Postoperative Vasoplegia After LVAD Implantation: External Validation Of A Preoperative Risk Model

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SUMMARY

- External validation of a preoperative risk model predicting vasoplegia after end-stage heart failure surgery
- Single centre retrospective cohort study
- Patients scheduled for first time long-term LVAD implantation
- Conclusion: The risk model could not accurately predict postoperative vasoplegia in these patients

BACKGROUND

Post-cardiac surgery vasoplegia is associated with increased morbidity and mortality. Recently, a prognostic risk model was published predicting post-operative vasoplegia in 225 patients undergoing end-stage heart failure surgery¹ (Table 1). As the left ventricular assist device (LVAD) group in the above study was small (15%), we investigated the predictive accuracy of this risk model in a larger group of end-stage heart failure patients undergoing long-term LVAD implantation.

METHODS

Patients undergoing first time long-term LVAD implantation from 2006 to 2016 were included. We used the definition of vasoplegia as proposed by van Vessem et al¹: cardiac index $\geq 2.2 \text{ L}\cdot\text{min}^{-1}\cdot\text{m}^{-2}$ and need for continuous vasopressor support (norepinephrine $> 0.2 \mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ or any dose of terlipressin) for 12 consecutive hours in the first 72 hours post-operatively. External validation was conducted with C-statistic and the Hosmer-Lemeshow goodness-of-fit (H-L) test.

Predictors	Coefficients
Age	+ 0.007 · [years]
Male gender*	+ 0.986
Surgical procedure	
- LVR*	- 1.533
- Cor Cap*	- 1.454
- LVAD	0
Creatine Clearance	- 0.005 · [ml·min ⁻¹]
Thyroxine	+ 0.029 · [pmol·l ⁻¹]
Anaemia*	+ 0.063
Bètablokker use*	- 0.610

Table 1. Vasoplegia risk score model formula coefficients¹ LVR: Left Ventricular Restoration, LVAD: Left Ventricular Assist Device. *Dichotomous results

	UMCU Cohort (n=153)	V. Vessem LVAD (n=33)	V. Vessem Cohort (n =225)
Age (years)	50 ± 13	59 ± 10	62 ± 10
Male gender	107 (70%)	26 (79%)	166 (74%)
Anaemia	80 (52%)	19 (58%)	70 (31%)
CrCL (ml/min)	71 ± 29	66 ± 21	74 ± 30
Thyroxine (pmol/l)	16 ± 5	19 ± 3	19 ± 3*
Bètablokker use	42 (28%)	26 (79%)	190 (84%)

Table 2. Patient characteristics Dichotomous data are shown as number (%). Continuous data are shown as mean ± standard deviation (SD), UMCU: University Medical Centre Utrecht, LVAD: Left Ventricular Assist Device. CrCL: creatinine clearance. *data based on 156 patients

Figure 1. ROC curve C-statistics showed a AUC of 0.61 (95%CI 0.52-0.70) indicating that the risk model predicted post-operative vasoplegia slightly better than random chance in our patient cohort.

RESULTS AND DISCUSSION

We included 153 patients of which 65 (42%) developed vasoplegia (Table 2: UMC-cohort). The H-L test indicated that observed and expected proportions were not significantly different ($p=0.69$, $df=8$). The AUC in our cohort after intercept calibration was 0.61 (95%CI 0.52-0.70) (Figure 1).

The incidence of vasoplegia in our LVAD patients (42%) was lower compared to van Vessem's LVAD group (61%), but higher compared to the overall incidence of vasoplegia in van Vessem's total cohort (29%). We observed in our cohort that more women were included, patients were younger, used less β -blockers and all patients were scheduled for LVAD implantation (Table 2).

Figure 2. Distribution risk scores. Based on proposed risk groups by van Vessem¹. No information was provided about the allocation of LVAD patient in van Vessem's cohort.

Moreover, the distribution of risk scores in our patients was different from patients in van Vessem's total cohort (Figure 2). A risk model developed in a population with a lower risk score is not necessarily applicable on a population with a higher risk score as might be the case in our study. Moreover, a prediction model will most often perform less in a

validation cohort compared to the derivation cohort (AUC 0.76, 95%CI 0.69-0.83)¹. There may be limitations to this study. This is a retrospective study, meaning data collection was not blinded or standardized. There were no missing data of any of the predictors and most hemodynamic data. However, we had to discuss the occurrence of vasoplegia in three patients due to lacking data.

CONCLUSION

In this external validation study, the risk model proposed by van Vessem et al. could not accurately predict which heart failure patients scheduled for first time LVAD implantation developed post-operative vasoplegia.

[1] Van Vessem ME, Palmen M, Couperus LE et al. Incidence and predictors of vasoplegia after heart failure surgery. Eur J Cardiothoracic Surg. 2017; 51(3): 532–8.