RECURRENT CEPHALIC ARCH STENOSIS – WHAT SHOULD I DO DIFFERENTLY?

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DISCLOSURES

- None
- Use of stents/stent grafts is off-label

OBJECTIVES

- Definition of recurrent cephalic arch stenosis
- Etiology - Anatomy / hemodynamics
- Prevalence
- Management
  - Endovascular
    - Angioplasty
  - Stents / Stent Grafts
  - Surgery

DEFINITION

- Cephalic Arch Stenosis
  - > 50% narrowing in the perpendicular portion of the cephalic vein in the region of the deltopectoral groove, before its junction with the axillary or subclavian vein
- Recurrent Cephalic Arch Stenosis
  - Poor response to angioplasty
  - Early re-stenosis (< 3 months)

ETIOLOGY - ANATOMY

- Course – Curve of cephalic arch leads to turbulent flow and altered shear stress
- Valves/Angle – At insertion into axillary vein
- External compression - By clavicular fascia and pectoralis major

ETIOLOGY - HEMODYNAMICS

- BC AVF have relatively high blood flow, all of which ultimately flows through the cephalic arch (cf RC AVF – flow diverges into both basilic and cephalic veins)
- Increased blood flow
- Increased turbulence
- Leads to accelerated intimal injury and subsequent stenosis
CEPHALIC ARCH - PREVALENCE
- 177 patients with cephalic AVF
  - 116 Radiocephalic (66%)
  - 61 Brachiocephalic (34%)
- Cephalic arch stenosis in 26/177 (15% prevalence)
  - 2/116 Radiocephalic (2%)
  - 24/61 Brachiocephalic (39%) (p < 0.001)

Rajan et al. Cephalic arch stenosis in dysfunctional AVF. JVIR 2003

CEPHALIC ARCH - ANGIOPLASTY
- 58% required high-pressure non-compliant balloons
- Primary patency – 42% at 6 months
- Primary assisted patency – 83% at 6 months
- Complications
  - Rupture of cephalic arch
  - Loss of access - 1
  - Wallstent placement - 1
  - Prolonged balloon inflation - 1

Rajan et al. Cephalic arch stenosis in dysfunctional AVF. JVIR 2003

MANAGEMENT OPTIONS
- Endovascular Therapy
  - Angioplasty
  - Stents/Stent-Grafts
- Surgical Therapy
  - Inflow reduction
  - Local repair (Patch angioplasty)
  - Outflow revision

CEPHALIC ARCH - RUPTURE

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CEPHALIC ARCH - ANGIOPLASTY
- The mean number of interventions required to maintain patency

1.6 per patient year of dialysis
CEPHALIC ARCH - CUTTING BALLOON ANGIOPLASTY

- MOA
  - By creating microincisions in the vessel wall, a cutting balloon may facilitate effective dilatation with the least radial force
  - Reduces barotrauma to the vessel wall
  - Induces less neo-intimal proliferation
  - Lower re-stenosis rate (theoretically)

Heerwagen et al. CAS in BC AVF: results of cutting balloon angioplasty. JVA 2010

CEPHALIC ARCH - CUTTING BALLOON ANGIOPLASTY

- Retrospective study, small n (17 AVF, 25 procedures), no controls
- Primary patency – 81% at 6 months
- Primary assisted patency – 94% at 6 months
- Complications
  - Pain (1), elastic recoil (1), minor rupture of cephalic vein (1) and access thrombosis (1)

Heerwagen et al. CAS in BC AVF: results of cutting balloon angioplasty. JVA 2010

CEPHALIC ARCH - CUTTING BALLOON ANGIOPLASTY

- The mean number of interventions required to maintain patency
  - 0.9 per patient year of dialysis
- The mean interval between radiological interventions
  - 13 months

Heerwagen et al. CAS in BC AVF: results of cutting balloon angioplasty. JVA 2010

CEPHALIC ARCH - STENTS

- Recurrent cephalic arch stenosis
- 25 consecutive patients, randomized to bare metal stents or stent grafts
- Angiography repeated at 3 months in 21 patients (3 died and 1 received a renal transplant)
- Re-stenosis rates
  - 7/10 in bare stent group (70%)
  - 2/11 in stent graft group (18%)


CEPHALIC ARCH - STENTS

The mean number of interventions required to maintain patency (bare stent group)
1.9 per patient year of dialysis

The mean number of interventions required to maintain patency (stent graft group)
0.9 per patient year of dialysis


Stents/stent-grafts are off-label uses
Restrict stents to cephalic vein / cephalic arch only
Avoid axillary / subclavian vein – jeopardizes future arm access

CEPHALIC ARCH – INFLOW REDUCTION

- 33 patients with recurrent cephalic arch stenosis identified from a retrospective database
- Flow reduction used via banding of the access inflow
- At 3, 6, and 12 months, the cephalic arch primary lesion patency was 91%, 76%, and 57%.
- The cephalic arch intervention rate was reduced from 3.34 to 0.9 per access-year (t=7.74, p<.001)

Miller et al. Access flow reduction and recurrent symptomatic CAS in R-CAVF. JVA 2010; 11: 281 - 287

CEPHALIC ARCH – SURGICAL REVISION

- Local repair: Patch angioplasty
- Data presented in abstract form in 17 patients
- 4 patients treated with stents – re-stenosis requiring stent extensions and repeat angioplasties
- 13 patients with angioplasty, of which 7 patients underwent surgical repair
- Though maintained by angioplasty, none have required stenting as yet thus still preserving it is a viable option

Miller et al. CAS – Surgery as first line therapy. JVA 2007

CEPHALIC ARCH – SURGICAL REVISION

- Venous outflow revision – redirection of flow through adjacent patent veins
  - Vein-to-vein anastomosis cephalic to basilic
  - Though infrequent, is prone to stenosis at site of revision
  - Concern for jeopardizing future options for basilic AVF

Shenoy et al. CAS – Surgery as first line therapy. JVA 2007


Chen et al. Role of surgical intervention for CAS. Seminars in Dialysis 2008

### CEPHALIC ARCH – SURGICAL REVISION

- **Primary patency before surgical revision** - 8% at 6 months and 0% at 12 months
- **Primary patency after surgical revision** - 69% at 6 months and 39% at 12 months
- **Interventions decreased from 3.5 to 1 per patient yr**

(Kian et al. Role of surgical intervention for CAS. Seminars in Dialysis 2008)

### CEPHALIC ARCH – SURGICAL REVISION

- Technically difficult
- Extensive surgery – increased patient morbidity
- Prone to re-stenosis and frequent interventions
- May jeopardize the creation of a basilic vein fistula in the future
- No long-term data on outcomes

### CEPHALIC ARCH STENOSIS - SUMMARY

- **Common problem in brachiocephalic AVF**
- **Angioplasty**
  - Remains first-line therapy
  - Suboptimal results
  - Resistant lesions
  - Recurrent lesions
  - Relatively high frequency of complications
  - Cutting balloons may be an option – more data needed

### CEPHALIC ARCH STENOSIS - SUMMARY

- **Stents or stent grafts** - ? Role
  - May be useful in the short-term
  - High incidence of re-stenosis in bare-metal stents
  - Potential for axillary/subclavian stenosis
- **Surgical options**
  - Inflow reduction
  - Patch angioplasty
  - Outflow revision - comes at the expense of using the basilic/axillary system

THANK YOU!