RISK STRATIFICATION OF PRE-LIVER TRANSPLANT POLYPECTOMY

Paul Travers, M.D.[1], Pedro Cortes, M.D.[1], Ashton E. Body[2], William C. Palmer, M.D.[3], Maoyin Pang, M.D., Ph.D[3]
[1]Mayo Clinic Florida Department of Internal Medicine, [2]Harvard University, [3]Mayo Clinic Florida Division of Gastroenterology

BACKGROUND

- Colonoscopies are routinely obtained prior to liver transplantation, although their utility and safety is a highly debated topic in the literature.
- There is currently no standardized method for clinicians to quantify risk of post-procedural complications.

AIMS

- Study the correlation between clinical and laboratory status at the time of pre-LT colonoscopy with rates of PCC
- Determine if there was an association between colonoscopic findings and/or polypectomy with PCC.
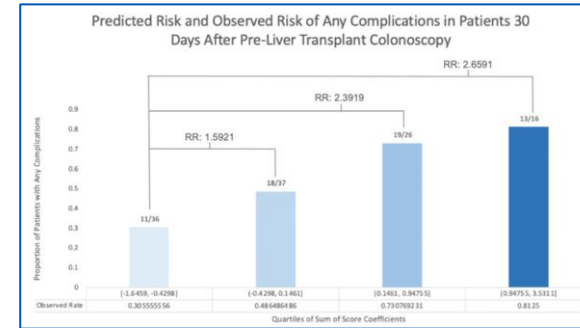- Create a risk score to predict which patients in this population are at highest risk.

METHODS

- **Patients:** All patients ≥ 18 yo who underwent a liver transplantation at Mayo Clinic Florida between May 2012 and March 2022 and had a colonoscopy within 90 days of transplantation were included. A total of 131 patients were included.
- **Primary Outcome:** Any complication, defined as occurring within 30 days of the pre-transplant colonoscopy, was the primary composite outcome. (Table 1)
- **Risk Score Development:** Wilcoxon Rank Sum or Fisher's exact tests were utilized to identify variables associated with the primary composite outcome. Univariable logistic regression analysis was performed to determine variables predictive of the primary composite outcome.

