Case Presentation

Saleem Toro, MD, MA
PGY-3, Cardiology Fellow

Supervisor: Ashrith Guha, MD, MPH, FACC
Medical Director, Heart Transplant and MCS Program ; Director, Pulmonary Hypertension and Right Heart Failure Program

HOUSTON Methodist
DEBAKEY HEART & VASCULAR CENTER

History of Presenting Illness

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27 Y/O male with initial diagnosis of congestive heart failure made in May, 2018 after presenting to the hospital with 2-week history of worsening SOB. The patient was a smoker and had history of substance abuse including methamphetamines and cocaine.

- CTPE which showed bilateral subsegmental PE, no evidence of a DVT in either lower extremity was negative. Placed on Coumadin (financial issues).
- Echocardiography: Left Ventricle LVIDd: 7.35 cm, Left Ventricle LVIDd: 7.35 cm, EF 20-25%, global hypokinesis.
- CTA showed no obstructive CAD. The patient did not have a family history of HF. TSH and Ferritin were also WNL.
- Discharge medications: Metoprolol tartrate 25 mg BID, Lisinopril 2.5 mg daily, Lasix 20 mg daily.
- Readmitted in 9/24/2018 for ADHF and had single lead ICD placed.

History of Presenting Illness

Hospital Course

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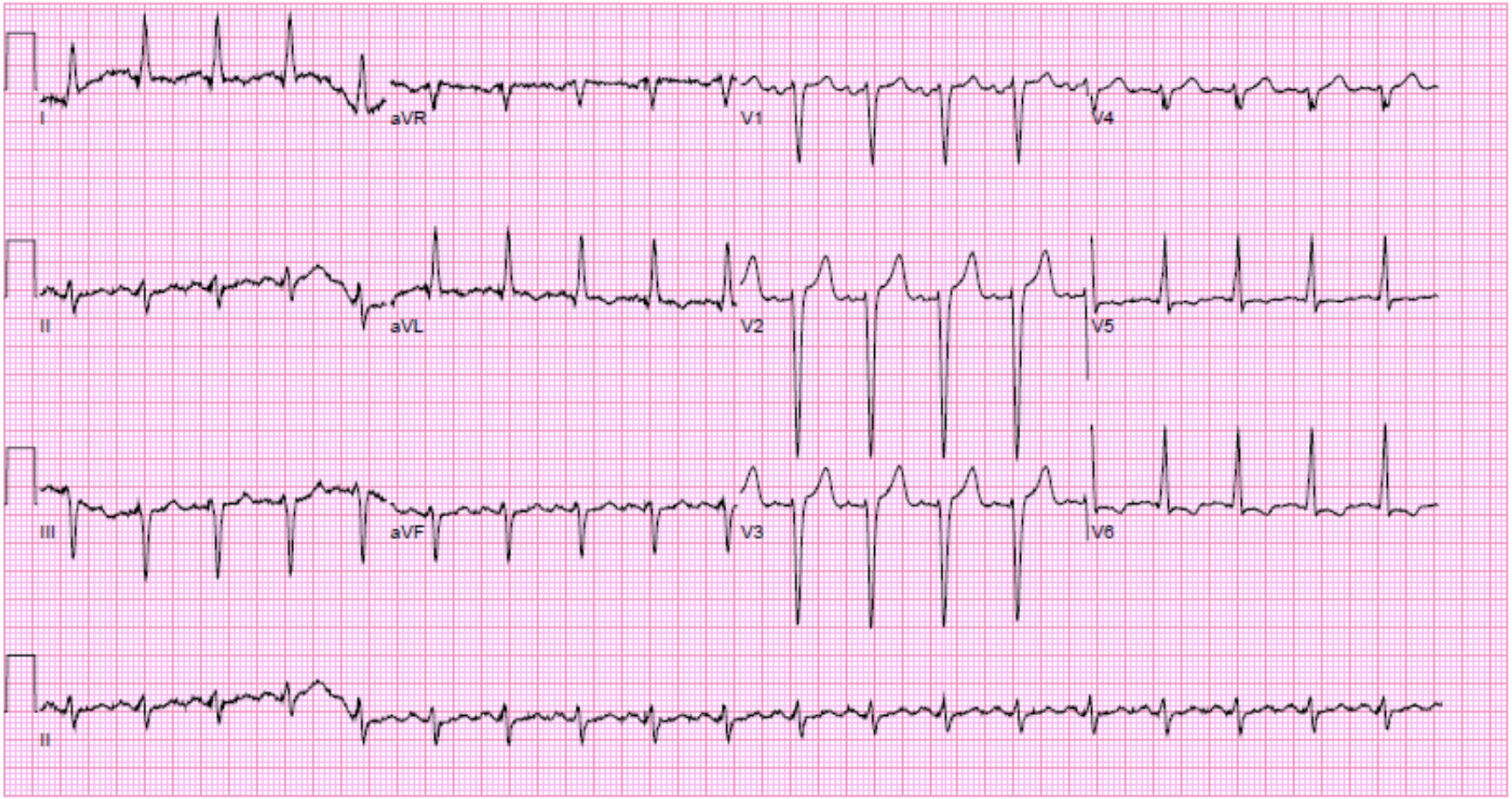

Lab work

Hospital Course

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CBC with platelet count + automated diff

Component Ref Range & Units	5 yr ago
WBC 4.0 - 10.0 K/µL	10.9 ^
RBC 4.20 - 5.80 M/µL	5.23
Hemoglobin 13.0 - 16.8 GM/DL	15.0
Hematocrit 40.0 - 50.0 %	47.4
MCV 82.0 - 98.0 fL	90.6
MCH 27.0 - 33.0 pg	28.7
MCHC 32.0 - 36.0 GM/DL	31.6 v
RDW 12.0 - 15.0 %	14.6
Platelets 150 - 430 K/CU MM	214
MPV 6.5 - 10.5 fL	12.9 ^
nRBC 0 - 0 /100 WBC	0
% Neutros %	54
% Lymphs %	38

Component Ref Range & Units	4 yr ago
TSH 0.27 - 4.20 uIU/mL	3.51

Basic metabolic panel (Na, K+, Cl, CO2, Glu, Ca, BUN, Cr)

Component Ref Range & Units	5 yr ago
Sodium 135 - 148 meq/L	137
Potassium 3.5 - 5.5 meq/L	4.2
Chloride 98 - 106 meq/L	106
CO2 20 - 31 meq/L	21
BUN 10 - 26 mg/dL	18
Creatinine 0.50 - 1.20 mg/dL	1.30 ^
Glucose 70 - 110 mg/dL	94
Calcium 8.5 - 10.5 mg/dL	9.6
EGFR mL/min/1.73 sq m	66

