# NHS BLOOD AND TRANSPLANT

# CARDIOTHORACIC ADVISORY GROUP – HEART

## Outcomes of urgent heart transplantation in patients with LVAD-related complications in the UK

## INTRODUCTION

1. LVAD-related complications are a common reason for requesting urgent heart transplant listing via the CTAG Adjudication Panel. An analysis of 66 patients urgently listed due to LVAD-related complications was presented at the Autumn 2021 CTAG-Heart meeting. Forty-eight patients received a heart transplant and the one year survival rate was 56%, significantly lower than for other urgent heart transplant recipients (88%).

2. It was agreed that extra data and analysis was required to understand the factors that lead to poor outcomes in this group of patients. This information will help guide adjudication of cases for urgent listing in the presence of LVAD-related complications and potentially shape discussions on allocation of scarce donor organs.

## DATA AND METHODS

3. All adult patients who received a heart transplant due to LVAD-related complications, as indicated by their urgent category, between 26 October 2016 and 31 March 2023 were considered. Patients who had received a total artificial heart (TAH) were excluded from this analysis. The table below shows the number of patients considered by centre:

| Centre | Number of patients |
|---|---:|
| Birmingham | 8 |
| Glasgow | 4 |
| Harefield | 17 |
| Manchester | 10 |
| Newcastle | 16 |
| Papworth | 15 |
| **Total** | **70** |

4. A corresponding cohort of all adult patients with who received a non-urgent transplant from LVAD support in the same time period was extracted for survival comparison.

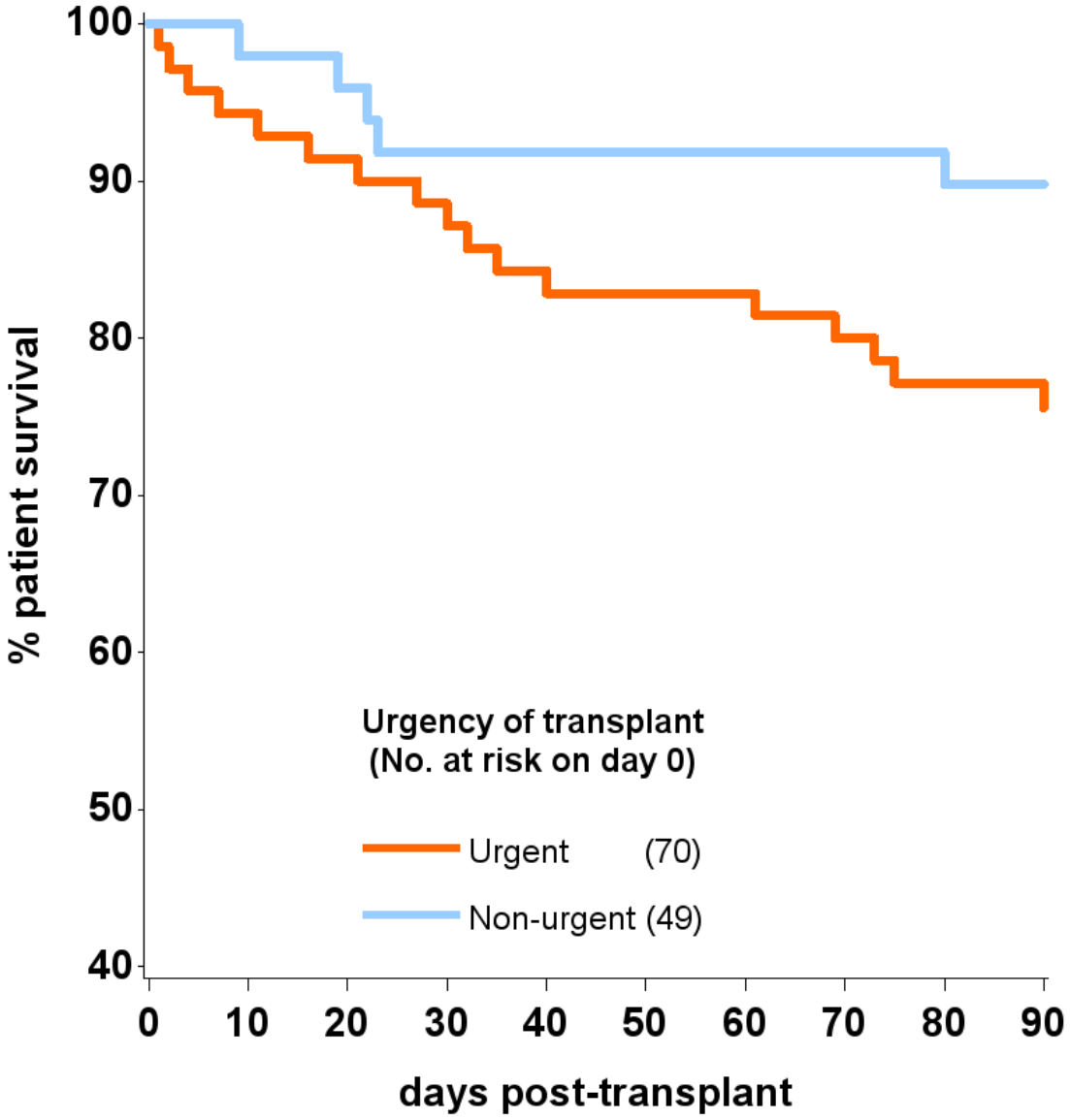
5. Analyses were performed using the Kaplan-Meier estimation method and log-rank test for categorical variables, and univariable Cox model and likelihood ratio test for continuous variables. P-values were considered significant at the 10% level due to the small sample size.

