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PGY-1
CRC Proposal

Application of the Ottawa Heart Failure Risk Scale to triage hospital admissions for acute decompensated heart failure

A. Study Purpose and Rationale

Heart failure affects over 5 million people in the United States and remains a significant cause of morbidity and mortality.[1] Acute decompensated heart failure (ADHF) remains one of the most frequent reasons for admissions to the hospital setting and represents an enormous cost burden to the health care system. Part of the challenge lies in the wide range of clinical presentations with dysfunction seen in the CV, respiratory, renal, hepatic and neurologic function. Not only does this make diagnosis of heart failure difficult, but determining the severity of decompensation challenging as well. Furthermore, outcomes vary greatly with admissions ranging from brief hospital stays for short courses of IV diuretics, to decompensations resulting in respiratory failure requiring intubation, ICU transfer, advanced therapies, or even progression to death. Indeed, the 5-yr mortality after initial diagnosis is nearly 50%.[1]

As a result, the trend has been for a conservative approach regarding the decision to admit vs. manage in the outpatient setting. One study found that as high as 73% of ED visits for ADHF result in admission, in stark contrast to the general admission rate of ~13% for all ED visits.[2] Furthermore, ADHF remains one of the most common reasons for readmission to the hospital after discharge, with a rate as high as 20-30% within 30 days.[3] To this end, recent focus has been placed on developing algorithms for stratifying risk of complications in order to discern which patients can be treated in the outpatient setting and which require admission. Several studies have demonstrated the utility of natriuretic peptides (BNP and NT-proBNP) in providing a rapidly available objective measure of severity of ADHF, including the REDHOT, IMPROVE-CHF, and BASEL studies.[2,4–6] These promising results have led to a proposal for a large multi-center study (STRATIFY) to develop a comprehensive model using data available during ED evaluation to estimate risk of complication and aid in the decision of whether or not to admit.[7]

Interestingly, a recent multi-center study in Canada found a much lower admission rate of 38% for ADHF but accordingly a high rate of serious complications among patients not admitted.[8] Using these data, they developed the Ottawa Heart Failure Risk Scale (OHFRS) incorporating patient history, vitals, EKG, and lab values (including BNP) on presentation. The final model gave 1 point each for: History of Stroke/TIA, $SaO_2 < 90\%$, HR > 110bpm during 3 min walk test, BUN > 12mmol/L, and NT-proBNP > 5000 ng/L, as well as 2 points each for: History of Intubation, HR > 110bpm, $CO_2 > 35$mmol/L, Positive Tpn, or EKG with ischemic changes. The final scale ranged from 0 to 15 points and correlated well with predicting serious complications of: 1) Death from any cause within 30 days, or within 14 days, 2) Admission to an ICU, 3) New need for noninvasive ventilation or intubation, 4) Myocardial infarction, 5) Cardiac surgery (including PCI and CABG) or new HD, or 6) Admission to the hospital from any cause.

At CUMC/NYP Presbyterian – Milstein, decisions to admit are made by ED physicians, followed by assignment to a Medical service by an admissions coordinator. In general, patients considered to be complex or have a risk of complication are triaged to a Housestaff-based service. As an alternative, patients considered to be straightforward with low risk of complication are triaged to a PA-based service. Currently, while this assignment is made with attention to clinical presentation, there is no defined, objective, evidence-based algorithm to guide this process. Indeed, patients occasionally decompensate and are transferred from the PA to the Housestaff service, and presumably patients are admitted to a Housestaff service that would have been well-served on a PA service. Each of these events represents a potential misallocation of resources and prolongation of hospital length-of-stay, as well as potential harm to patient care.

The aim of this study is determine whether application of the OHFRS could accurately risk-stratify our patient population presenting with ADHF and thereby predict which patients were at risk for a more prolonged or complicated hospital course. Ultimately, the goal will be to develop an objective tool for guiding the appropriate triage of ADHF admissions to the ideal service.

B. Study Design and Statistical Analysis
This study will be a retrospective cohort study of patients admitted to the Medicine Housestaff service for acute decompensated heart failure at CUMC/NYP Presbyterian – Milstein during the period of January 1, 2013 to December 31, 2013. We will exclude patients with: prior admission for ADHF within 30 days, prior/ongoing evaluation for advanced therapies (transplant, LVAD), significant valvular disease, or on hemodialysis.