Troponin I

Component Ref Range & Units	5 yr ago
Troponin I 0.00 - 0.15 ng/mL	0.01

ECHOCARDIOGRAPHY

Hospital Course

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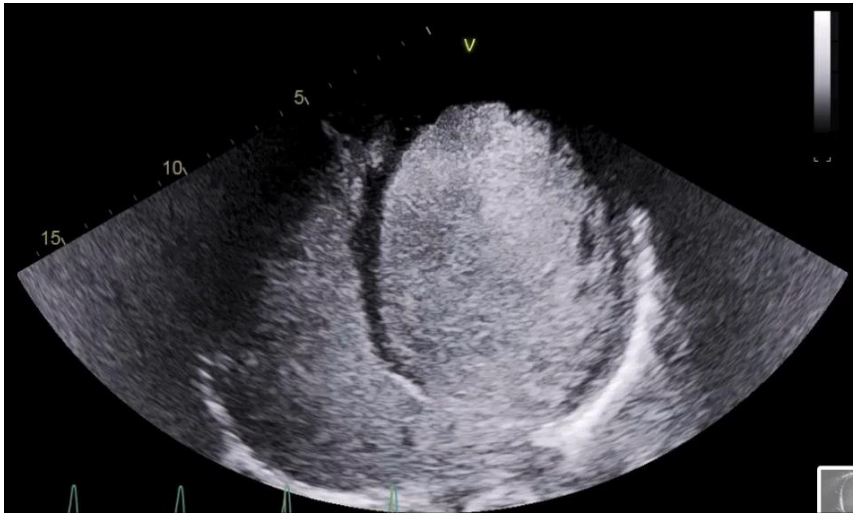

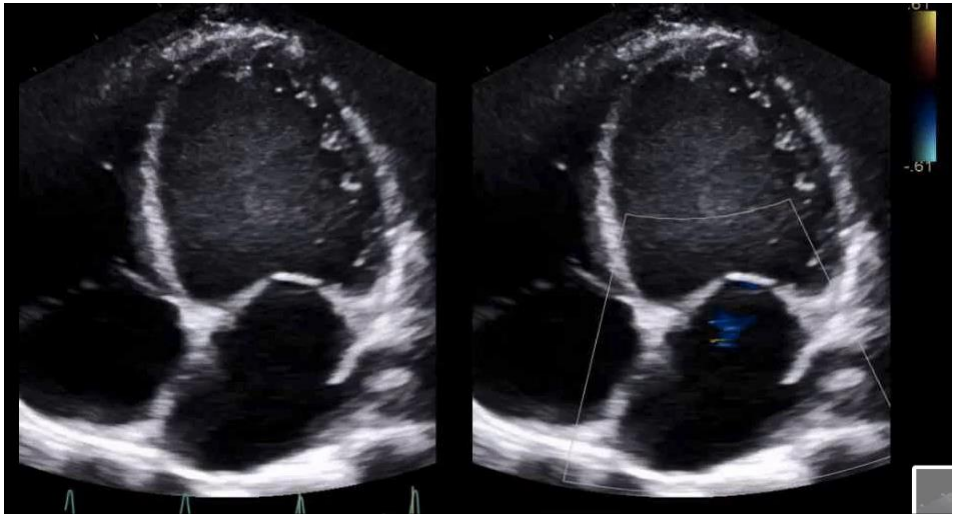

Right Heart Cath

Hospital Course

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Hemodynamics: Condition 1

	Systolic	Diastolic	End Diastolic	Mean	A Wave	V Wave
Right Ventricle	50 mmHg	8 mmHg	18 mmHg			
PA	50 mmHg	30 mmHg		35 mmHg		
Right Atrium				18 mmHg	18 mmHg	22 mmHg
PCW				28 mmHg	30 mmHg	20 mmHg

Derived Hemodynamic Data: Condition 1

Type	HR	Cardiac Output	Cardiac Index	PVR	SVR	PVR Index	SVR Index
Thermo	107	4.13 l/min	2.05 l/min/sqm			272.9	
Fick				159.1		320.2	
	106	3.52 l/min	1.75 l/min/sqm				

Further Work Up

During initial hospitalization

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- Patient was discharged on 10/16/18 on Captopril, Aldactone and Torsemide after being diuresed aggressively.
- Admitted on 11/18/18 to another facility, went into a cardiogenic shock after receiving fluids and being started on Coreg.
- He ended up requiring dobutamine assisted diuresis, EF reported 10% during that admission. Patient was discharged on dobutamine infusion 2 mcg/min.
- Discharge medications also included: Aldactone 25 mg daily, Torsemide/Metolazone and Digoxin 250 mcg/daily.

Further Course

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- Re-admitted on 12/31/18, with worsening SOB, RHC showed
- RA 9, PA 38/22/28, wedge 17, CO 5.07, CI 2.4 (on dobutamine 2mcg/kg/min).
- HMIII placed on 1/11/19, (Patient had history of substance abuse, medication noncompliance, deemed high risk for HT. (INTERMACS score 3, EUROMACS score of 4 (RV failure on Echo, INTERMACS score of 3)

- Patient was transiently on Dobutamine for RV support post LVAD, then he was weaned off and transitioned to Digoxin/Metoprolol succinate /Lisinopril.
- Echo 1/21/2019 post discharge showed (LVEDD 7.9 cm, EF<10%, RV function severely depressed, moderate TR).

Echocardiogram

3/20/2019

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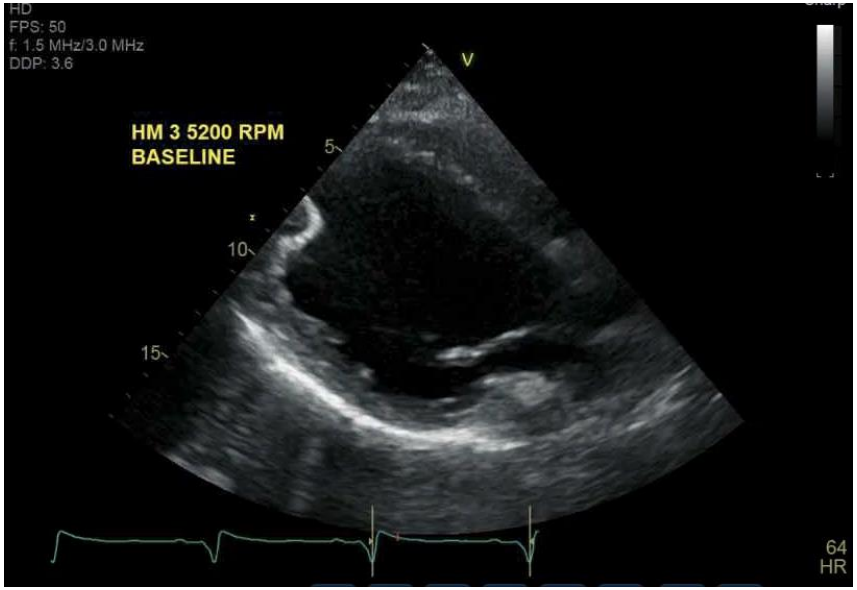

