Recognition, Prevention and Management of Complications

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How do we learn to recognize and manage complications?

- Textbooks
- Case review, Case reports
- When they happen to someone else
- When they happen to us
- From our mistakes
How do we learn to recognize and manage complications?
Complications in PCI

1. Identify the complication
2. How was the complication caused and how can it be prevented?
3. How would you manage the complication?
Case
Stent cannot cross the lesion even after predilatation
How would you recover the lost stent?
Stent Loss

Stent on wire
- Inflate balloon to retrieve the stent
- Retrieve on microcatheter

Stent not on wire
- Gooseneck snare
- Extension catheter (GuideLiner/Guidez illa)

If stent cannot be retrieved
- Stent crushing
- Additional stent alongside
- Large coronary artery

Elevated risk of periprocedural MI, emergent CABG, and death
Consider surgical removal
Twisting Two-wire Technique
An attempt was made to cross inside the stent with a 1.25 mm balloon in order to secure the stent on the small balloon and retrieve it, this step was not successful.
The stent was snared with a gooseneck (ev3)
Figure 7.2  Incorrect technique of ensnarement. Withdrawing the ends of the wire to capture the embolized material or stent can cause disengagement.
Lessons

• This case demonstrates the importance of maintaining wire access through the dislodged stent, which gives the operator a wide range of options to retrieve the stent.
• Balloon-assisted retrieval is effective only if the operator is able to pass a small balloon through the dislodged stent.
• When performing the loop snare technique, it is essential to be sure that the loop encircles the dislodged stent and to perform the snaring by advancing the delivery catheter rather than pulling on the snare.
Case
Baseline
PCI

Post-predilatation
PCI

Chest pain and Hypotension
What would your immediate treatment strategy be in this patient?

A. Urgent CABG
B. Immediate balloon inflation
C. Immediate pericardiocentesis
D. Protamine
Perforation

Balloon Inflation

Hemodynamic Evaluation

Stable

Yes

Further balloon inflation
Protamine

No

Persistent Bleeding?

Balloon Deflation

Repeat angiography 5-10 minutes later

Unstable

Distal Main Vessel
A. Subcutaneous fat
B. Coils
C. Thrombin
D. Microsphere/beads

If they all fail, and especially on small branches:
E. PTFE on main vessel to exclude side branch

Distal Side Branch
A. Microsphere/beads
B. Coils
C. Thrombin
D. Subcutaneous fat

Prox. Side Branch
- Relevant side branch diameter: PTFE on side branch.
- Very small side branch: PTFE on main vessel to exclude side branch

Proximal Main Vessel

Bifurcation

No Bifurcation

Surgery

PTFE

1. Distal Main Vessel
2. Distal Side Branch
3. Proximal Side Branch
4. Proximal Main Vessel

Stable Unstable

Hemodynamic Evaluation

Call the Anesthesiologist
IV Fluids infusion
Vasoactive amines
IABP Placement
Protamine
Blood transfusion
Pericardiocentesis

Postdilate prox edge well
Tamponade, pericardiocentesis, incomplete sealing

Why is extravasation still present?
Balloon positioned correctly
PCI

Balloon placed more proximally with good sealing

Prolonged balloon inflation

“The best balloon is the one that caused the perforation”
Continued extravasation despite prolonged balloon inflation. What would you do?

A. Continue inflation with a perfusion balloon
B. Covered stent implantation
C. BMS implantation
D. Coil embolization
E. Microsphere embolization
Covered Stent

Jomed PTFE 3x19mm

Post-Jomed
Types of covered stents

**InSitu Direct-Stent® Stent-Graft**
(InSitu Technologies Inc.)

**JOSTENT GraftMaster®**
(Abbot Vascular)

**Over and Under® Pericardium Covered Stent (PCS)**
(ITGI Medical)
Continued extravasation despite covered stent implantation. Now what?

A. Prolonged balloon inflation

B. Urgent CABG

C. Postdilatation

D. Implantation of another covered stent
2nd Covered Stent

2nd Jomed PTFE 3x19mm

Post-Jomed
3rd Covered Stent

In-Situ Stent Graft 3x19mm
Final Result
Case
Clinical History

57 year-old male

- Hypercholesterolemia, smoker
  
  No other risk factors

- Cardiac History
  
  - 1996: inferior myocardial infarction with BMS on the proximal RCA
  
  - 1998: PCI \(\rightarrow\) DES on the mid-proximal CX

- Currently symptomatic for angina (CCS 2)
  
  - Positive stress test with inducible ischemia of the antero-lateral wall
  
  - Normal EF (55%), akinesia of the inferior wall
Coronary angiography

Left coronary artery
Long diffuse disease of the mid-proximal LAD, diffuse disease of the 1st diagonal
Good result of the previous stenting on Cx

Right coronary artery
Distal diffuse disease
Good result of the previous stenting
Coronary angiography

Critical stenosis of the proximal part

Critical stenosis of the 1st diagonal

Medina 1:1:1
True Bifurcation
(significant stenosis on the main and side branches)

- **No**
  - Provisional SB stenting

- **Yes**
  - Is SB suitable for stenting?
    - **No**
      - Provisional SB stenting
    - **Yes**
      - Elective implantation of two stents (MB and SB)

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**Approach is dictated by the Side Branch!**
Procedure

Pre-dilation with a 2.5 NC balloon

SES 3.5 x 28 mm

Angio after stenting

Wiring using 2 Universal guidewires
Next step?