We will then apply the OHFRS with the following modifications: we will use BNP > 500 pg/mL instead of NT-proBNP > 5000 ng/L due to institutional preference, and we will exclude the 3-minute walk test as this is rarely performed at our hospital. The modified-OHFRS will thus range from a score of 0 to 14. We will then determine the presence of serious complications, defined as: death, MI, PCI/CABG, new onset of arrhythmia, transfer to ICU/CCU, intubation or new NIPPV requirement, initiation of vasopressors or inotropes, initiation of dialysis, or prolonged length of stay (> 6 days).

These results will then be used to construct a Receiver Operating Characteristic (ROC) curve. Area under the curve (AUC) will be calculated. For an alpha of 0.05 and beta of 0.20, to detect an AUC as low as 0.60, we would require a sample size of at least 64 patients with each outcome, which at our institution is entirely feasible. We will then determine the sensitivity and specificity at each cutoff score.

C. Study Procedure
N/A

D. Study Drugs
N/A

E. Medical Device
N/A

F. Study Questionnaires
N/A

G. Study Subjects
Cases will be derived from retrospective chart review of hospital admissions at CUMC/NYP Presbyterian – Milstein. Those cases fitting the criteria described in part B will be selected for this study.

H. Recruitment of Subjects
N/A

I. Confidentiality of Study Data
Cases selected for inclusion will be assigned a unique ID code and all personally identifying information will be removed from the chart information. Furthermore, only required clinical data from initial presentation and characterization of hospital course (length of stay, presence of complications, etc.) will be transferred to a separate file prior to data analysis. All information will be stored on secured servers and approved devices in accordance with CUMC IT policies and HIPAA regulations.

J. Potential Conflict of Interest
The study authors claim no potential conflicts of interest.

K. Location of the Study
This study will be conducted through retrospective chart review from a single center (CUMC/NYP Presbyterian – Milstein) in New York, NY.

L. Potential Risks
N/A

M. Potential Benefits
N/A

N. Alternative Therapies
N/A

O. Compensation to Subjects
No compensation will be offered.

P. Costs to Subjects
None

Q. Minors as Research Subjects
No minors will be included in this study.

R. Radiation or Radioactive Substances
N/A

Bibliography

1. Go, A. S. *et al.* Heart disease and stroke statistics--2013 update: a report from the American Heart Association. *Circulation* **127,** e6–e245 (2013).
2. Pang, P. S., Jesse, R., Collins, S. P. & Maisel, A. Patients with acute heart failure in the emergency department: do they all need to be admitted? *J. Card. Fail.* **18,** 900–3 (2012).
3. Jencks, S. F., Williams, M. V & Coleman, E. A. Rehospitalizations among patients in the Medicare fee-for-service program. *N. Engl. J. Med.* **360,** 1418–28 (2009).
4. Maisel, A. *et al.* Primary results of the Rapid Emergency Department Heart Failure Outpatient Trial (REDHOT). A multicenter study of B-type natriuretic peptide levels, emergency department decision making, and outcomes in patients presenting with shortness of breath. *J. Am. Coll. Cardiol.* **44,** 1328–33 (2004).
5. Moe, G. W., Howlett, J., Januzzi, J. L. & Zowall, H. N-terminal pro-B-type natriuretic peptide testing improves the management of patients with suspected acute heart failure: primary results of the Canadian prospective randomized multicenter IMPROVE-CHF study. *Circulation* **115,** 3103–10 (2007).
6. Mueller, C. *et al.* Use of B-type natriuretic peptide in the evaluation and management of acute dyspnea. *N. Engl. J. Med.* **350,** 647–54 (2004).
7. Collins, S. P. *et al.* Risk stratification in acute heart failure: rationale and design of the STRATIFY and DECIDE studies. *Am. Heart J.* **164,** 825–34 (2012).
8. Stiell, I. G. *et al.* A risk scoring system to identify emergency department patients with heart failure at high risk for serious adverse events. *Acad. Emerg. Med.* **20,** 17–26 (2013).