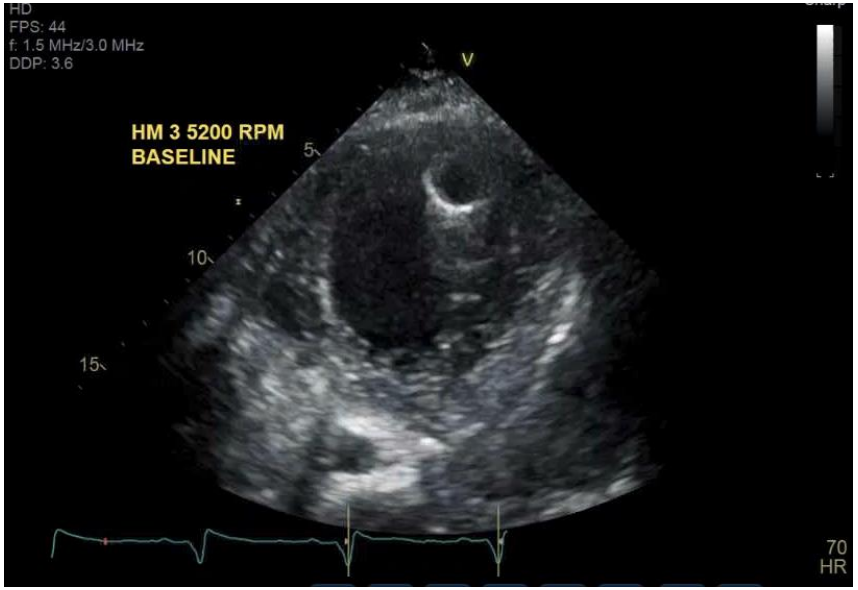

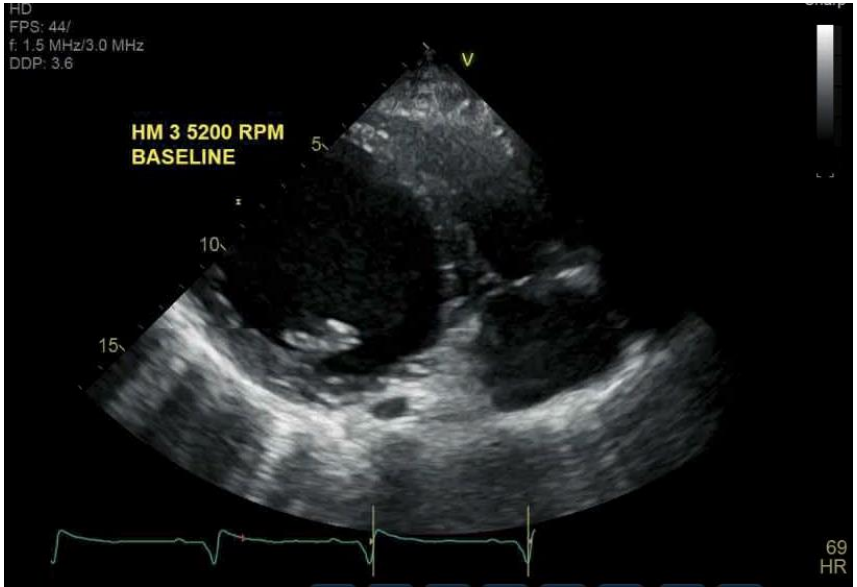

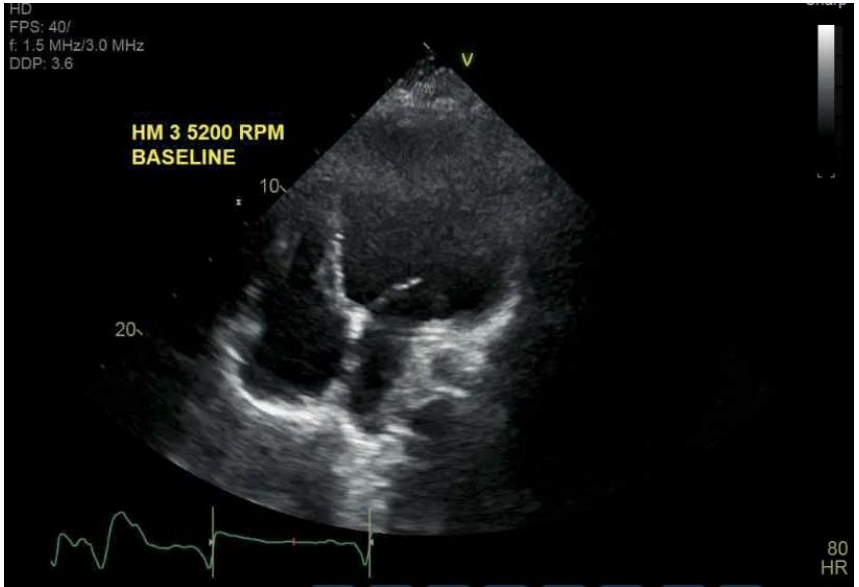

Follow up Course

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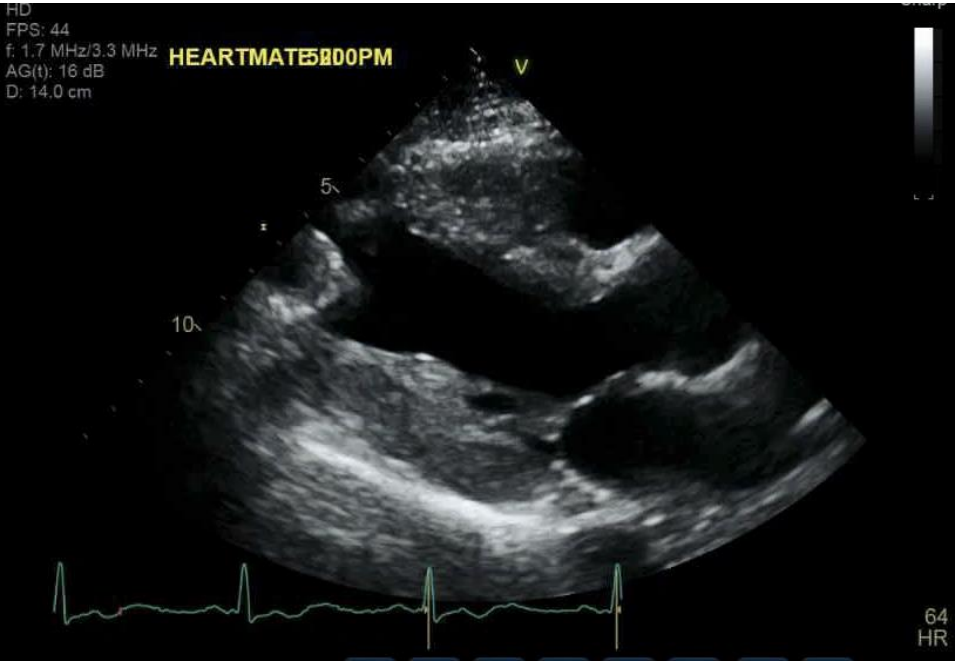
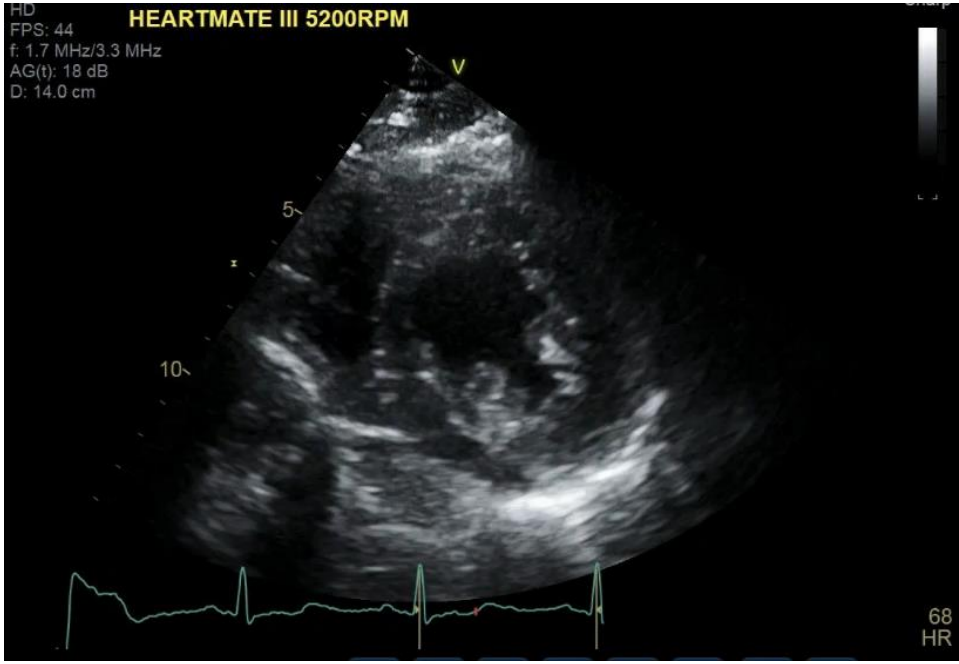
