Distal Hypoperfusion Ischemic Syndrome (DHIS)

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Conflict of Interest Disclosure

- None

Introduction

- Incidence of DHIS ranges from 1% to 25%
- A serious condition with a potential devastating outcome
- It is one of few medical emergencies for access surgeons and interventionalists

Pathophysiology

- Traditional View (“Steal Syndrome”)
  - AVF/AVG has low resistance, and it can shunt away large amounts of blood flow
  - Blood was “stolen” from artery distal to the AV anastomosis in a retrograde fashion
  - Hand ischemia occurs – steal syndrome

A Left Brachio-Cephalic AVF

Steal Phenomenon
Pathophysiology – Current View (DHIS)

- Steal phenomena - common
- For the most of time, it is secondary to arterial inflow stenosis and/or distal arteriopathy
- Distal hand hypoperfusion ischemia (DHHIS or DHIS)

Arterial Inflow Stenosis in Dysfunctional AV Access

- A perspective study of 101 HD pts with dysfunctional AV access
- MRA showed 19 arterial stenoses in 14 patients (14%).

Arterial Inflow Stenosis Distal to AV Anastomosis

- DSA confirmed 18 of these lesions in 13 patients
- Of the 13 patients, 7 patients had arterial stenoses only and 6 patients had arterial and venous stenosis.
- Poor flow rates (9 patients), steal symptoms (2 patients), and insufficient access maturation (2 patients)

Arterial Stenosis/Occlusion

Distal Arteriopathy
**Diagnosis**

- Clinical Diagnosis is largely based on symptoms and physical findings.
- Pain, coldness, numbness, and muscle weakness at rest or during hemodialysis.
- Physical findings: coldness, pallor, paresthesias, paralysis, ulceration, gangrene of fingers.

**Diagnosis**

- Radial pulse – not reliable in forearm AVF
- Compression of AVF/AVG will transiently relieve some, if not all, of the symptoms and signs.

**Digital Pressure Measurement**

- BDP (basal digital pressure)
- DBI (digital to contralateral brachial index)
- CDP (change in digital pressure with access compression)

**A case-control study (Schenzer et al, Vascular Medicine 2006: 11: 227 – 231) showed**

- BDP < 60 mm Hg or DBI < 0.4 were highly associated with hand ischemia.
- However, CDP was marginal in predicting hand ischemia.

**Compression of AV Access Increase Blood Flow Into the Ischemic Hand**

**Differential Diagnosis**

- DHIS
- Carpet tunnel syndrome
- Destructive Arthropathy
- Ischemia monomelic neuropathy
Differential Diagnosis

- Diabetic or uremic neuropathy
- Venous hypertension induced hand ischemia
- Dermatological lesions

Stages of DHIS

Stage 1
- Pale/blue/cool hand without pain
- No or slight cyanosis of nail beds, mild pallor of skin of hand, reduced arterial pulsations at the wrist, reduced systolic finger pressure

Stage 2
- Pain during hand exercise and/or with dialysis
- Pain, cramps, numbness, or disturbing evidence in fingers or hand

Stage 3
- Pain at rest or motor dysfunction of fingers or hand

Stage 4
- Tissue loss, including silver, necrosis, or gangrene

Management

- The goals of management
- Preserve AV access
- Save hand or finger tips
- Functional AV access with adequate hemodialysis treatment

Management

Table: Treatment results of dialysis patients

<table>
<thead>
<tr>
<th>Author, year (ref.)</th>
<th>Number of patients</th>
<th>Time of symptoms (%)</th>
<th>Access patency (%)</th>
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<td>DeChaine et al., 1997 (10)</td>
<td>13</td>
<td>91</td>
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<td>Henry et al., 1998 (25)</td>
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<td>Bowers et al., 1998 (26)</td>
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<td>Jovaisa et al., 1996 (27)</td>
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<td>Leventhal et al., 1994 (28)</td>
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<td>Momma et al., 1998 (29)</td>
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<td>Lee et al., 1998 (30)</td>
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<td>Leventhal et al., 1994 (28)</td>
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<td>Short et al., 1998 (31)</td>
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<td>Khan et al., 2002 (32)</td>
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<td>Kamata et al., 2002 (33)</td>
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<td>Kim et al., 2006 (34)</td>
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Management

- Flow reduction techniques
  - Banding or plication
  - Short jump graft with small diameter
  - Long jump graft with normal diameter
  - Frequently cause thrombosis of AV access

Management

- Ligation of AVF/AVG
  - Immediate relief of hand ischemia
  - Loss of AV access
  - Reserved for severe tissue loss or failure of other methods

Management

- Distal Revascularization and Interval Ligation (DRIL)
  - Over decades experience with excellent patency of AV access and bypass vein
  - Treatment of choice (Surgery)

- Alternatives of DRIL
  - RUDI, PAI

Banding and Surgical Techniques

- Minimally Invasive Limited Ligation Endoluminal - Assisted Revision (MILLER) banding procedure
  - Balloon-assisted banding
  - Used for high-flow AV access
  - The banding site can be further dilated using the balloon if flow is not adequate
  - Problems: aneurysm formation in the venous segment upstream from the banding site
Symptoms of hand ischemia
r/o other causes of hand pain
Perform complete arteriography

Arterial stenosis +
Amenable to PTA/Stenting?
Yes
No
PTA/Stenting
MILLER/ Surgical intervention

DHIS is not uncommon, and remains to be a challenge to an access specialist
It is usually not caused by “steal”, but arterial inflow stenosis and/or distal arteriopathy
The diagnosis can be made clinically, but underline etiology requires further imaging studies

Goals of treatment: preserve the access, save hand or finger tips, and adequate HD.
Surgical approaches: DRIL, RUDI, and PAI
New approach: Miller procedure
Thank You!