Logistic Regression

Baseline Characteristics	Any Complication		Acute Renal Failure		Infections	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
Age at colonoscopy, per 1 year	1.01 (0.97-1.04)	0.76	1.00 (0.97-1.04)	0.80	0.99 (0.95-1.03)	0.75
Age ≥ 65 years	1.21 (0.53-2.76)	0.66	2.10 (0.90-4.88)	0.87	0.81 (0.28-2.38)	0.70
Male gender	0.74 (0.35-1.55)	0.42	0.49 (0.23-1.06)	0.07	1.09 (0.43-2.77)	0.85
BMI, per 1 kg/m²	1.01 (0.95-1.08)	0.66	1.02 (0.96-1.09)	0.56	1.00 (0.92-1.08)	0.92
Obesity	1.06 (0.52-2.19)	0.87	1.50 (0.70-3.23)	0.30	1.01 (0.41-2.50)	0.99
Complications from Cirrhosis						
Ascites	2.74 (1.22-6.12)	**0.0142**	2.52 (0.95-6.68)	0.063	2.07 (0.66-6.54)	0.21
Hepatic Encephalopathy	2.24 (0.94-5.30)	0.068	2.23 (0.78-6.40)	0.14	0.46 (0.17-1.23)	0.12
Grade 1 or 2	1.58 (0.30-8.28)	0.59	2.75 (0.31-24.54)	0.37	NA	NA
Grade 3 or 4	0.63 (0.13-3.30)	0.59	0.36 (0.041-3.24)	0.37	NA	NA
SBP	3.66 (1.15-11.63)	**0.028**	2.70 (1.02-7.13)	**0.045**	1.52 (0.49-4.66)	0.47
Hepatorenal syndrome	1.62 (0.52-5.05)	0.40	3.00 (1.01-8.95)	**0.049**	0.62 (0.13-2.95)	0.55
Hemodialysis-dependent	4.94 (0.58-42.23)	0.14	6.36 (1.18-34.3)	**0.032**	0.69 (0.080-6.04)	0.74
Labs at time of colonoscopy						
Sodium, per 1 mg/dL	1.01 (0.94-1.07)	0.86	0.99 (0.93-1.07)	0.86	1.05 (0.96-1.14)	0.29
Total bilirubin, per 1 mg/dL	1.10 (1.04-1.17)	**0.0007**	1.08 (1.04-1.12)	**0.0002**	1.01 (0.98-1.05)	0.56
INR, per 1 point	2.40 (1.22-4.71)	**0.011**	2.21 (1.16-4.23)	**0.016**	0.85 (0.44-1.67)	0.65
Albumin, per 1 mg/dL	0.69 (0.38-1.24)	0.21	1.01 (0.54-1.90)	0.97	0.53 (0.24-1.15)	0.11
Creatinine, per 1 mg/dL	1.20 (0.92-1.55)	0.18	1.54 (1.16-2.04)	**0.0030**	0.95 (0.70-1.29)	0.75
MELD-Na score, per 1 point	1.10 (1.05-1.16)	**0.0002**	1.15 (1.08-1.22)	**<0.0004**	0.98 (0.93-1.03)	0.50
MELD-Na ≥ 21	3.47 (1.64-7.35)	**0.0011**	5.74 (2.06-15.98)	**0.0008**	0.63 (0.26-1.52)	0.30
MELD-Na ≥ 30	4.99 (1.77-14.11)	**0.0024**	7.33 (2.97-18.09)	**<0.0004**	0.85 (0.29-2.52)	0.77
Colonoscopy Data						
Bowel Prep Adequate	1.40 (0.57-3.40)	0.46	2.57 (0.82-8.11)	0.11	0.22 (0.082-0.59)	**0.0027**
Total Number of Polyps Found, per 1 polyp	1.08 (0.83-1.39)	0.58	0.96 (0.73-1.27)	0.78	1.01 (0.74-1.39)	0.94
Polypectomy Performed	1.17 (0.57-2.38)	0.67	0.92 (0.43-1.97)	0.82	1.59 (0.66-3.82)	0.30
Polyp > 8 mm Removed	0.62 (0.18-2.05)	0.43	0.46 (0.11-1.93)	0.29	2.36 (0.61-9.08)	0.21
Findings on Colonoscopy						
Rectal varices	0.75 (0.21-2.74)	0.67	0.97 (0.24-3.97)	0.97	0.45 (0.054-3.72)	0.46
Portal Hypertensive Colopathy	0.50 (0.081-3.10)	0.46	1.54 (0.25-9.62)	0.64	1.06 (0.11-9.94)	0.96
Diverticula	1.01 (0.44-2.30)	0.98	0.78 (0.32-1.95)	0.60	1.08 (0.39-3.01)	0.88
Ulcers/friable tissue	0.89 (0.28-2.80)	0.84	1.01 (0.29-3.50)	0.98	0.75 (0.16-3.62)	0.72
Arteriovenous malformations	0.76 (0.10-5.60)	0.79	0.75 (0.076-7.46)	0.81	NA	NA
Mass	0.50 (0.081-3.10)	0.46	0.56 (0.060-5.15)	0.61	2.99 (0.47-18.90)	0.25
Complications 30 days pre-colonoscopy						
Acute Kidney Injury	2.82 (0.87-9.19)	**0.085**	3.01 (1.067-8.50)	**0.037**	2.73 (0.90-8.28)	**0.077**
Ascites	4.30 (0.90-20.46)	**0.067**	2.50 (0.75-8.30)	0.13	3.54 (1.02-12.27)	**0.047**
Infection	7.59 (1.67-34.5)	**0.0088**	3.46 (1.25-9.58)	**0.017**	1.79 (0.57-5.59)	0.32
Hypotension Requiring Pressors	0.77 (0.0469-12.53)	0.85	NA	NA	NA	NA
Respiratory Failure	NA	NA	NA	NA	NA	NA