The patient presented in 8/2019 with hypertension and low flow alarms, the patient was moved to the unit and started on Nicardipine drip.





Echocardiogram

8/20

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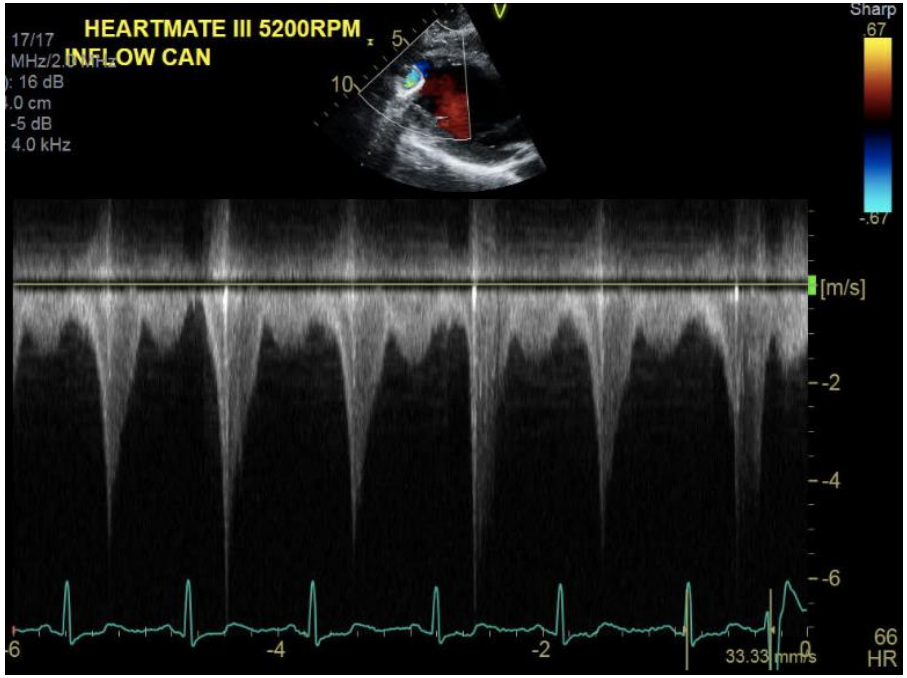

