

Crashing Aortic Stenosis SIM Case

Section I: Scenario Demographics

Scenario Title:	Crashing Aortic Stenosis
Date of Development:	June 12, 2022
Target Learning Group:	All Groups

Section II: Scenario Developers

Scenario Developer(s):	Hnan Sharif
Affiliations/Institution(s):	SPH CCFP-EM PGY-3
Contact E-mail (optional):	hnansharif@msn.com

Section III: Curriculum Integration

Learning Goals & Objectives	
Educational Goal:	Achieve familiarity with the clinical considerations necessary for evaluation and management in a crashing critical AS patient
CRM Objectives:	
Medical Objectives:	<ol style="list-style-type: none"> 1. Discussion of sonographic and physical exam findings in critical AS 2. Discussion of appropriate medical management for stabilization of critical AS 3. Discussion of clinical considerations prior to intubation in critical AS 4. Discussion of available options surgical options for definitive management of severe AS

Case Summary: Brief Summary of Case Progression and Major Events

75 yr Fijian old male presenting to hospital following syncopal episode while walking upstairs in his home. Initial ED arrival with GCS 15 but appears tachypneic and dyspneic. Initial VS are normotensive but tachycardic and tachypnic. Patient will eventually progress to hypotension and likely arrest regardless of learner actions but will arrest more promptly if aggressive diuresis or aggressive preload reduction. If patient arrests he will develop V.Fib arrest due to coronary hypoperfusion with progression from V.Fib to PEA to ROSC. Following ROSC learner will need to consult Cardiology and/or Cardiovascular/Thoracic Surgery and request CCU admission and consideration for balloon valvulotomy vs LVAD bridge to therapy to definitive surgical valvular management.



Crashing Aortic Stenosis SIM Case

References

- Aortic Valve Disease
 - Dr. K Wiskar Dec 2018
 - WesternSono PoCUS Series
- Antihypertensive Treatment in Severe Aortic Stenosis
 - Kang, TS et al. June 2018
 - Journal of Cardiovascular imaging
- Surgical Valvotomy Versus Balloon Valvuloplasty for Congenital Aortic Valve Stenosis: A Systematic Review and Meta-Analysis
 - Hill, G et al. Aug 2016
 - Journal of the American Heart Association
- Valvular Heart Disease in Patients Supported With Left Ventricular Assist Devices
 - Wang, T et al. Jan 2014
 - Journal of the American Heart Association
- 2020 ACC/AHA Guideline for the Management of Patients With Valvular Heart Disease: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines
 - Otto, C et al. Dec 2020
 - Journal of the American Heart Association
- Aortic Stenosis
 - Gottlieb, M et al. Feb 2022
 - EM:RAP
- Crashing Aortic Stenosis
 - Weingart, S et al. Mar 2022
 - EM:RAP

Crashing Aortic Stenosis SIM Case

Section IV: Scenario Script

A. Clinical Vignette: To Read Aloud at Beginning of Case

75 yr Fijian old male, with recent immigration to Canada, presenting to hospital following syncopal episode while walking upstairs in his home. At time of ED arrival he is tachycardic, tachypnic with Sats of 94% on 4L NP

B. Scenario Cast & Realism

Patient:	Computerized Mannequin	Realism: <i>Select most important dimension(s)</i>	Conceptual
	Mannequin		Physical
	Standardized Patient		Emotional/Experiential
	Hybrid		Other:
	Task Trainer		N/A

Confederates Brief Description of Role

C. Required Monitors

EKG Leads/Wires	Temperature Probe	Central Venous Line
NIBP Cuff	Defibrillator Pads	Capnography
Pulse Oximeter	Arterial Line	Other:

D. Required Equipment

Gloves	Nasal Prongs	Scalpel
Stethoscope	Venturi Mask	Tube Thoracostomy Kit
Defibrillator	Non-Rebreather Mask	Cricothyroidotomy Kit
IV Bags/Lines	Bag Valve Mask	Thoracotomy Kit
IV Push Medications	Laryngoscope	Central Line Kit



Crashing Aortic Stenosis SIM Case

PO Tabs	Video Assisted Laryngoscope	Arterial Line Kit
Blood Products	ET Tubes	Other:
Intraosseous Set-up	LMA	Other:

E. Moulage

F. Approximate Timing

Set-Up:	10 min	Scenario:	10 min	Debriefing:	20 min
---------	--------	-----------	--------	-------------	--------



