

UTILITY OF INTERMACS RISK CLASSIFICATION AT THE TIME OF ASSESSMENT FOR ADVANCED THERAPIES

F. Foroutan, E. Friesen, J. Krakovsky, S. Chih, H.J. Ross, A.C. Alba

Ted Rogers Centre of Excellence in Heart Function, Peter Munk Cardiac Centre, University Health Network
Department of Heart Failure and Heart Transplantation, Ottawa Heart Institute, University of Ottawa



INTRODUCTION

Durable ventricular assist device (VAD) and heart-transplantation are two therapeutic choices for end-stage heart failure patients. Heart-transplantation (HTx) is the treatment of choice due to a superior median survival. Due to lack of donor organs, however, heart transplantation is not always readily available for advanced heart failure patients with uncertain and variable prognosis. Clinicians and health care providers are tasked with identifying the best therapeutic course for such patients. To determine the best course of therapy, health care providers may rely on risk scores to classify patients with respect to their prognosis.

The Interagency Registry of Mechanically Assisted Circulatory Support (INTERMACS) is an instrument developed to profile patients based on hemodynamic status prior to VAD implant. It is a seven-point scale with the purpose of refining patient selection for mechanical assistance.

Previous studies established its prognostic utility at the time of VAD implant or HTx. We aimed to assess the INTERMACS in heart failure patients at the time of assessment for advanced therapies.

RESULTS

Median age was 53 years (IQR 44 – 60), 53% male (Table 1). The median follow-up of this cohort was 2.9 years (min of 1 day, max of 12 years) . During this follow-up period, 84 patients received a VAD as bridge to transplant/candidacy prior to listing, and 419 patients were listed. Of the VAD patients, 51 were subsequently listed for transplant; 18 who, were not listed, died during VAD support. Of the 470 listed patients, 17 were de-listed, 31 died on the list, 273 received a HTx, and 100 required first VAD implantation (of which 74 received HTx).

We did not find any association between INTERMACS risk classification and overall mortality (Figure 1). Only INTERMACS class III, as compared to INTERMACS class I, showed lower risk of overall mortality. Treatment with HTx reduced the overall risk of mortality. We observed a 2 fold increase in the risk of mortality in patients treated with VAD (Table 2).

On the waitlist, treatment with VAD was associated with higher mortality risk. Patients classified as INTERMACS I-II showed a 5 fold increase in the risk of mortality and de-listing. This risk was significantly mitigated with the VAD support (HR 0.1, 95% CI 0.02 – 0.4). Implantation with VAD was associated with higher probability of transplantation. INTERMACS III-IV were more likely to receive a transplant, but this probability was decreased with utilization of VAD support (HR 0.3, 95% CI 0.2 – 0.6) (Table 3).

Table 1 – Baseline demographics by INTERMACS status

	Overall	I	II	INTERMACS	III	IV	V-VII	P-Value
n	503	33	14	126	102	228		
Age	53 (44 - 60)	55 (47 - 58)	55 (35 - 64)	52 (42 - 61)	54 (42 - 60)	53 (45 - 60)		0.5
Female Sex (%)	235 (47)	11 (33)	6 (42)	54 (43)	46 (45)	118 (52)		0.23
Creatinine (mg/dl)	102 (81 - 131)	92 (78 - 112)	89 (76 - 124)	103 (81 - 144)	98 (77 - 135)	104 (86 - 130)		0.27
Hemoglobin (g/dl)	124 (106 - 138)	102 (89 - 117)	96 (69 - 121)	109 (91 - 125)	120 (100 - 136)	132 (121 - 144)		<0.0001
BMI	24 (22 - 29)	23 (22 - 27)	24 (18 - 31)	25 (21 - 28)	24 (21 - 28)	25 (22 - 29)		0.21
Ischemic Etiology (%)	156 (31)	13 (39)	3 (21)	38 (30)	33 (32)	69 (30)		0.76
Diabetes (%)	109 (22)	4 (12)	3 (21)	33 (26)	23 (22)	46 (20)		0.46
Blood group								
A	210 (42)	13 (39)	8 (57)	57 (45)	35 (34)	97 (42)		
B	26 (5)	5 (15)	1 (7)	8 (6)	6 (6)	6 (3)		
AB	61 (12)	5 (15)	1 (7)	9 (7)	14 (14)	32 (14)		0.1
O	206 (41)	10 (30)	4 (29)	52 (41)	47 (46)	93 (41)		

METHODS

We conducted a retrospective cohort study of consecutive Heart Failure patients assessed and deemed eligible for advanced therapies. We included patients followed at Toronto General Hospital and Ottawa Heart Institute between 2006 – 2016. Patients were followed from the time of VAD implant or at the time of listing for HTx. We classified the hemodynamic profile of patients at the time of assessment for advanced therapies. The INTERMACS hemodynamic risk classification tool was utilized for classification of patients. Assessment was made in duplicates by two intentent reviewers blinded to outcomes.

To evaluate the association between INTERMACS classification with the composite outcome of overall mortality (mortality on the waitlist, post-VAD, and post-HTx) and de-listing, we developed a multivariable cox-regression model (with the weibull distribution). We adjusted the model for VAD and HTx as time-dependent covariates, along with age, creatinine, hemoglobin, and etiology at the time of assessment.

To evaluate the impact of advanced therapies (VAD compared to listing for HTx) with waitlist mortality, we conducted a multivariable competing risk cox regression model with HTx as competing event. We also tested the probability of HTx with death as the competing event. The utility of VAD was evaluated as a time-dependent covariate (as some patients were listed for transplantation, but subsequently required VAD implantation.)

Table 2 – Association between INTERMACS and overall mortality

	Hazard Ratio	95% Confidence Interval	P-value
INTERMACS			
II	0.51	0.16 – 1.62	0.25
III	0.40	0.20 – 0.83	0.013
IV	0.62	0.30 – 1.28	0.199
V-VII	0.57	0.28 – 1.14	0.111
VAD	2.07	1.23 – 3.50	0.006
HTx	0.49	0.29 – 0.82	0.007

Adjusted for age, creatinine, hemoglobin, and etiology

Table 3 – Association between INTERMACS and waitlist outcomes

MORTALITY & DELISTING			
	Hazard Ratio	95% Confidence Interval	
VAD	5.26	2.41 – 11.49	<0.001
INTERMACS			
I - II	4.76	1.73 – 13.11	0.003
III - IV	1	0.52 – 1.93	0.999
VAD & INTERMACS I - II	0.11	0.03 – 0.44	0.002
VAD & INTERMACS III-IV	0.58	0.21 – 1.58	0.286

TRANSPLANT

	Hazard Ratio	95% Confidence Interval	
VAD	1.87	1.25 – 2.79	0.002
INTERMACS			
I - II	1.42	0.56 – 3.60	0.455
III - IV	1.58	1.20 – 2.07	0.001
VAD & INTERMACS I - II	0.51	0.17 – 1.55	0.233
VAD & INTERMACS III-IV	0.33	0.20 – 0.56	<0.001

CONCLUSION

INTERMACS classification at the time of assessment for advanced therapies has no association with overall mortality of heart failure patients, even when adjusting for their advanced therapies. INTERMACS hemodynamic profile at the time of assessment may be useful for selection of heart failure patients for VAD implantation, as it reduced the risk mortality on the waitlist.

Figure 1 – Overall survival by INTERMACS