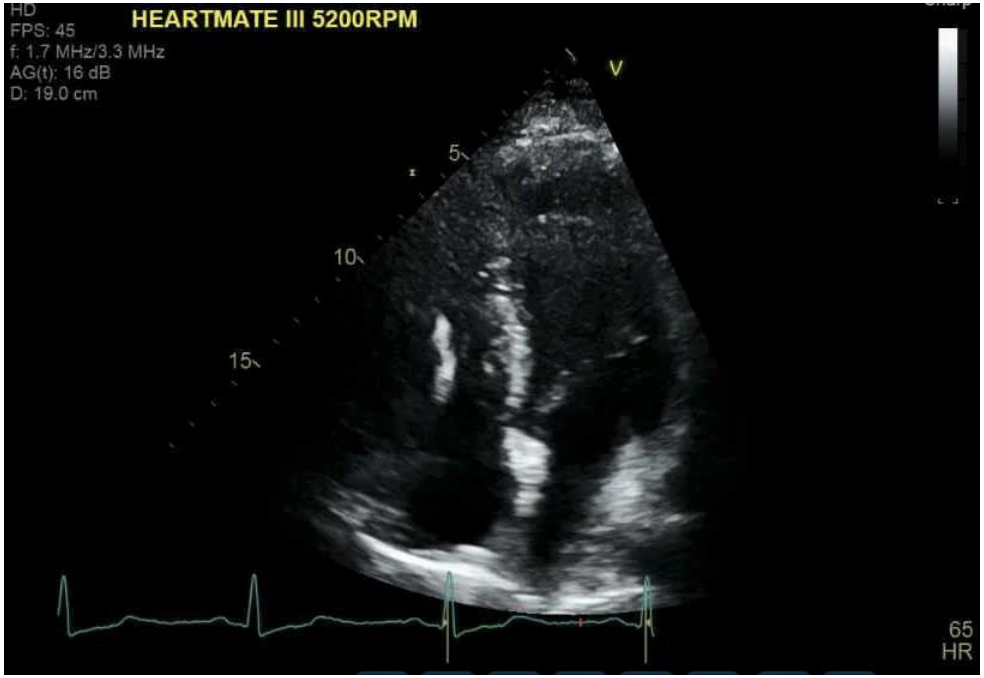

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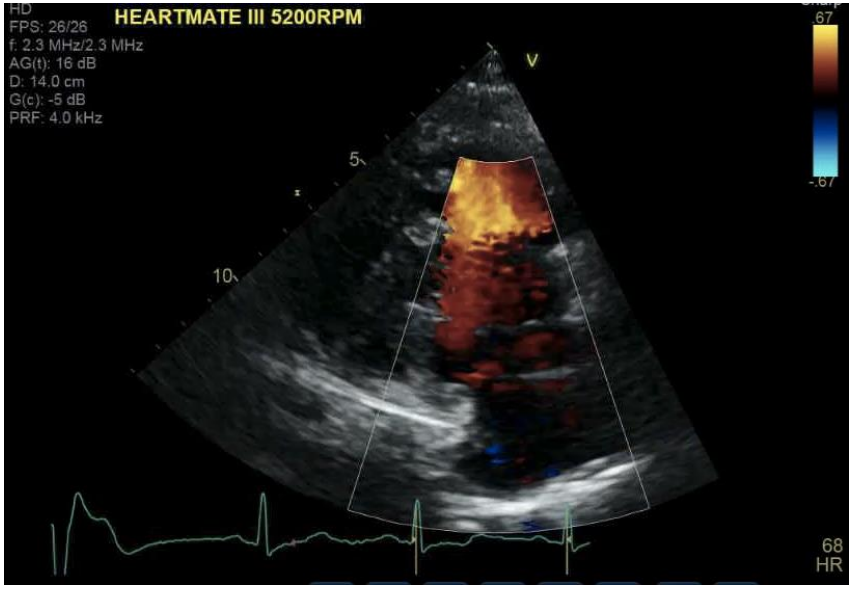

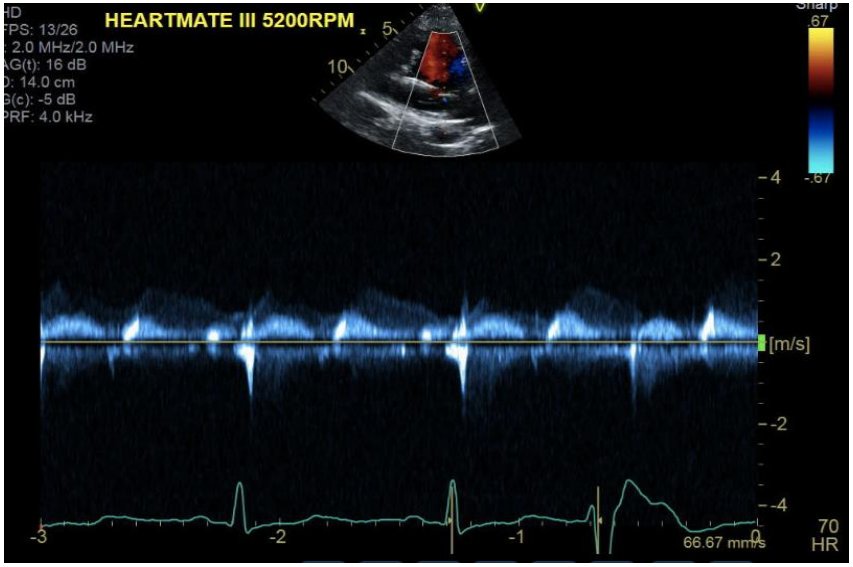

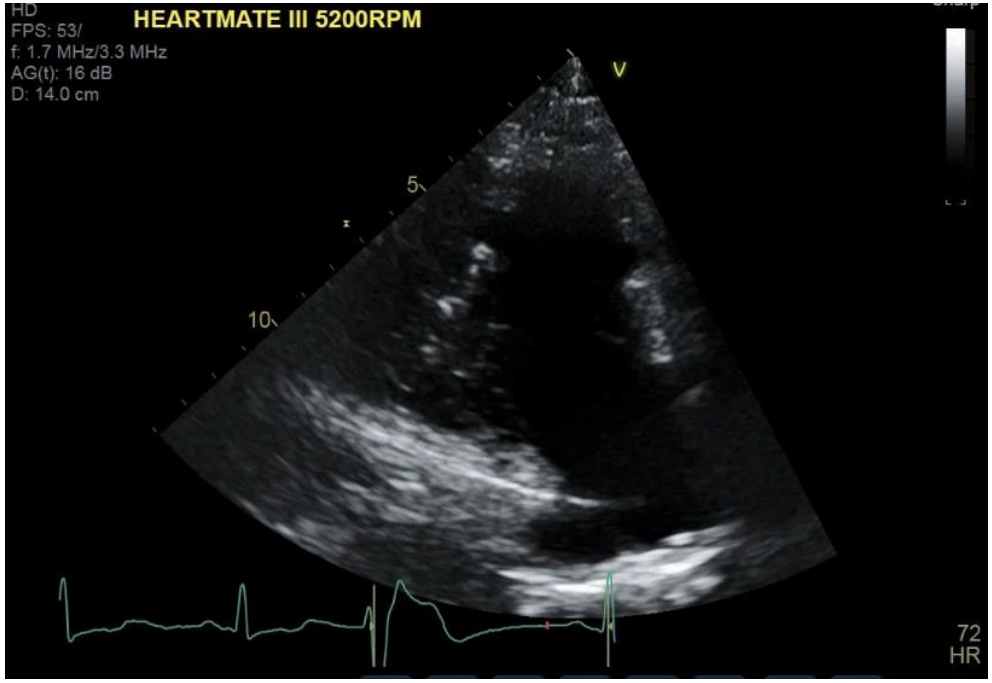

Further Clinical Course

8/8/2019

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- Echo 8/2019 showed EF 45%, mild RV depression, LVEDD 4.7 cm. LVAD cannula noted at the LV apex. Increased velocities across the inflow cannula during late systole is noted, suggestive of inflow cannula obstruction. Suspect suction event based on Doppler profile.

- The patient was transitioned from Nicardipine drip to Norvasc, hydralazine and Aldactone for BP control.

- RHC in 8/2019 showed (RA 4, PA 24/5/11, Wedge 8, CO 6.1 l/min, 3.2 l/min/sqm).

Follow up Course

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- Patient continue to follow up as outpatient.
- Office visit in 12/2019 medications included: Coreg increase 37.5mg BID, Hydralazine prn for SBP >120. Lisinopril 20mg BID. Spironolactone 25mg daily.

Follow up Course

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- In May, and June 2020, he developed persistent drainage from the driveline exit site, with cultures growing **Enterbacter cloacae** complex and **MSSA**. Treated with Doxycycline.
- He had incision and debridement of the LVAD exit wound on 7/4. Surgical cultures grew Enterobacter which remained susceptible to doxycycline. He was again discharged on doxycycline.
- Admitted 7/31/20 with drive line infection symptoms, CT showed no fluid collection around the pump of the drive line. However, the patient continued to have chest pains and there was a concern that infection reached to the pump. Patient was started On Cefepime and Vancomycin during the admission.