Crashing Aortic Stenosis SIM Case

Section V: Patient Data and Baseline State

A. Patient Profile and History				
Patient Name: Aneal		Age: 75		Weight: 80 kg
Gender: M		Code Status: Full code		
Chief Complaint:				
History of Presenting Illness: SOB and diaphoretic				
Past Medical History:		Medications:		
HTN			Atorvastatin 20mg PO QD Ramapril 5mg PO QD	
Dyslipidemia				
Severe AS				
Allergies: NKDA				
Social History: Lives with wife and son. Moved to Canada from Fiji 3 years ago. Works as a security guard. No alcohol, tobacco or drugs				
Family History: Noncontributory				
Review of Systems:	CNS:	Hx of presyncope with exertion		
	HEENT:	Nil		
	CVS:	Chest pain with exertion		
	RESP:	Dyspnea with exertion		
	GI:	Nil		
	GU:	Nil		
	MSK:	Nil	INT:	Nil
B. Baseline Simulator State and Physical Exam				
No Monitor Display	Monitor On, no data displayed		Monitor on Standard Display	



Crashing Aortic Stenosis SIM Case

HR: 115/min	BP: 135/62	RR: 26/min	O ₂ SAT: 93% on 4L
Rhythm: Sinus tachycardia	T: 36.5°C	Glucose: 9.1 mmol/L	GCS: 15(E4 V5 M6)
General Status: Diaphoretic, tachypneic and dyspneic			
CNS:	Alert and oriented.		
HEENT:	PERRL, EOMI, MMM, supple neck		
CVS:	Harsh parasternal systolic crescendo decrescendo murmur. Regular. Tachycardic. Delayed S2 PoCUS: Reduced EF. Stenotic and calcified aortic valve. No pericardial effusion . No signs of right heart strain. Stenotic and calcified aortic valve with limited mobility		
RESP:	Coarse crackles. PoCUS: B lines. No sign of pneumothorax		
ABDO:	Soft, Nontender, No distension, No guarding. PoCUS: Benign exam		
GU:	No CVAT, Perineal exam unremarkable		
MSK:	Symmetrical 5/5 strength in bilateral upper and lower extremities	SKIN:	1+ dependent pitting edema. No rashes

Crashing Aortic Stenosis SIM Case

Scenario States, Modifiers and Triggers

x	Patient Status	Learner Actions, Modifiers & Triggers to Move to Next State	
1. Baseline State Rhythm: Sinus tachycardia HR:115 b/min BP: 135/62 RR: 26 resp/min O ₂ SAT: 93% on 4L T: 36.5 °C	-GCS 15 -Dyspnic + tachycardia -Mild anterior chest discomfort, worse with exertion. If history requested patient will inform of previous aortic stenosis dianosis	<u>Learner Actions</u> -Apply O2 -Consider gentle fluid support -Consider CPAP/BIPAP -Consider rate reduction with low dose beta -Goal: increase pulse pressure with gentle reduction in heart rate	<u>Modifiers</u> <i>Changes to patient condition based on learner action</i> -Patient will deteriorate quickly if diuresis or preload reduction is provided <u>Triggers</u> <i>For progression to next state</i> -Patient will proceed to become progressively hypotensive regardless of actions but decline is more gradual if desired actions are provided
2. Rhythm: Sinus tachycardia HR:122 b/min BP: 92/50 RR: 32 resp/min O ₂ SAT: 82% on 4L	-GCS 11 (E2V4M5) -Increasing complaint of angina and dyspnea	<u>Learner Actions</u> -If CPAP/BIPAP not previously started it should be started at this point -Learner team should be concerned with signs of shock and start vasopressors. Preferred agent in AS is Phenylephrine due to its effects in pure afterload support without chronotropy or inotropy. Additionally, phenylephrine's propensity for reflex bradycardia will prolong diastole and increase coronary filling time. Vasopressin would also be suitable for management in shock AS. Norepinephrine is less preferable due to beta cardiac and extracardiac effects which will contribute to tachycardia. -If intubation attempted learner should take care to proactively	<u>Modifiers</u> -If preload reduction or diuresis provided prior achieving MAP>65 then patient will arrest -If desired actions of Phenylephrine and BIPAP are provided the patient will stabilize shock but respiratory distress will progress forcing intubation -If learner queries PE SIM lead will provide team with a negative D-dimer <u>Triggers</u> -If learner gives large dose of propofol or fentanyl/midazolam without care to support BP, then patient will arrest -If inappropriate shock support interventions provided patient will arrest