6. The rate of severe PGD was estimated by identifying patients who received short-term Mechanical Circulatory Support (MCS) in the immediate post-transplant period in the VAD Database.

## RESULTS

7. **Figure 1** presents the overall survival of patients in the analysis cohort. The 90 day survival rate for urgent transplant recipients was 75.6% (95% CI: 63.7-84.0) and for non-urgent transplant recipients was 89.8% (95% CI: 77.2-95.6). This difference was statistically significant (p=0.0536). Note that the 90 day survival rate post first adult DBD heart transplant for patients not on VAD support as published in the Annual Heart Transplantation Report is 92.1%.

**Figure 1 90 day survival of patients who received an urgent heart transplant for LVAD complications, with non-urgent LVAD at time of transplant comparison cohort (p=0.0536)**




8. **Table 1** examines the effect of different factors on the likelihood of a patient surviving to 90 days post-transplant. These analyses were limited by the small sample size, and only the centre which performed the transplant was associated with increased risk of mortality, however this is likely due to variations in practice between centres.

9. The rate of severe PGD in the urgent group was 36%. This was significantly higher than the rate of severe PGD in the non-urgent comparison cohort, 18% (p=0.0423).

**Table 1 Examining impact of variables on 90 day survival of urgent patients transplanted due to LVAD-related complications**