	aOR	2.5%	97.5%	P-Value	Score Coefficient
(Intercept)	0.2738	0.0696	0.9842	0.0529	-1.2955
Age = 65	2.2501	0.8292	6.4610	0.1181	0.8110
Male	0.7044	0.2776	1.7548	0.4532	-0.3504
MELD-Na = 21	4.0026	1.5609	11.0288	0.0050	1.3869
History of HE	1.1065	0.3423	3.5660	0.8639	0.1012
Ascites 30 days prior	4.7426	0.9881	35.9804	0.0770	1.5566
Infection 30 days prior	8.4345	2.2050	58.6155	0.0093	2.1323
Never Smoker	1.3551	0.5631	3.3064	0.4986	0.3039

AURROC: 0.7756; AIC: 145.5707

Calculated Predicted Risk: $\dfrac{e^{[sum(score\ coefficients)]}}{1+e^{[sum(score\ coefficients)]}}$

Predicted Risk and Observed Risk of Any Complications in Patients 30 Days After Pre-Liver Transplant Colonoscopy

Cutoff	No. of Patients	No. Complications	% Complications	Sensitivity	Specificity	PPV	NPV	LR+
≥-0.4298	37	18	48.65%	0.9016	0.4528	0.6548	0.7500	1.6477
≥0.1461	26	19	73.08%	0.7705	0.6981	0.7460	0.7255	2.5522
≥0.9380	32	26	81.25%	0.3770	0.9057	0.8214	0.5581	3.9979
Total	131	74	56.49%					

PPV, positive predictive value; NPV, negative predictive value; LR, positive likelihood ratio

*Cutoff corresponds to the sum of score coefficients for the model
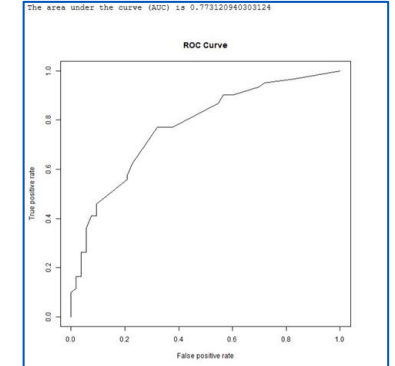

ROC Curve

CONCLUSIONS

- History of ascites, SBP, and MELD-Na score were predictive of PCC.
- Completion of polypectomy, regardless of the size of the polyp, and colonoscopic findings were not predictive of PCC
- Patients with DC have an elevated baseline risk of any PCC
- As scores on our risk calculator increased, so did the observed rate and relative risk of PCC

RESULTS

Predicting Any Complication: Ascites, SBP, total bilirubin, PT/INR, MELD-Na, and infection in the 30 days prior to pre-LT colonoscopy were statistically significant predictors of any PCC on unadjusted logistic regression. Multivariable logistic regression gave us a 7 variable model to predict any PCC. The strongest predictors of PCC were MELD-Na ≥ 21 and history of any infection in the 30 days prior to colonoscopy.

Accuracy of the Risk Score: The sum of the score coefficients was subdivided into quartiles and the OR for any PCC was calculated for our included patient population. The AURROCC of the model was 0.7756. The sensitivity, specificity, PPV, NPV, and positive LR were calculated for different cutoff values of the sum of the score coefficient. At the lowest cutoff, the multivariable model had a sensitivity of 90.1%, NPV of 75%, and LR of 1.64, and a specificity of 90.6%, PPV of 82%, and LR of 3.99 at the highest cutoff.

REFERENCES

1. Weismuller, TJ, Bleich, F, Negm, AA, Schneider, A. Screening colonoscopy in liver transplant candidates: risks and findings. Clin Transplant. 2013; 27(2):E161-8
2. Huang RJ, Banerjee S, Friedland S, Ladabaum U. Risk of ambulatory colonoscopy in patients with cirrhosis: a propensity-score matched cohort study. Endosc Int Open. 2020;8(10): E1495-E1501