- Remove the Wire
- Rewiring
  - Kissing balloon
  - 2 stent strategy?
Loss of anatomical reference

Onset of symptoms

Management
Rewiring of the side branch using a hydrophilic guidewire (Fielder FC, then Pilot 50)
Attempts to rewire the SB

→ Dissection of the side branch
→ Diffuse spasm
→ Ongoing symptoms

Next step?

Change wire
Rescue STAR
....but

Ellis type III perforation of D1

Prolonged inflation of a NC 3.5 balloon
Aneugraft stent 3.5 x 25 mm

Exclusion of the SB

Urgent pericardiocentesis
Key Messages

• No two bifurcations are identical and an individualized approach is appropriate
• Plan your strategy well
• Even apparently simple bifurcations can become complicated
• Do not remove the jailed wire until you are sure of the final result on the SB
• Beware of hydrophillic wires
• Be prepared to manage complications

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Case
Background

- 57-year old man with known Alport syndrome: dialysis from age 17-years
- Kidney transplant @ age 34-years
- Transplant failure @52-years, back on dialysis
- Was on the waiting list for renal transplant
- HCV positive
• First episode of angina in 2008

• Had undergone PCI to RCA at local hospital

• Recurrence of symptoms in Aug 2011

• Angiogram @ local hospital had demonstrated
  Diffuse disease in LAD
  Moderate disease of Cx
  Patent stent in RCA
• Given his renal issues and awaiting transplant, was initially managed medically

• But recurrent episodes of ACS despite optimal medical Rx

• Patient referred to us for further management
Diffuse Disease

Baseline
Diffuse Disease

Balloon Predilatations & DCB 2.25x30mm, 2.5x40mm, 3.0x30mm
Diffuse Disease

What do you think of flow in LAD?
Diffuse Disease

Would you stent now? Where?
Diffuse Disease

DES (cre8) 2.5×20mm
Diffuse Disease

What do you think of coronary flow?
Diffuse Disease

Would you implant other stents?
Diffuse Disease

After guidewire removal
Diffuse Disease

Would you have stopped the procedure at this point?
Femoral angio for vascular closure device
We decided to stent LAD because of risk of acute vessel closure from dissection.
Diffuse Disease

Where would you stent?
Stenting: DES (cre8) 3x25mm on mid-LAD, 3.5x25mm on prox LAD
Diffuse Disease

What is happening?
Diffuse Disease
Diffuse Disease
Diffuse Disease

What is the diagnosis?
What would you do?
Severe chest pain
Hypotension
Sustained Cardiac arrest

CPR
Intubation
IABP
IC repro
Several boluses of IC Sodium Nitroprusside
   Adenosine
   Adrenaline

Patient was revived
Diffuse Disease and Slow Flow

Distal injection with Crusade Microcatheter
Diffuse Disease and Slow Flow
Diffuse Disease and Slow Flow
Further cardiac arrest

CPR
Several boluses of IC Sodium Nitroprusside
Adenosine
Adrenaline

ECMO

Patient was revived
Diffuse Disease and Slow Flow

Final Angio
Diffuse Disease and Slow Flow

Final Angio
LV function was only moderately impaired on echo

- But sustained rib-fracture during CPR (CKD on dialysis – prone of pathologic fractures)
- Manifested as severe intra-thoracic bleeding
- In total received 110 units of blood transfusion
- Bleeding persisted for 72-hours despite surgical exploration
- DIC / Multi-organ failure – Died 5-days later
Lessons

• Slow flow has a differential diagnosis
• Making the correct diagnosis may prevent further errors
• Beware GP 2b/3a inhibitors after CPR and cardiac massage
• Distal contrast injection in cases of no flow mandatory for determining the diagnosis
• PCI in native coronary arteries can be associated with slow flow even in patients with stable angina with no visible thrombus. The presumed mechanism is embolization of lipid-laden plaques.
• Correct slow flow before stent implantation
• The mainstay of treatment of slow flow is maintenance of effective systemic blood pressure and selective intracoronary administration of vasodilators
This case illustrates an exception to the rule

When you make two mistakes in a row:

No Mercy!
“Good judgement comes from experience . . . and experience comes from bad judgement”