

With Aortic Dissections, How Can Pressures in the True and False Lumens Be Measured, and How Should These Influence Treatment Decisions



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Should These Be Treated Before or After Closure of the Primary Tear?
What is the Value of Fenestration or Septotomy?

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Acute Aortic Dissection

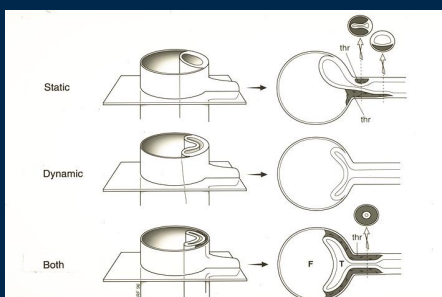
- In classical aortic dissection, a tear in the inner lining of the aortic wall allows blood from the lumen to enter the wall space, often expanding it into a second channel.
- Life-threatening risks are aortic rupture and organ malperfusion.
- In cases with organ malperfusion, angio evaluation begins with review of the physical findings, CT scan, and intravascular ultrasound evaluation of the iliofemoral arteries, visceral arteries, and aorta.

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MALPERFUSION (-15 mm Hg)
VS
MALPERFUSION SYNDROME
=
PERFUSION DEFICIT
VS
DEFICIT + ORGAN DAMAGE

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MALPERFUSION – MICHIGAN CLASSIFICATION

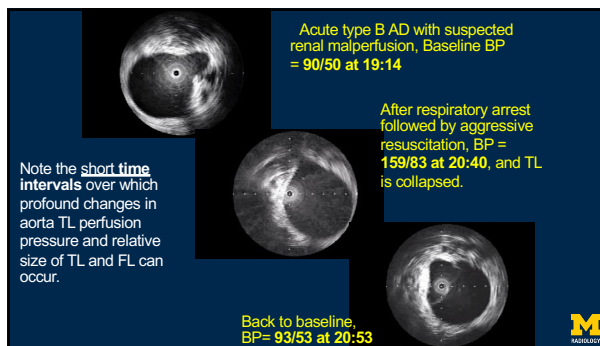
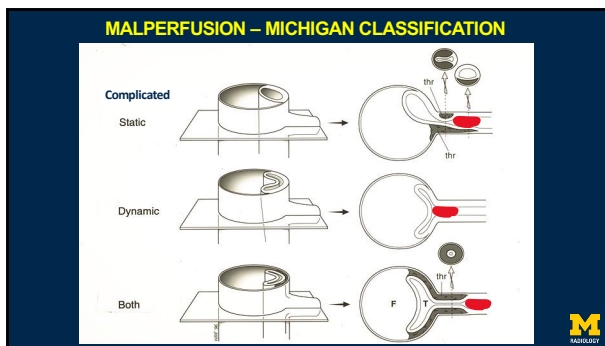


Static

Dynamic

Both

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- ### Obstruction in aortic dissection
- Complicated dynamic or static:
 - True lumen thrombus in regions of stasis
 - Dynamic: flap covers vessel origin, with complex relation between blood pressure, branch artery flow, and caliber of true lumen
 - Fixed, transient, or intermittent
 - Static: dissection flap enters vessel and obstructs (depending on presence / size of reentry tear or false lumen thrombosis)
 - Eliminate thrombus before restoring central flow, to avoid embolic shower
 - Cover entry tear by root replacement or TEVAR or fenestrate the dissection flap near the obstructed origins
 - Stent from inflow to outflow
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- ### So, when obstruction is suspected, possibilities:
- CT shows TL collapse (cause of dynamic obstruction) and vessels at risk (due to static obstruction).
 - IVUS determines presence of TL thrombus and re-entry points
 - When should we intervene
 - Manometry determines pressure gradient threshold for intervention
 - Gradients might have diminished under preliminary medical tx. Ask yourself, how likely is patient to relapse
 - In ATAAD, root repair will eliminate most dynamic obstruction, so if no organ damage (no malperfusion syndrome), need not treat
 - In ATBAD and post-op ATAAD, treat obstruction depending on organ involved and magnitude of pressure deficit, and is medical supervision convenient?
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Manometry is the arbiter of malperfusion (>15 mm Hg gradient between root and branch artery beyond acute disease) and is the standard of when malperfusion has been eliminated

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Manometry is performed

with an omni-flush catheter in the aortic root and a modified selective catheter for branch artery pressures (such as a cobra or reverse-curve catheter), with side hole near the tip and measurement distal to compromised lumen).

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Clinical case early chronology

- 66-year-old man with onset of pain approximately 08:30 on 10/29, when complained to his son about the onset of pain in both legs and abdomen during a walk.
- 10/29
- 08:30 approximate time of symptom onset
- 12:25 BP 141/63 at ED of outside hospital in MI
- 12:42 BP 122/88
- 12:43 bilateral DP pulses weak
- 12:52 creatinine 1.12, AST 20, lactate 5.1
- 13:27 CT of chest abdomen and pelvis
- 13:45 BP 188/74, Esmolol started



IR manometry is 4.5 hr after CT scan.