Crashing Aortic Stenosis SIM Case

		support blood pressure to MAP > 65 and avoid cardio-depressant medications for induction. -High risk intubation and consideration for awake or Ketamine dissociative intubation	
3. *If learner triggers arrest* Rhythm: V. fib HR: Nil BP: Nil RR: Nil	Standard ACS protocol for VF arrest. Patient will transition from VF => PEA => ROCS assuming standard ACLS protocols	<u>Learner Actions</u> -Standard ACLS for VF arrest	<u>Modifiers</u> <u>Triggers</u> -ROSC will be achieved with standard ACLS care for VF
4. *Post Arrest ROSC* Rhythm: Sinus tachycardia HR: 120 b/min BP: 97/65 RR: ventilated		<u>Learner Actions</u> - learner seeks consultation with cardiac surgical service and requests discussion about transfer to definitive care for balloon vs surgical valvulotomy	<u>Modifiers</u> <u>Triggers</u> - case ends after consultation with CCU + CTVS

Section VI: Scenario Progression

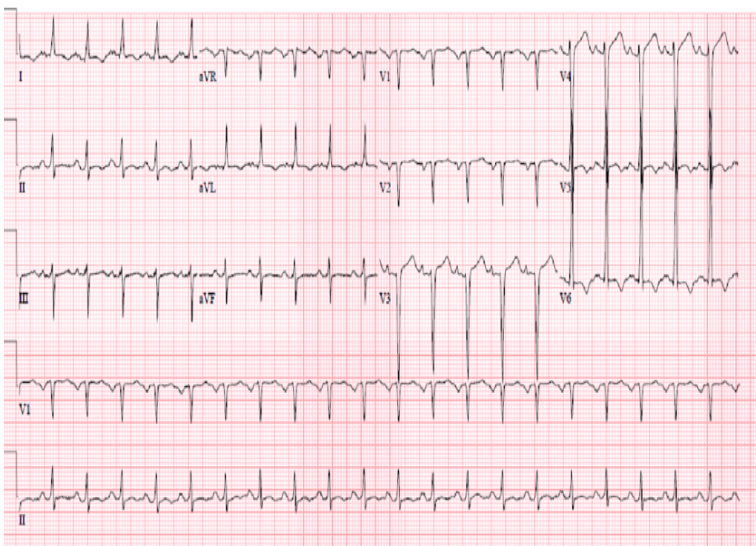


Crashing Aortic Stenosis SIM Case

Section VII: Supporting Documents, Laboratory Results, & Multimedia

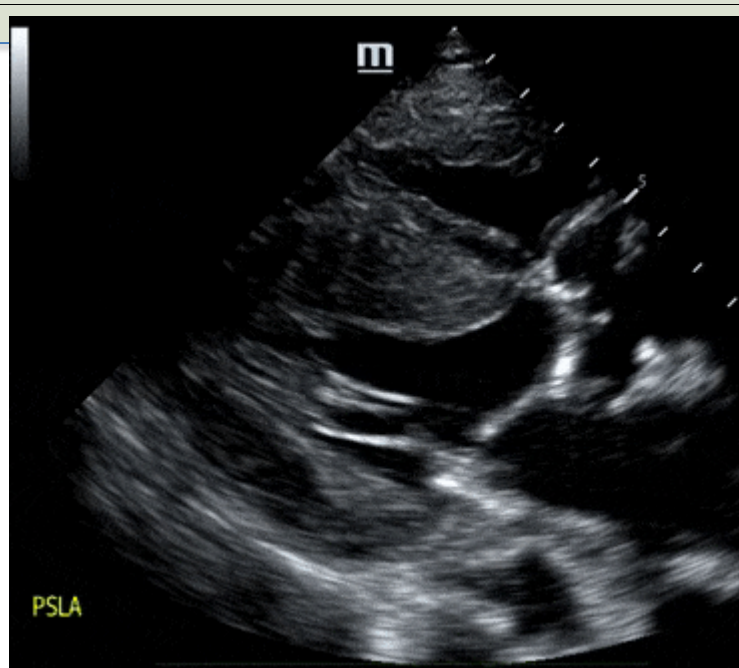
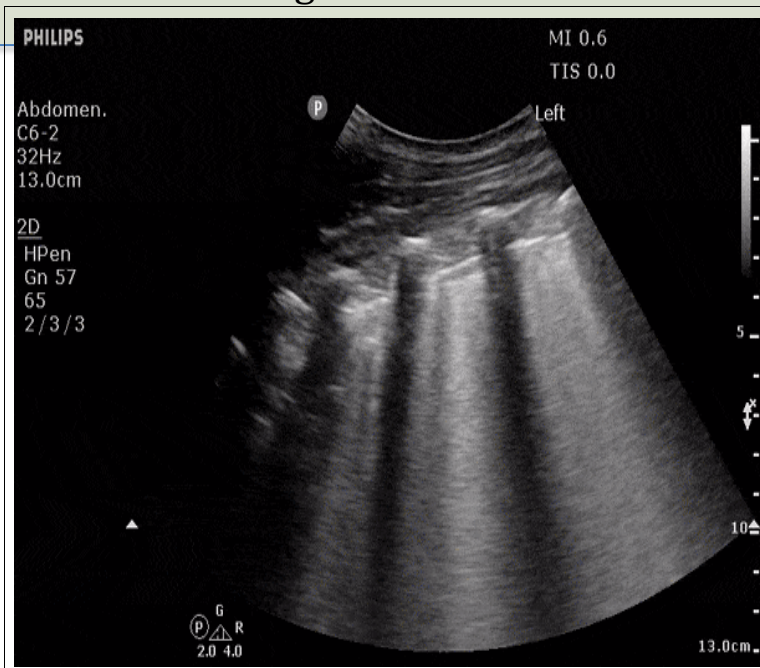
Laboratory Results							
Na: 137	K: 4.2		Cl: 112	HCO ₃ : 20	BUN: 14	Cr: 130	Glu: 9.5
Ca: 2.3		Mg: 0.9		PO ₄ : 1.0		Albumin: 35	
VBG	pH: 7.29		PCO ₂ : 36	PO ₂ : 85	HCO ₃ : 19		Lactate: 2.5
WBC: 11.7		Hg: 95		Hct: 0.41		Plt: 197	

Images (ECGs, CXRs, etc.)



Ultrasound Video Files (if applicable)

Crashing Aortic Stenosis SIM Case



Crashing Aortic Stenosis SIM Case

Section VIII: Debriefing Guide

General Debriefing Plan			
Individual	Group	With Video	Without Video
Objectives			
Educational Goal:	Understanding the acute management of critical aortic stenosis		
CRM Objectives:	Call for help early, especially if complex patient. Maximize resource utilization		