Follow up course

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- Conversation about LVAD removal vs transplant was going on, the patient was still actively smoking which was an issue in regard to cardiac transplantation.

LVAD Recovery Protocol

RHC 8/6/2020

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CARDIAC CATHETERIZATION PROCEDURE REPORT

RHC was performed to demonstrate changes in hemodynamics with LVAD wean.

FINDINGS

Baseline at 4900 RPM

1. Right atrial pressure is 7mmHg.
2. Right Ventricular Pressure 29/0/10mmHg.
3. PA Pressure 24/14, mean 17mmHg.
4. Pulmonary capillary wedge pressure 13mmHg.
6. By Fick, CO: 7.76 l/min, CI 3.50 l/min/sqm
7. By Thermodilution: CO: 9.42 l/min, CI 4.25 l/min/sqm

Speed	RA (mmHg)	PA (mmHg)	PCWP (mmHg)	FICK CO/CI	THERMO CO/CI
4900	7	24/14 (17)	13	7.76/3.50	9.42/4.25
4700	6	25/12 (17)	10	8.36/3.77	7.82/3.52
4500	6	26/12 (16)	12	7.17/3.23	7.67/3.46
4300	7	28/12 (17)	10	7.24/3.26	7.87/3.55
4100	6	28/11 (17)	9	7.04/3.17	8.50/3.83

Speed	PI	Flow (L/m)	Power (W)	BP (mmHg)	HR
4900	10.7	2.9	3.4	124/81	92
4700	11.5	2.3	3.2	121/75	88
4500	12.3	1.9	3.0	122/71	90
4300	12.7	1.6	2.8	125/77	88
4100	12.8	1.4	2.6	125/75	92

LVAD recovery Protocl

Echocardiogram

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SUMMARY:

Device type: HM3

Reason for exam: LVAD myocardial recovery

Baseline speed: 4900 rpm. Late-peaking elevated LVAD inflow cannula velocities at 3.6 m/sec, that can be suggestive of intermittent suction

Blood pressure = 124 /71

1. BL rpm; LVED 5.5 cm; AoV opening: every beat; AR-none
2. 4700 rpm; LVED 5.2 cm; AoV opening: every beat; AR-none
3. 4500 rpm; LVED 5.8 cm; AoV opening: every beat; AR-none
4. 4300 rpm; LVED 4.9 cm; AoV opening: every beat; AR-none
5. 4100 rpm; LVED 5.3 cm; AoV opening: every beat; AR-none

1. There is no mitral regurgitation
2. LVOT VTI remained unchanged.
3. RV systolic function appears mildly depressed, with unchanged size on ramp down

Follow up Course

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- His case was discussed at MDR and decision was made that he could not be listed for transplant at this time given recent cigarette use for which VAD explant would not be an option currently.
- Patient stopped smoking on 7/1/2020.
- Over the next year till 7/1/2021, patient had multiple follow up appointments with medications adjustments.
- He needed to get into NA meetings and to get to see a psychiatrist.

LVAD Recovery Protocol

9/21/21

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Conclusion

Phase	RA (m)	PA	PCWP	CO/CI (TD)	CO/CI (FICK)	LVAD PI	FLOW	POWER
	LVAD speed chage							
4900	3	24/8/13	7	8.5/3.9	5.2/2.4	8.7	3.4	3.4
4700	2	22/6/12	6	7.1/3.3	5.5/2.5	8.9	3.4	3.0
4500	2	25/8/13	8	5.9/2.7	5.0/2.36	10.7	2.7	2.9
4300	2	24/8/12	8	5.7/2.6	5.2/2.4	11.6	2.3	2.7
4100	2	24/8/14	8			12.3	1.8	2.5
4000	3	24/8/14	8	6.6/3.0	5.7/2.6	12.8	1.6	2.5
Leg raise	6							
	Exercise							
Peak Exercise / 4000	8	42/20/27	18/20/16	10.5/4.9				
recovery (1 min)	2	32/8/18	8/12/8					
recovery (3mins)	2	25/8/13	8/12/6	7.8/3.6				

LVAD Recovery Protocol

9/21/21

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Interpretation:

1.Normal filling pressures at 4900 RPM with normal cardiac output.

2. With each decrement in LVAD speed, the filling pressures remained normal. The cardiac output decreased but even at the lowest speed, patient was able to maintain a normal cardiac output with limited contribution from the LVAD.

3. With passive leg raise, the RA pressure increased mildly.

4. With exercise, the PA pressure and PCWP increased mildly and CO increased x1.8 from baseline, indicating limitation with exercise.

5. By 3 mins, patients PA pressures and PCWP normalized.

6. There was a blunted response in HR (Patient on full dose of Coreg)

Conclusion:

Hemodynamics suggest LV recovery with some limitation with exercise.

CPET

10/22/21

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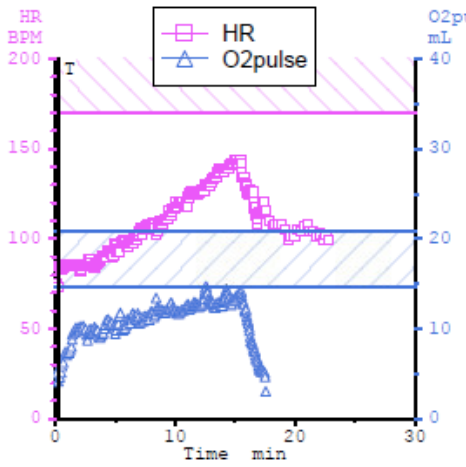
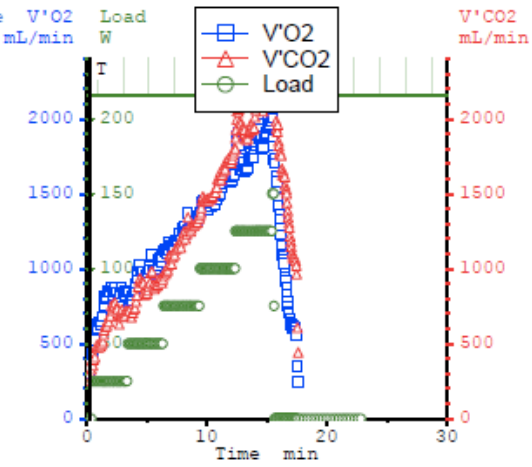
Summary (30 - sec)		VT1 [VSlope]	VT2	VT3	Peak (R)	Peak Load Predicted Peak...	Peak values (R) % Predicted(Max)...
V'O2	[mL/min]	1106	0	0	2058	3369	61
Load	[W]	75	0	0	150	260	58
HR	[BPM]	104	0	0	144	190	76
O2pulse	[mL]	10.6	0.0	0.0	14.3	17.7	81
RER		0.93	0.00	0.00	1.15	-	-
V'E	[L/min]	26	0	0	67	144*	47*
BR FEV%	[%]	82	0	0	53	28	190

		Pred	Pre	%Pred
FVC	**L**	5.82	5.39	92.7
FEV 1	**L**	4.72	4.10	86.8
MVV	**L/min**	180	150	83.1





CPET
10/22/21

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CONCLUSION:

Patient exercised for 15 minutes and 13 seconds on upright bicycle protocol achieving 5.7 METS of exercise at 150 Watts. Stress ECG was normal. Patient had normal heart rate and blood pressure response to exercise. Patient stopped exercising due to muscle fatigue.

