Incidence and cause of persistent low flow alarm after HeartMate 3 left ventricular assist device insertion

Takuya Ogami[1], Yoshifumi Naka[2], Joseph Sanchez[2], Yuming Ning[2], Paul Kurlansky[2], Lucas Witer[2], Yuji Kaku[2], Veli Topkara[2], Melana Yuzefpolskaya[2], Paolo Colombo[2], Sayer Gabriel[2], Nir Uriel[2], Hiroo Takayama[2], Koji Takeda[2]

1.New York-Presbyterian/Queens

2.Columbia Medical center

ABSTRACT

Purpose: This study sought to determine the incidence and cause of readmission due to persistent low flow alarms after HM3 LVAD implantation.

Methods: We retrospectively reviewed 135 patients who received HM3 LVAD between November 2014 and December 2018 in our single center. Patients who required readmission due to persistent low flow alarms were identified and analyzed. Cumulative hazard function curve was constructed for probability of low flow alarm readmission.

Results: Twenty-three patients (17.4%) required 28 readmissions due to persistent low flow alarms during median follow up of 11.2 months. The incidence of readmissions with persistent low flow alarms was 1.31 person-years. The probability of low flow alarm readmission was 17.7% at 1-year. Of 23 patients, 4 patients (17.4%) required multiple readmissions. The etiology of persistent low flow alarms is summarized in Table: Hypovolemia was present in 11 (39.3%) and hypertension was present in 16 (17.8%). Inflow or outflow obstruction requiring surgical intervention was present in 5 (17.8%). The reason for the alarm was not identified in 5 patients (17.8%). No patients had an electrical issue with the pump or a driveline disruption identified.

Conclusion: Readmission due to low flow alarms is relatively common after HM3 LVAD. Hypovolemia was the most frequent etiology of low flow alarms. Obstruction of the inflow cannula or outflow graft is a serious complication that can present with low flow alarms and requires reoperation.

OBJECTIVES

- Advanced heart failure is one of the most challenging condition and was estimated to range between 6-25% of heart failure patients
- Mechanical circulatory support including left ventricular assisting device (LVAD) has developed as a bridging measure to transplant or even definitive treatment.
- HeartMate 3 (HM3: Abbott, North Chicago, IL, USA) is one of most recently innovated LVAD.
- HM3 has some new features including artificial pulse, large flow path pump gaps and modular driveline as well as low flow alarm system.
- We aimed to determine the incidence and cause of readmission due to persistent low flow alarms after HM3 LVAD implantation.

METHODS

- Included all patients who received HM3 for advanced heart failure between November 2014 and December 2018. Patients who required readmission due to persistent low flow alarms were identified and analyzed.
- Outcomes are any complications detected by persistent low flow alarm including mechanical obstruction and right heart failure.

Table 1: Baseline characteristics

	n=23
Age (years, median [IQR])	63.16 [53.99, 76.63]
Male (%)	16 (69.6)
Race (%)	
White	12 (52.2)
Black	6 (26.1)
Hispanic	4 (17.4)
Other	1 (4.3)
Body surface area (m^2,median [IQR])	12 (52.2)
Comorbidities (%)	
Hypertension	15 (68.2)
Hyperlipidemia	13 (59.1)
Diabetes mellitus	8 (34.8)
Coronary artery disease	12 (52.2)
COPD	3 (13.6)
Cerebrovascular accident	3 (13.6)
Peripheral vascular disease	1 (4.3)
Smoking (%)	12 (52.2)
LVEDD (median [IQR])	6.40 [4.10, 8.50]
Right ventricular dysfunction (%)	
Borderline reduced	2 (8.7)
Mild	4 (17.4)
Mild to moderate	1 (4.3)
Moderate	6 (26.1)
Moderate to severe	2 (8.7)
Severe	1 (4.3)

COPD: chronic obstructive pulmonary disease, LVEDD: left ventricular end-diastolic dimension

Table 2: Outcomes

	n=23	%
In-hospital mortality	0	0
Any mortality	1	4.35
RVAD requirement	4	17.4
Received transplant	4	17.4

ECMO: extracorporeal membrane oxygenation, IABP: intra-aortic balloon pump, RVAD: right ventricular assisting device

Table 3: The cause of low flow alarm

	n=28	%
Hypovolemia	11	39.3
Hypertension	5	17.8
Inflow/outflow mechanical obstruction	5	17.8
Right heart failure	1	3.57
Arrhythmia (VT)	1	3.57
Unknown	5	17.8

VT: ventricular tachycardia

RESULTS

- A total of 135 patients
- Median follow up period was 21 months.
- Twenty-three patients (17.4%) required 28 readmissions due to persistent low flow alarms
- The most common cause of low flow alarm was hypovolemia.
- Five (17.8%) cases required surgical intervention for mechanical obstruction.

CONCLUSIONS

Readmission due to low flow alarms is relatively common after HM3 LVAD. Hypovolemia was the most frequent etiology of low flow alarms. Obstruction of the inflow cannula or outflow graft is a serious complication that can present with low flow alarms and requires reoperation. Further follow up and reports from other institutions are warranted.

REFERENCES

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