Medical Objectives:	<div>1) Identify clinical exam features of aortic stenosis</div> <div>2) Recognize features on PoCUS for identification of critical cardiac and pulmonary differentials which may contribute to shock or respiratory distress</div> <div>3) Identify key medical interventions beneficial in critical aortic stenosis</div> <div>4) Recognition that definitive management of aortic stenosis is surgical management</div>		
Sample Questions for Debriefing			
<div>1) Why do patients arrest in critical AS</div> <div>=> Coronary perfusion pressure (CPP) = DBP – LVEDP and coronaries are perfused during diastole. As aortic valve diameter gets progressively tighter LVEDP must go up. Eventually CPP drops off. Additionally, coronaries are perfused during diastole and cardiac compensation with tachycardia will shorten coronary filling time</div> <div>2) What are some bridge therapies available in the care of young patients with critical AS and refractory shock</div> <div>=> 1. LVAD 2. IABP 3. ECMO</div> <div>3) Discuss intubation strategies in patients with critical AS</div> <div>=> Provider should take care to proactively support blood pressure and avoid cardio-depressant medications for induction. Rapid drops in BP will drop CPP. Consideration for topicalization and awake intubation vs cardio neutral induction agent such as Etomidate in non-septic patient or low dose Ketamine in septic patient</div>			
Key Moments			
<div>1. Identification that patient is suffered from critical AS with decompensation</div> <div>2. Recognition that patients with critical AS are preload dependent and support with gentle fluids vs CPAP to improve venous return is indicated</div> <div>3. Recognition that despite adequate SBP, DBP is low and patient will need afterload support to improve DBP</div> <div>4. Identification of a hemodynamically fragile patient prior to intubation and recognizing that BP support throughout intubation is critical</div> <div>5. Identifying that the inciting pathology is mechanical and that definitive management is surgical valvular repair via transvalvular or surgical repair</div>			