The performance of the RADIAL score to predict primary graft failure in heart transplant recipients surviving prolonged ventricular assist device support.

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Background

Primary Graft Dysfunction (PGD) often occurs intraoperatively and is the primary cause of early mortality after heart transplantation(HT). The RADIAL score is a simple grading system for predicting severe PGD(Table 1). Higher scores are predictive of PGD. However, at our center HT recipients predominately rely on ventricular assist device (VAD) support for exceptionally long periods and the RADIAL score has not been validated in such patients groups.

Table 1 Calculation of the RADIAL score⁽¹⁾

A point for each category is added for a total score

- R** Right atrial pressure>10mmHg,
- A** recipient Age>60y,
- D** Diabetes mellitus,
- I** Inotrope dependence,
- A** donor Age>30y,
- L** Length of ischemic time>240

Goal of Study

Our goal was to examined the performance of the the RADIAL score for predicting PGD at our single center.

Methods

We conducted a retrospective analysis of 63 adult HT recipients at our hospital from 2010 to 2016. Collected data included age, sex, reliance and length of VAD support, and the occurrence of PGD. The RADIAL score was calculated for each case. Our primary outcome was the correlation of the RADIAL score with the occurrence of PGD. To assess the predictive value of the RADIAL score a logistic-regression model was constructed from the collected results and the area under a receiver-operating characteristic (ROC) curve was calculated. A value over 0.7 was considered as an acceptable predictive performance model.

Results

We included 63 HT cases for the final analysis.(Table 2) There were 27 cases of PGD.(Table 3) The RADIAL score was calculated for each case. (Table 3) The average RADIAL score for PGD and non-PGD cases was, 2.4 ± 1.0 and 1.9 ± 1.0 , respectively ($p = 0.06$) . The area under the ROC curve calculated from our model was 0.61.

Table 2 Patient background and severity of Primary Graft Dysfunction (PGD)

Patient Background		Severity of Primary Graft Dysfunction [n, (%)]	
Number of patients [n]	63	none	36 (57.1)
Age, years	39 ± 13	mild	9 (14.3)
Sex (female / male)	22/41	moderate	13 (20.6)
BMI (kg/m ²)	20.6 ± 3.4	severe	5 (7.9)
Circulatory assist			
LVAD , n (%)	57 (90.5)		
assist period, (days)	869 ± 398		
LVAD drive-line infection , n (%)	17 (27.9)		

LVAD: left ventricular assist device

Table 3 RADIAL scores

RADIAL related values (n=63)		RADIAL scores (n)	
Right atrial pressure [mmHg]	7.9 ± 4.1	Low risk	
Recipient age [years]	39 ± 13	0 point	3
Diabetes mellitus [n]	0	1 point	15
Inotrope dependence [n , (%)]	35 (55.6)	Moderate risk	
Estimated donor age [years]	42 ± 13	2 points	25
Length of ischemic time [min]	217 ± 45	High risk	
RADIAL score	2.1 ± 1.1	3 points	12
		4 points	8
		5 points	0
		6 points	0

Fig.1 The relationship between severity of PGD and RADIAL score.

Table 4 Comparison of PGD grades and average RADIAL scores

Comparison 1	PGD of any grade	No PGD	p-value
RADIAL score	2.4 ± 1.0	1.9 ± 1.0	0.055
Comparison 2	moderate to severe PGD	Mild PGD and no PGD	p-value
RADIAL score	2.3 ± 1.1	2.0 ± 1.0	0.30
Comparison 3	Severe PGD	Mild to Moderate PGD and no PGD	p-value
RADIAL score	2.6 ± 1.3	2.1 ± 1.0	0.29

Table 5 Performance in predicting PGD severity

Prediction	RADIAL score cut-off value	Odds Ratio(95% Confidence Interval)	p-value	Area Under Curve from calculated ROC curve
PGD of any grade	3	0.65(0.36-1.00)	0.06	0.63
moderate to severe PGD	4	0.76(0.45-1.28)	0.29	0.56
Severe PGD	4	0.62(0.26-1.50)	0.28	0.61

Conclusion

The performance to for the RADIAL score to predict PGD was low in our model. Although this was a small single center analysis, the RADIAL score may not be useful in predicting PGD in patients undergoing HT after surviving longer periods of VAD support.

1) RADIAL: A novel primary graft failure risk score in heart transplantation. JavierSegovia et al. The Journal of Heart and Lung Transplantation 2011;644-651.