High Risk PCI and Relation to Cardiogenic Shock

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Case

- 80 years-old male with HTN, DM, PVD, CAD with cath 20 years ago with mild disease
- Large AAA with EVAR 2007 and 2015 repair for endoleak now 8.5x8.5cm
- Had FEVAR with bilateral groin exposure, brachial access, R renal fenestration and L renal snorkel with significant intraop bleeding
- 7 U RBC transfusion
Case

• Intra op hypotension and ST depression in anterolateral leads
• Post op aVR ST elevation with diffuse ST depression. CP free and Trop negative
• CP next morning
• Cardiac cath was performed

CV surgery

• CV surgery was consulted
• They agreed on operating but wanted to wait to decrease the chance of bleeding
• That early morning the patient had a PEA arrest got better with fluids and blood transfusion
• LVEF now 20-25%
• Now CV did not want to operate
Cardiogenic Shock

- Revascularization
- PCI – *procedural and technical considerations*
- Mechanical Circulatory Support

Revascularization
**Early Revascularization in Acute Myocardial Infarction Complicated by Cardiogenic Shock**

Six-month mortality: 50% vs. 63%, \( P=0.03 \)


**Sustained Benefits of Early Revascularization on Long-term Mortality**

- 2/3 of hospital survivors with CS treated with early revascularization were alive at a median of 6 years.
- Early revascularization resulted in: 13.2% absolute and 67% relative improvement in long-term survival

Hochman et al. JAMA. 2006;295(21):2511-2515
Revascularization Improves Mortality in Elderly Patients with AMI Complicated by Cardiogenic Shock

Differences in the Profile, Treatment, and Prognosis of Patients with Cardiogenic Shock by MI Classification

A report from NCDR Action GWTG Registry

More delay to revascularization and higher mortality in NSTEMI patients
PCI

Procedural and Technical Considerations

Drug-eluting vs. Bare Metal Stents in Patients with Cardiogenic Shock

Ledwoch J, et al.. Heart. 2017;103(15):1177

Adjusted for baseline risk factors

HR 0.83 (95% CI 0.64 to 1.06); p = 0.14
Access Site Choice in Patients with Cardiogenic Shock Undergoing PCI

Radial vs. Femoral Arterial Access

• Transradial access is associated with a significant reduction in adjusted 30-day all-cause mortality and MACCE, compared with Transfemoral access.

‘Culprit Lesion Only’ vs. ‘Immediate Multivessel’ PCI in Patients With AMI-Cardiogenic Shock

• 706 patients w AMI-related Cardiogenic Shock (2013-17; 83 European centers)

• PCI of the culprit lesion only was superior to immediate multivessel PCI with respect to the 30-d composite end point of death/renal-replacement therapy (lower mortality).

The CULPRIT-SHOCK trial
Holger Thiele et al. NEJM 2017 Oct 30
Mechanical Circulatory Support

Percutaneous Mechanical Circulatory Support Devices

- IABP
- Impella
- Tandem Heart
- ECMO
IABP

- Ubiquitous
- Easy to use and insert
- 7-8F access
- Diastolic augmentation and systolic unloading

Myat A et al. JACC CV Interv 2015;8(2):229

IABP-Shock II Trial

- RCT 2009-12
- 600 patients
- CS - AMI
Impella

- CO 2.5-5 L
- Can be used up to 7 days
- Larger access 14-24 Fr
- Does not require cardiac rhythm or function
- Unloads the LV
- Cannot be used when there is LV thrombus
- Caution with papillary muscle rupture
- Usually cannot get the patient out of deep cardiogenic shock

USPELLA Registry: AMI + Shock

- 154 consecutive patients.
- PCI + Impella 2.5 support.
- 38 US hospitals.

Early initiation of hemodynamic support prior to PCI with Impella 2.5 is associated with more complete revascularization and improved survival in the setting of refractory CS complicating an AMI.
**Percutaneous MCS versus IABP in Cardiogenic Shock after AMI**

*The IMPRESS in Severe Shock trial*

- Randomized, prospective, open-label, multicenter trial:
  - N = 48 pts; severe CS-AMI
  - Assigned to: pMCS vs. IABP
  - The percutaneous MCS consisted of the 2.5 and CP Impella platforms

Routine treatment with pMCS was NOT associated with lower mortality in patients with CS-AMI.

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**Tandem Heart**

- CO 4-5L/min
- Can support for 14 days
- Does not require stable rhythm
- Not universally available
- Transseptal
- 2F venous 1F arterial
- Risk of canula displacement
- Limb ischemia
- Hemolysis
The Percutaneous Ventricular Assist Device in Severe Refractory Cardiogenic Shock

N = 117 patients with severe refractory cardiogenic shock

Percutaneous Extracorporeal Membrane Oxygenation

Advantages:
• Can augment cardiac output by >4.5 l/min
• Can be used to support the circulation for up to several weeks
• Does not require a stable cardiac rhythm for optimal function
Venoarterial Extracorporeal Membrane Oxygenation for Refractory Cardiogenic Shock in Elderly Patients

*Trends in Application and Outcome* From the Extracorporeal Life Support Organization (ELSO) Registry

- N = 735 elderly patients (14% - mean age = 75 ± 4 years)

Age is an independent negative predictor of in-hospital survival.


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Venoarterial Extracorporeal Membrane Oxygenation for Refractory Cardiogenic Shock in Elderly Patients

*Trends in Application and Outcome* From the Extracorporeal Life Support Organization (ELSO) Registry

Cardiogenic shock
N = 1,018 pts

- Use of VA-ECMO in cardiogenic shock is increasing over time.
- In-hospital mortality is higher in elderly patients, but the overall outcome doesn't appear unacceptable → VA ECMO should not be denied solely on age

Clinical Features and Outcomes in Adults with Cardiogenic Shock Supported by ECMO
The MGH Experience

Patients successfully weaned and survival to discharge by etiology of CS

n = 123 patients with ECMO for CS from 2009 - 2014
Caroll BJ et al. Am J Cardiol 2015;116:1624

Percutaneous Short-term Active Mechanical Support Devices in Cardiogenic Shock
A systematic review and collaborative meta-analysis of randomized trials

Four RCTs randomizing 148 patients with CS+AMI to TandemHeart or Impella MCS (n = 77) vs. IABP (n = 71)

No differences in CI, PCWP, or the incidence of leg ischemia - Higher bleeding w MCS

Despite an initial beneficial effect on MAP and lactate levels, percutaneous MCS did not improve mortality compared to IABP (possibly partly explained by an excess of complications, e.g. bleeding).

Thiele et al. EHJ 2017
Follow-up

- The patient was discharged after a long hospitalization and on follow up LVEF 40-45%
- No symptoms

Hemodynamics

- During the intervention the patient had no pulsatile flow
- MAP remained in the 70-80mmHg range.
Hemodynamics

Hemodynamics
Hemodynamics

Hemodynamics
Hemodynamics

Cardiogenic Shock

- The PCI of the patients with cardiogenic shock remains to be challenging
- The cause of the shock and the duration of the shock should be taken into consideration
- The use of assist devices should also be individualized
- Sometimes we might need to prioritize the organ systems