Development of a pancreatic necrosectomy risk score in acute necrotizing pancreatitis

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Introduction

- Necrotizing pancreatitis is associated with high morbidity and mortality
- Pancreatic necrosectomy is considered a late-stage treatment for necrotizing pancreatitis
- There is a paucity of literature describing risk factors for progression to pancreatic necrosectomy among those admitted with acute pancreatitis

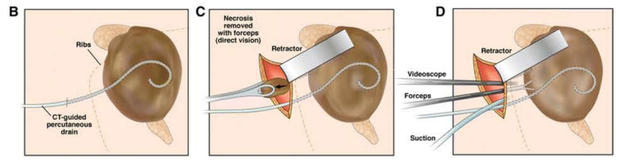


Figure 1: Surgical step-up approach describing percutaneous drain placement in addition to video-assisted retroperitoneal debridement (VARD) for pancreatic necrosis. Adapted from van Brunschot et. al.

Purpose

1. Describe the natural history of patients admitted with acute pancreatitis at our center
2. Develop a risk model predictive of progression to open necrosectomy amongst patients admitted with acute pancreatitis

Data

- Data taken from Henry Ford Multidisciplinary Treatment of Acute Necrotizing Pancreatitis Group (HF-MUSTANG) database of patients with pancreatitis
- Inclusion criteria: adult patients ≥18 years old, admitted July 01, 2013 to July 01, 2022 for acute pancreatitis
- Exclusion criteria: age <18 year old, admission prior to July 01, 2013 or after July 01, 2022

Methods

- Variables of interest† were selected using backwards stepwise selection with criteria for entry P = 0.1 and exit P = 0.2. Logistic regression models were fitted based on selected variables to predict requirement for open pancreatic necrosectomy during the same admission.
- Performance of the model was assessed in the by computing the area under the receiver operating characteristic curve (AUROC) after 10-fold stratified cross-validation.

† Models were adjusted for patient age, sex, BMI, history of hypertension, diabetes, peripheral arterial disease, chronic kidney disease, chronic obstructive pulmonary disease, cerebrovascular disease, dementia, myocardial ischemia in the last 6 months, chronic heart failure exacerbation in the last 30 days, etiology of pancreatitis, prior 30-day readmission, number of prior computed tomography (CT) imaging, and various serum laboratory values within 72 hours of admission

Baseline Characteristics

Table 1: Baseline characteristics of patients admitted with acute pancreatitis from July 01, 2013 to July 01, 2022. A total of 3493 patients were included in this study.

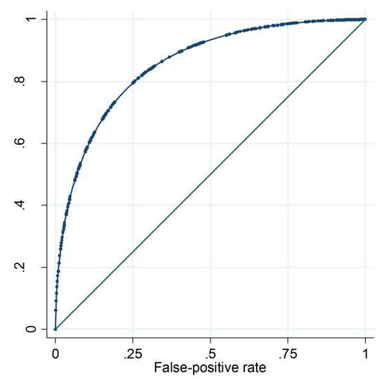
Characteristics	Overall (n=3493)	OR (n=108)	No OR (n=3385)	P-value
Comorbidities				
Age [IQR]	56 [43-68]	55 [42-65]	56 [43-58]	**0.04**
Male Sex (%)	58.6	70.5	58.3	**0.006**
Race (%)				
White	67	78.1	66.6	0.08
Black	22.5	15.3	22.8	
Asian	1.2	0	1.2	
Other	9.3	6.6	9.4	
BMI (kg/m^2) [IQR]	28.1 [23.7-33.3]	31.1 [25-35]	28.1 [23.6-32.3]	**0.007**
Pancreatitis Factors				
Cause of pancreatitis				
Alcohol	61.6	66.7	61.5	0.87
Gallstones	29.2	27.3	29.3	
Drug induced	1	0	1	
Other	8.2	6	8.3	
Presence of pancreatic necrosis on CT imaging (%)	8.1	39	7.1	**<0.001**
Number of prior CT scans [IQR]	1 [0-2]	3 [1-6]	1 [0-2]	**<0.001**
Open necrosectomy (%)		3%		
Repeat open necrosectomy (%)		1%		
Number of prior drains [IQR]	4 [2-8]	10 [6-20]	3 [2-6]	**<0.001**
Hospitalization Factors				
ICU admission (%)	23.3	40.1	23.4	0.2
ARDS on admission (%)	0.2	0	0.2	0.32
CVA on admission (%)	0.1	0	0.6	0.2
MI on admission (%)	1.6	0	1.7	0.09
PE on admission (%)	0.5	0	0.5	0.21
Pneumonia on admission (%)	3.1	1.9	3.1	0.24
Organ failure on admission (%)	29.1	15.2	29.5	**<0.001**
Hospital LOS [IQR]	7.8 [4.2-15]	20.6 [9.4-39.9]	7.6 [4.2-14.4]	**<0.001**
ICU LOS [IQR]	3.1 [1.7-7.3]	6.8 [3.8-20.7]	3.1 [1.7-7]	**<0.001**
Outcomes				
Disposition (%)				
Home	56.7	57	48.1	0.47
SAR	20.6	16.7	21.1	
Inpatient Rehab	3.6	3.4	8.7	
Death/Hospice	13.5	14.9	16.3	
Other	5.6	8	5.8	

Table 2: Multivariable logistic regression identifying risk factors at admission for progression to pancreatic necrosectomy during the same hospital stay amongst those admitted with acute pancreatitis.

Characteristic	Odds Ratio	P-value	95% Confidence Interval	
Number of prior drains	1.081	**<0.001**	1.047	1.116
Male sex	1.209	0.143	0.655	2.232
Race	0.992	0.162	0.724	1.359
Etiology of pancreatitis	0.802	0.274	0.540	1.191
Number of prior CT	1.048	0.216	0.936	1.174
Pancreatic necrosis on CT	4.291	**<0.001**	2.197	8.381
Organ failure on admission	0.362	**0.008**	0.170	0.769
Prior 30-day readmission	2.573	**0.031**	1.092	6.061
ICU on admission	0.812	0.576	0.392	1.684

Results

Model Validation



Area Under Curve	95% Confidence Interval	
0.8551	**0.7899**	**0.9212**

Figure 4: Performance of the pancreatic necrosectomy risk score was assessed in the by computing the area under the receiver operating characteristic curve (AUROC) after 10-fold stratified cross-validation. 95% confidence intervals were calculated 200 bootstrap replications.

Pancreatic Necrosectomy Risk Score

*log odds (open necrosectomy)= 0.08*Number of prior drains + 0.19*Male - 0.01*Race - 0.22*Etiology + 0.05*Number of prior CT + 1.46*Pancreatic necrosis on CT - 1.02*Organ failure on admission + 0.94*30-day readmission - 0.21*ICU admission- 2.72*

Conclusions

- We demonstrate a risk score using 9 easily obtainable clinical factors that robustly predict progression to pancreatic necrosectomy during the same admission amongst patients admitted with acute pancreatitis.
- Further study will be necessary to confirm and validate this model in larger prospective cohorts.

References

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