolone with metronidazole recommended if it appears that infection is present. [31, 33]
6. Re-CT scan only for deterioration or failure to improve (no more frequently than every 5-10 days) [32]
7. Monitor intra-abdominal pressure in those patients with abdominal distention; consult general surgery if > 25mm Hg [37]
8. Nutrition support if NPO >1 week (Semi-elemental nutrition revealed better clinical outcomes over TPN in severe pancreatitis. Either jejunal or gastric delivery of feeding is appropriate) [2, 16, 38,42, 43, 44, 47]
9. Stress ulcer prophylaxis with H2 blockers or PPIs [14]

STRATEGIES TO MINIMIZE RE-ADMITS [1]

1. Caution with early feeding [12]
2. Refer for alcohol treatment
3. Obtain detailed medication history to minimize recurrences [10]
4. Review all repeat admissions for unidentified causative factors (diabetes, elevated triglycerides, drug-induced, etc.)

REFERENCES

Reference list

For copies of manuscripts cited in this evidence-based algorithm, access the "Acute Pancreatitis Notebook" located in the MICU Conference Room.

Figure 1. Acute pancreatitis algorithm at the University of Missouri - Columbia.

For RANSON and/or MODIFIED GLASGOW:

(Ranson/Glasgow Score of 3 is SEVERE)

STEP 1: The following demographics and vital signs are necessary: **Age, Temperature, I/O, HR, RR, MAP**

STEP 2: The following lab tests are necessary: **ABGs, Lytes, Glucose, BUN, Creat, LFTs, Ca++, HPD**

STEP 3: Timing of assessment as follows:

- *Ranson — score on admission and score specific parameters indicated by "* " within 48 hours*
- *Glasgow — score daily*

PARAMETER	RANSON	MODIFIED GLASGOW
AGE >55	1	1
ABGs *pO2<60	1	1
*Base Deficit > 4 mEq/L	1	
Glucose Glucose > 182		1
Glucose > 200	1	
BUN BUN > 46		1
*increase in BUN > 5 (1st 48 hrs)	1	
Calcium *Calcium < 8	1	1
I/O *fluid retained > 6 L (1st 48 hrs)	1	
HPD WBC > 15,000		1
WBC > 16,000	1	
Hct decrease > 10 vol %	1	
LFTs AST/ALT > 100	nbsp	1
AST/ALT > 250	1	
LDH > 350	1	
LDH > 600		1
Albumin < 3.2		1
YOUR PATIENT'S SCORE		

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Figure 2. Acute pancreatitis algorithm at the University of Missouri - Columbia.

3 times higher than the upper reference limit. Once prompted, the algorithm was reviewed by house staff and attending physicians as a resource and guide for hospital admissions with acute pancreatitis and placed in the patient's chart. The focus of care became doing daily assessments and triage to the ICU if necessary. Ongoing attention to pain control, hydration, nutritional support, and treatment of alcohol related issues were parts of the new focus.

Data on mortality, cost, and length of stay were collected over the next few years. There were noted to

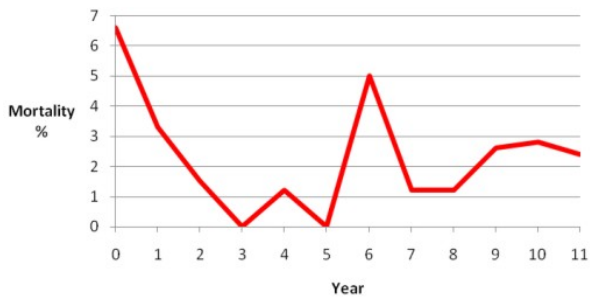

Figure 3. Mortality rates for acute pancreatitis from pre-algorithm (year 0) to year 11 (2008).

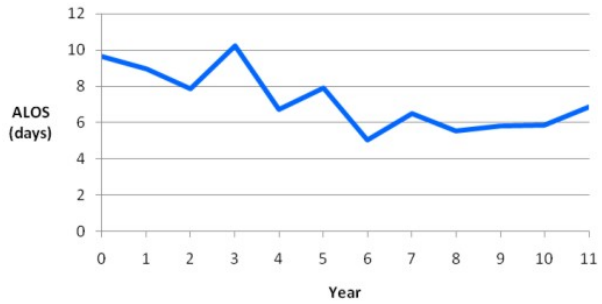

Figure 4. Average length of stay (ALOS) for acute pancreatitis from pre-algorithm (year 0) to year 11 (2008).

be improvements in all of these areas using the hospital as its own control. Mortality was significantly reduced from 6.6% (4/61) in 1997 (pre-algorithm) to a mean of 2.3±2.0% (±SD) over the subsequent 11 years (Figure 3). The average length of hospital stay was also significantly reduced from 9.62 days in 1997 (pre-algorithm) to a mean of 7.24±1.68 days over the subsequent 11 years (Figure 4). In the year prior to the initiation of the algorithm, the average cost of taking care of a patient with acute pancreatitis was $6,186. In the eleventh year of data collection, the average cost per patient was $6,160. Although this appears to be only a small cost reduction, if adjusted for inflation and persistently rising healthcare costs in the United States, this small reduction becomes a significant decrease in patient care costs.

The data continues to be collected with the trend in improvement in outcomes has been sustained since the year 2000. No other institution-wide changes were made involving the diagnosis and care of acute pancreatitis since the algorithm was introduced. Therefore, we believe that the development of the acute pancreatitis algorithm and its use is primarily responsible for the improvement observed at the University of Missouri Hospital and Clinics in the outcomes of our treatment of acute pancreatitis.

Conflict of interest The authors have no potential conflicts of interest

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