Pulmonary response to exercise was normal including normal breathing reserve and no evidence of O2 desaturation at peak exercise.

RER at peak-exercise was 1.15. Patient's peak VO2 was 22.1 mL/kg/min which is 81% predicted. Patient reached ventilatory threshold at 33% (normal 40-50%) of predicted peakVO2. O2 pulse was mildly reduced - 67% predicted (adverse prognosis when < 85% predicted). VE/VCO2 slope was normal at 27.3. Normal HR recovery during first minute of recovery phase (abnormal < 16 bpm).

Overall, patient has mild-moderate cardiac output limitation to exercise. However, in the context of LVAD recovery protocol, this is an acceptable performance on cardiopulmonary excise testing for consideration of LVAD explantation. However, these results must be weighted against other clinical parameters used to define appropriate candidacy for LVAD explantation.

Follow up Course

11/2/21

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- Transplant Committee meeting 11/2/21: accepted for LVD explant, transplant as back up plan if needed if patient decompensates post explant.

- S/p LVAD ligation 3/8/22.

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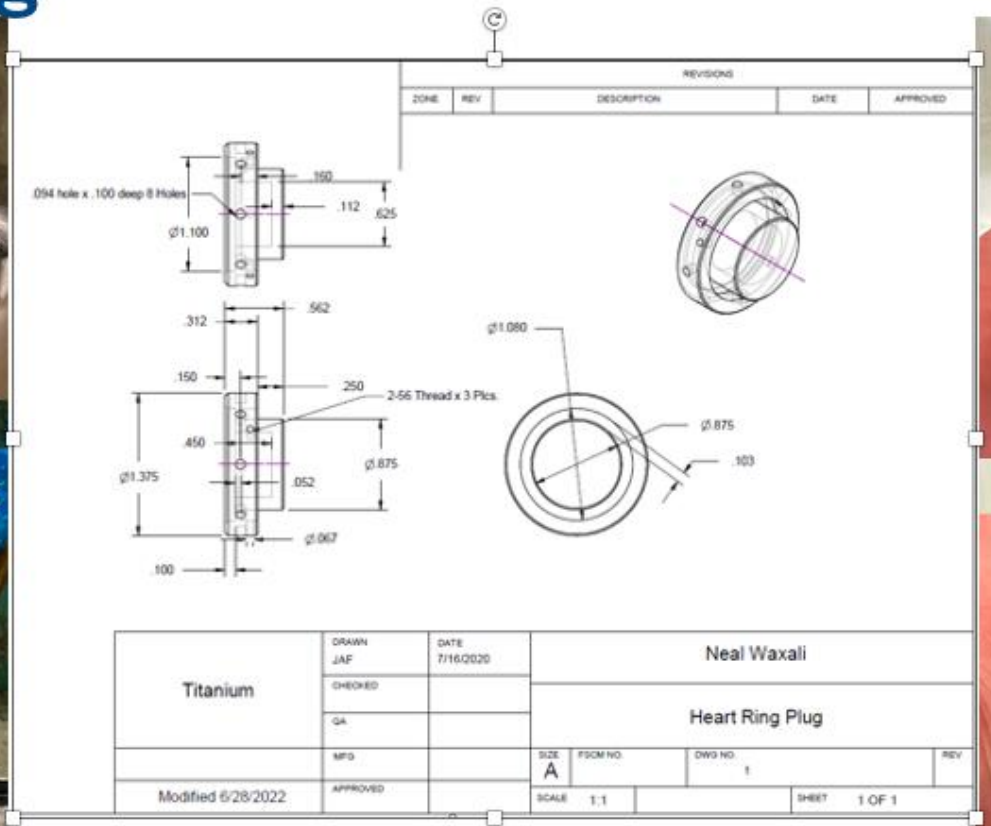
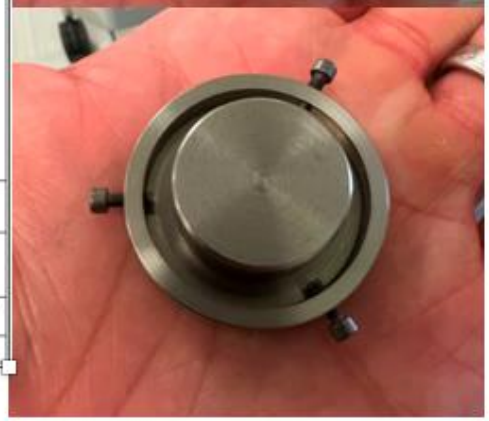
Waxali Plug





HOUSTON Methodist LEADING MEDICINE

Clinical Course

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- Medical regimen, Entresto 49-51 mg BID, Coreg 50 mg BID and Digoxin 125 mcg daily, Aldactone 12.5 mg dialy, and SGLTi was introduced during this admission.

- On 5/10/22 patient had purulent drainage from the wound site.

PET SCAN Images

5/12/22

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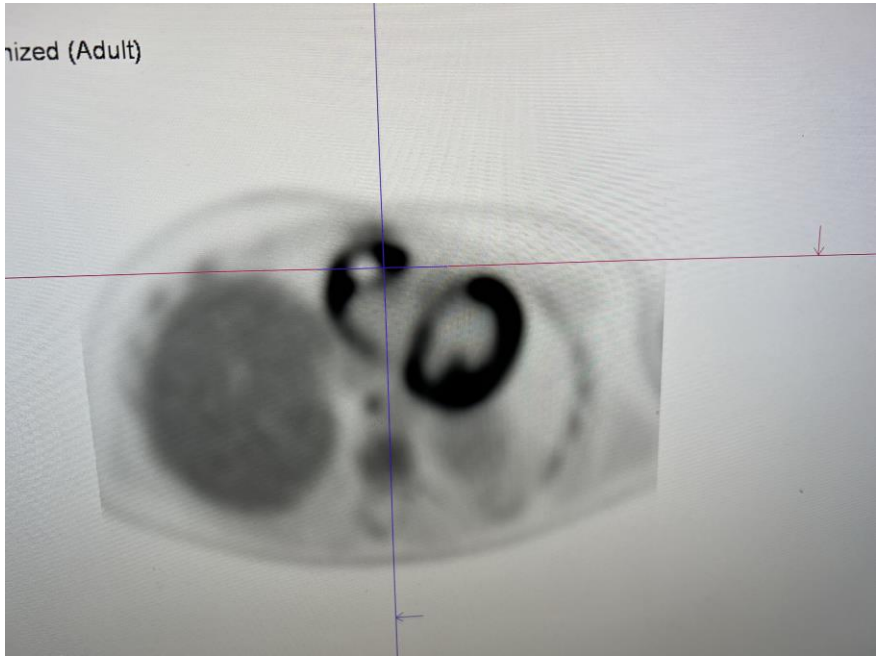