| Variable | Died within 90 days N=16 | | Alive at 90 days[1] N=54 | | p-value[2] |
|---|---|---|---|---|---|
| | N | % | N | % | |
| *Presence of complication* | | | | | |
| Right ventricular failure dependent on inotropes | 2 | 18 | 9 | 82 | |
| Recurrent systemic infection related to VAD | 11 | 28 | 29 | 72 | |
| Other VAD issues including refractory VAD thrombosis | 3 | 16 | 16 | 84 | 0.67 |
| *Type of LVAD* | | | | | |
| Heartware (HVAD) | 11 | 26 | 32 | 74 | |
| Heartmate II | 3 | 30 | 7 | 70 | |
| Heartmate III | 2 | 12 | 15 | 88 | 0.47 |
| *More than one VAD* | | | | | |
| No | 14 | 27 | 37 | 73 | |
| Yes (LVAD replaced/Centrimag with LVAD) | 2 | 11 | 17 | 89 | 0.2027 |
| *VAD duration* | | | | | |
| <1 year | 1 | 9 | 10 | 91 | |
| 1 year or more | 15 | 24 | 44 | 76 | 0.44 |
| *GFR group* | | | | | |
| 90ml/min or more | 4 | 22 | 14 | 78 | |
| 60-89 ml/min | 8 | 29 | 20 | 71 | |
| 59 ml/min or less | 4 | 17 | 20 | 83 | 0.59 |
| *BMI* | | | | | |
| <25 | 6 | 38 | 10 | 62 | |
| 25-<30 | 8 | 20 | 33 | 80 | |
| 30 or more | 2 | 15 | 11 | 85 | 0.31 |
| *pHM % difference* | | | | | |
| Oversized (negative difference) | 12 | 27 | 32 | 73 | |
| Undersized (positive difference) | 4 | 15 | 22 | 85 | 0.40 |
| *Ischaemia time* | | | | | |
| <4 hours | 8 | 23 | 27 | 77 | |
| 4 hours or more | 8 | 30 | 19 | 70 | |
| Missing | 0 | 0 | 8 | 100 | 0.76 |
| *Centre* | | | | | |
| Birmingham | 1 | 13 | 7 | 88 | |
| Glasgow | 1 | 25 | 3 | 75 | |
| Harefield | 8 | 47 | 9 | 53 | |
| Manchester | 3 | 30 | 7 | 70 | |
| Newcastle | 2 | 13 | 14 | 88 | |
| Papworth | 1 | 7 | 14 | 93 | **0.0848** |
| Recipient age, median (IQR) | 53 (46 – 58) | | 50 (36 – 59) | | 0.66 |
| Creatinine (umol/l), median (IQR) | 87 (78 – 108) | | 100 (76 – 123) | | 0.58 |

**Table 1 Examining impact of variables on 90 day survival of urgent patients transplanted due to LVAD-related complications**

| Variable | Died within 90 days N=16 | Alive at 90 days[1] N=54 | p-value[2] |
|---|---|---|---|
| Bilirubin (umol/l), median (IQR) | 12 (9 – 20) | 13 (9 – 28) | 0.71 |
| Missing | 1 | 3 | |

[1] For 5 patients survival times were less than 90 days (76-88 days)
[2] Log-rank test for categorical variables and likelihood ratio test for continuous variables

10. **Figure 2** displays the unadjusted Kaplan-Meier survival curves for a selection of the variables in **Table 1**.

**Figure 2 90 day survival of patients who received an urgent heart transplant for LVAD complications, stratified by specific variables in Table 1**