Aortic root 111/57 (77), SMA 36/27 (30) despite contrast material in SMA. IVUS showed no TL expansion. Notice, contrast in SMA does not mean adequate SMA perfusion



Presentation, femoral pulses not palpable



Reperfusion priorities

- Common femoral or Iliac artery TL thrombus to obtain clean access
- SMA (TL thrombus / dynamic / static) to rescue gut
- Celiac artery: if liver enzymes are elevated, treat like SMA. Usually, the celiac takes care of itself
- Confirm or secure 1 good kidney (dynamic / static)
- Legs (femoral arteries: lysis if TL thrombus, but consider vascular surgery assistance for infrainguinal thrombus)
- Legs (Iliac artery dynamic, static): establish normal perfusion pressure to the common femorals
- More compromised kidney if it appears salvageable



Manometry with pigtail catheter in aortic root and cobra catheter with sidehole in branch arteries


- Aortic root 99/51 (67), REIA 52/37 (41) at 17:56
- Aortic root 107/53 (71), LEIA 68/31 (37) at 17:59
- Aortic root 108/55 (73), RRA 46/35 (40) at 18:03
- Aortic root 111/57 (77), SMA 36/27 (30) at 18:06
- TL at T12 103/41 (55), FL at T12 114/49 (65), baseline at 18:21
- TL at L2 93/40 (51), FL at T11 118/49 (68), post PTA flap at 18:26
- Supra-celiac fenestration and north TL stenosis complete at 18:33
- Infrarenal fenestration and north TL stenosis complete at 19:00
- Aortic root 79/43 (55), REIA 76/40 (50) at 19:04
- Aortic root 79/41 (73), distal REIA 86/37 (48) at 19:17
- LEIA 82/36 (40) at 19:22
- Two-stent extension to bilateral distal FEA complete at 19:26
- Aortic root 94/42 (58), SMA 71/39 (48) at 19:40
- Aortic root 86/40 (55), RRA 75/37 (48) at 19:44
- Aortic root 89/41 (56), TL at L2 98/39 (62) at 19:46
- Aortic root 80/39 (54), RRA 77/36 (48) at 19:47



IR findings

Hemodynamically stable acute type A dissection with

- left renal artery supplied by false lumen
- dynamic obstruction of the remaining visceral and iliac arteries
- dynamic + static obstruction of left common iliac artery, with
- additional dynamic + static obstruction of left superficial femoral artery + true lumen thrombus.



Procedures

IR

- Supraceliac fenestration and suprarenenteric aorta TL stenting
- Thrombolysis in left iliac and superficial femoral arteries
- Infrarenal aorta fenestration and aortoiliac TL stenting, with unresolved obstruction of left SFA

Vascular Surgery

- Left SFA embolectomy
- Left leg 4 compartment fasciotomy

General Surgery

- Laparotomy
- Subtotal colectomy


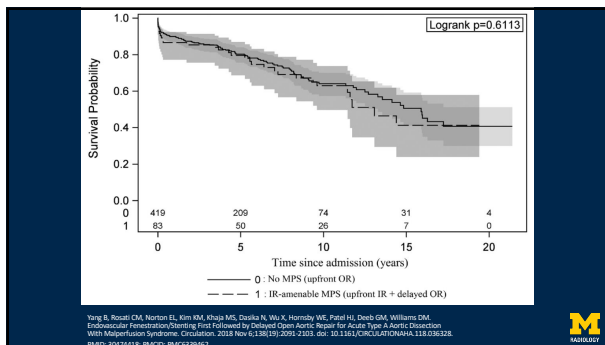
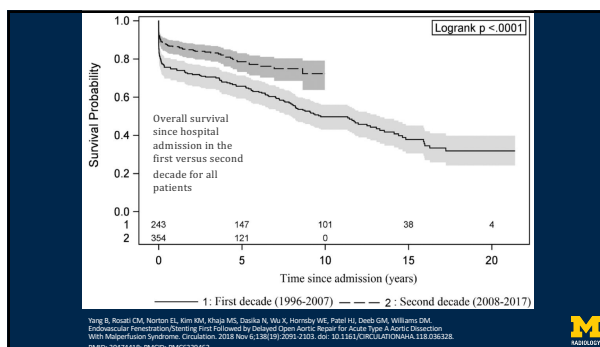
Nephrology

- Hemodialysis for 10 days



Chronology

- 10/29
- IR procedure, left leg embolectomy and 4-compartment fasciotomy, subtotal colectomy
- 11/13
- Intermittent bacteremia with fluid collection in pelvis
- 11/14
- US-guided tube placement, complicated by through and through injury to small bowel.
- 11/16
- 17:03 CT abdomen and pelvis
- 20:50 laparotomy and bowel repair
- 12/1 now s/p IR fenestration, total colectomy, 4-compartment LLE fasciotomies, L leg revascularization via outdown on 10/30 and CRRT from 10/29-11/9
- 12/5 fasciotomy sites healing well
- 7/6 no change in aorta diameter, no A.I. Fasciotomy sites have healed. Decubitus ulcer continues slow healing. Biliary drain present 7/6 but removed later. Because of all his co-morbidities, his aorta has not yet been repaired, now 2 years later.

Conclusion

When ATAAD is accompanied by cardiovascular complications or when malperfusion is not associated with tissue damage, then root repair takes precedence over organ re-perfusion.

Note that this standard of care risks embolization of coexisting TL thrombus in SMA, renal, and iliofemoral arteries, which is masked as post-operative complication.

In uncomplicated ATAAD accompanied by malperfusion syndrome (organ perfusion deficit with organ damage) or ATBAD with malperfusion, patient survival improves in a program of aggressive IR-first management of critical arterial obstruction with directed treatment of damaged organs followed by root repair if indicated, when clinical status and blood markers permit.



THANK YOU FOR YOUR ATTENTION