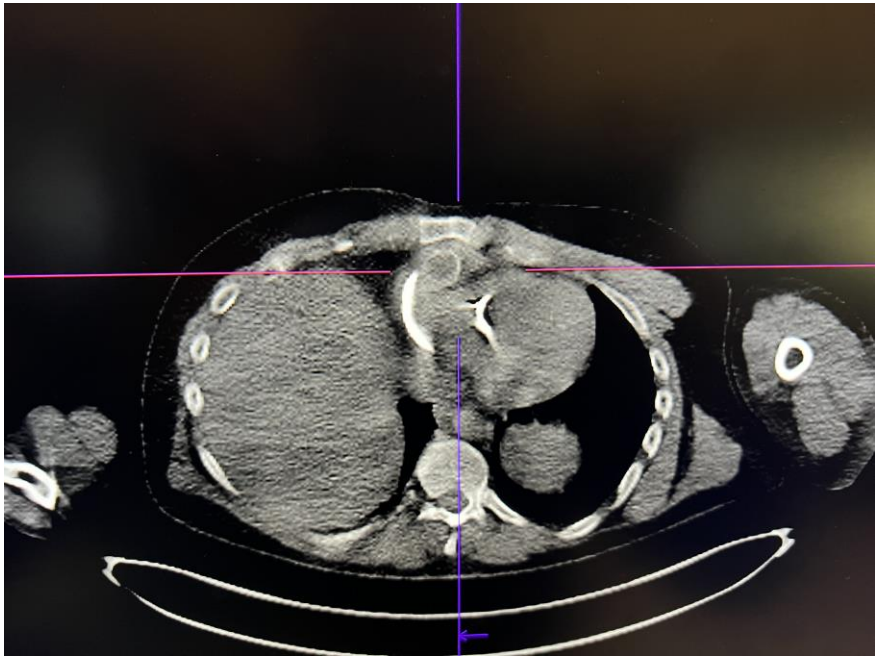

PET SCAN

5/12/22

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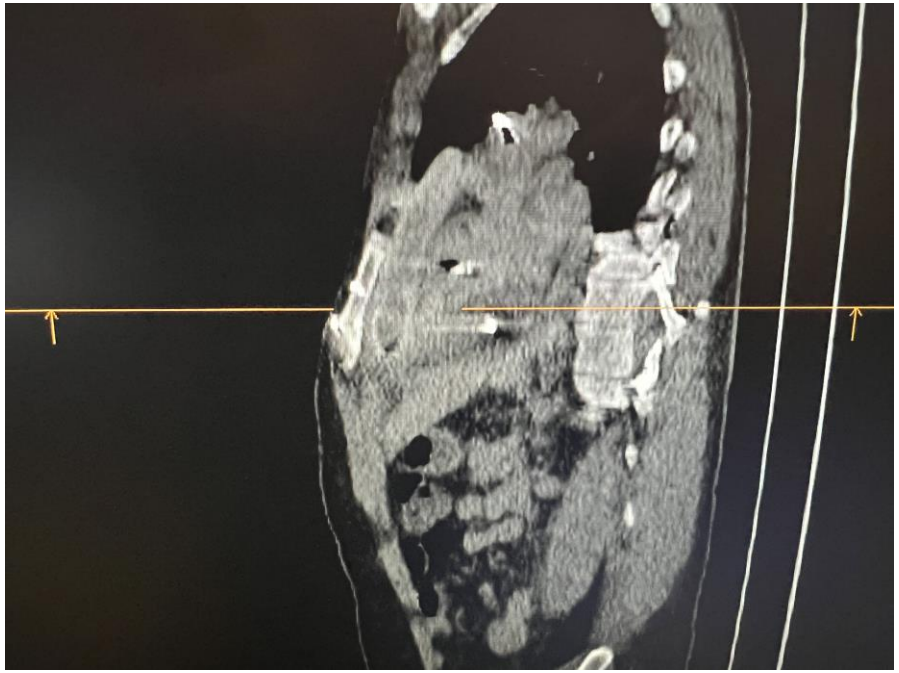

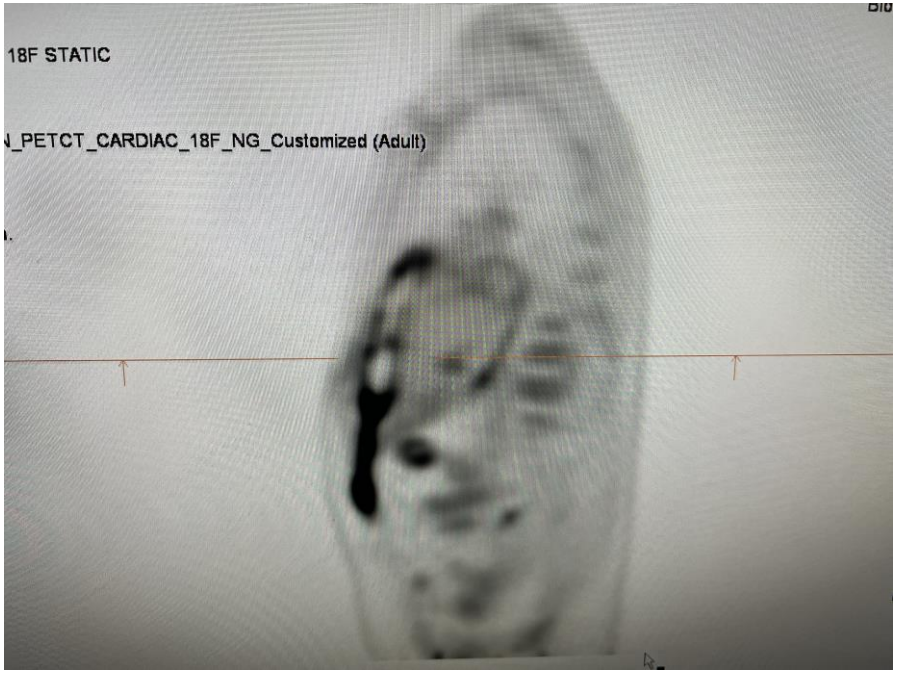

Showed uptake in almost all parts of the LVAD. FDG uptake around the LVAD Pump, the Driveline and outflow cannula, Suggested there is active infection in the inflow, driveline and outflow cannula. Subxyphoid tissue communicating with the driveline which is where the drainage is coming from.

Clinical Course

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- Committee meeting 6/7/22 agree to explant.
- Explanted 11/30/22, postponed 2/2 to multiple teeth extraction.

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Thank You