**Figure 2a 90 day survival by complication type (p=0.67)**

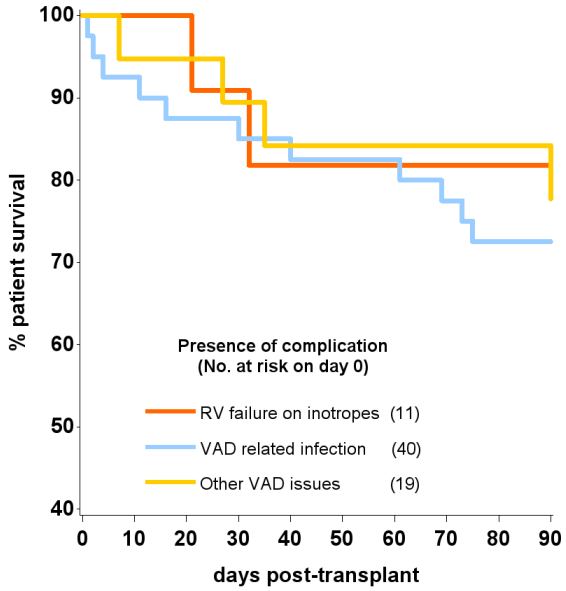



**Figure 2b 90 day survival by LVAD type (p=0.47)**

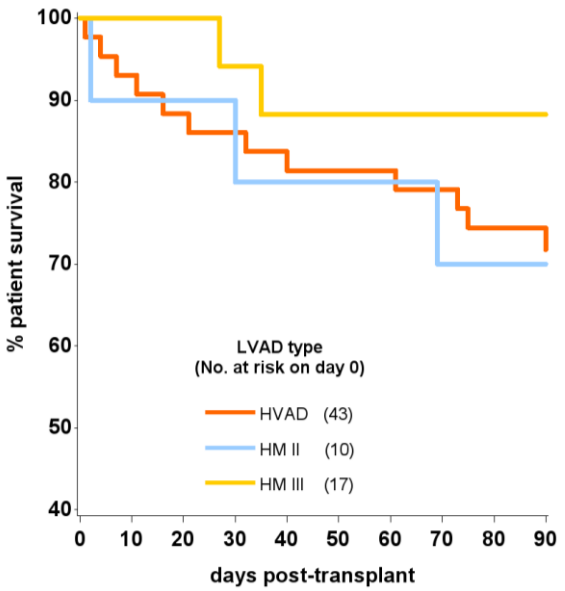



**Figure 2c 90 day survival by recipient BMI group (p=0.31)**

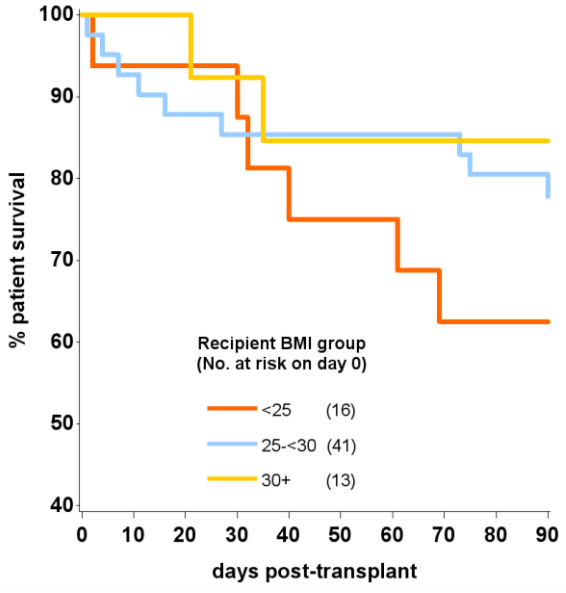
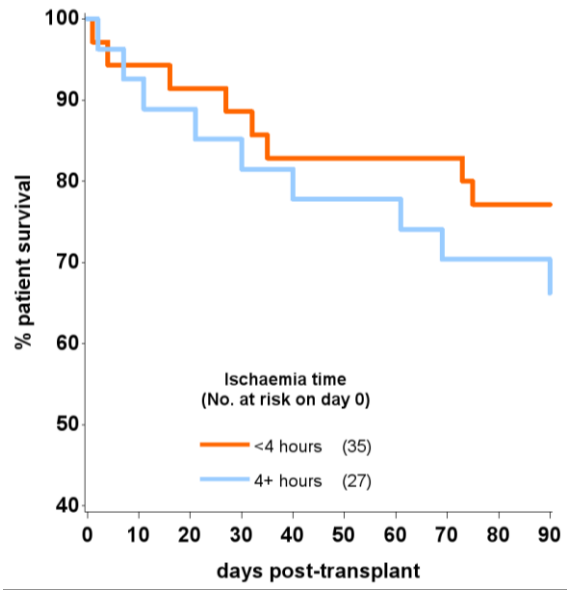



**Figure 2d 90 day survival by ischaemia time (p=0.76)**



## CONCLUSIONS

11. In a cohort of 70 patients who received an urgent heart transplant due to LVAD-related complications, the survival at 90 days was 75.6% (lower than both the 89.8% for non-urgent patients on LVAD at time of transplant and the 92.1% for first adult DBD transplants from patients not on support presented in the Annual Heart Transplantation Report). Differences in survival were only associated with centre, however this is likely due to variations in practice. None of the other variables tested were found to have a significant effect on patient survival at 90 days.

12. This analysis should be interpreted with caution due to the small sample size and unadjusted nature of the tests.

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**Statistics and Clinical Research** **October 2023**