Arteriovenous Malformations

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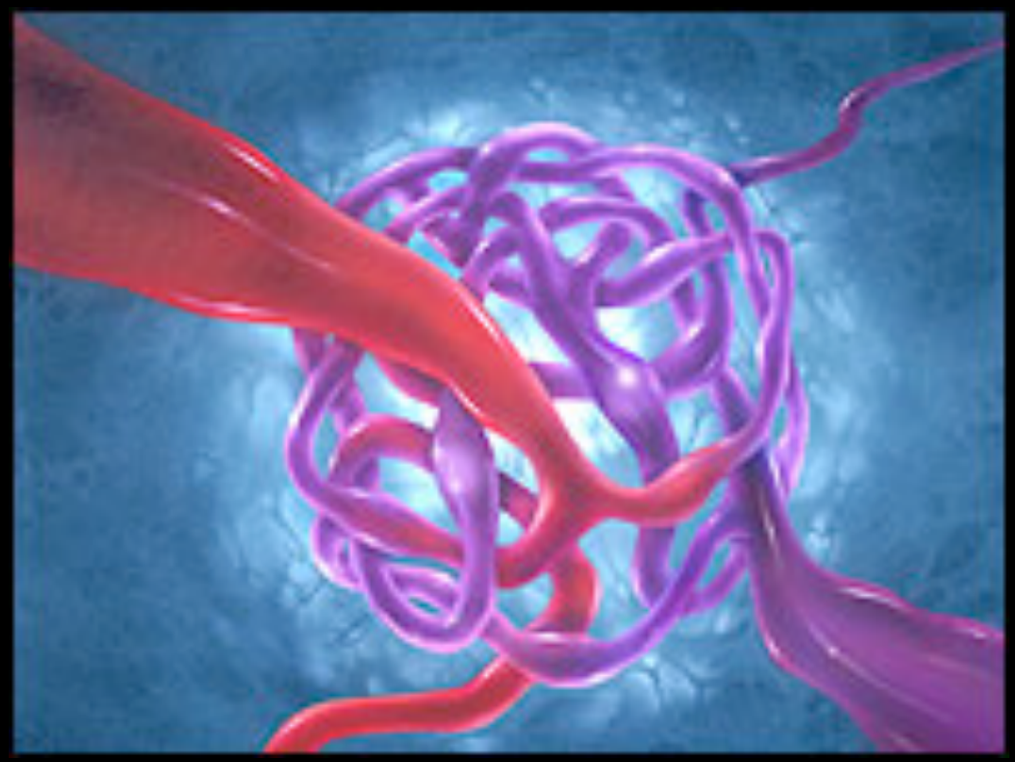
Outline

- Clinical features
- Natural History
- Decision analysis
- Principles of Surgical Management

Clinical Features

Definition

- an abnormal conglomeration of blood vessels where arterial blood flows directly into draining veins without intervening capillary bed or brain parenchyma resulting in arteriovenous shunting



Definition

- often there are numerous fistulas between arterioles and veins
- results in high pressure vascular channels at risk of rupture

Epidemiology

- prevalence = 0.01% - 0.52%
- congenital but sporadic
- may be associated with genetic syndromes:
    - Osler-Weber-Rendu Syndrome
    - Sturge Weber Syndrome

Epidemiology: AVM vs. Aneurysm

- ratio 1 : 5.3 (pre-CT era)
- AVM's tend to present in patients during third decade of life
    - cf. aneurysms where peak incidence is 55yrs
- aneurysms may be included within the AVM

Clinical Presentation

- range of symptoms including:
  - hemorrhage (most common) - 50%
  - seizures - risk higher for younger patients
  - mass effect
  - ischemia (steal phenomenon)
  - headache

Diagnostic Modalities

- Useful imaging techniques include:
    - cerebral angiography
    - CT and CTA
    - MRI and MRA
    - PET
    - functional MRI

What are we looking for?

- presence or absence of associated aneurysms
- presence or absence of venous outflow
- pattern of venous outflow
- relationship to eloquent areas
- *en passage* feeding vessels

Natural History

Hemorrhage and AVMs

- most common presenting sign -generally present as ICH (less commonly SAH)
- overall risk of hemorrhage of arteriovenous malformations = 2 - 4% per year
- hemorrhage associated with 5-10% of death
- 30-50% chance of disabling neurological deficit associated with hemorrhage
- hemorrhage of AVM accounts for 2% of strokes
- lifetime risk (%) = 105 - patients age (yrs)

Hemorrhage and AVMs

- after inital hemorrhage, annual risk of rupture ranges from 4.5% - 34%
- 6% during the first year with return to baseline

Risk factors for re-hemorrhage:

presence of aneurysms

drainage into deep venous sinuses

deep location

single draining vein

venous stenosis

*** controversial***

Hemorrhage and AVMs

- Stapf et al. performed a prospective study looking at factors predicting re-hemorrhage
- 2 independent factors identified:
    - drainage into deep venous sinus
    - deep location

No. of Factors	Risk of Rupture	Risk of Re-hemorrhage
0	1.3%	11%
1	3%	15%
2	8%	35%

Decision Analysis

The Variables...

age

patient preferences

presentation

features of AVM

aneurysms

limitations of treatment modalities

Surgical Resection

Spetzler - Martin grading system

Graded Feature	Points
Size	
small (<3cm)	1
medium (3-6cm)	2
large (>6cm)	3
Eloquence of adjacent brain	
non-eloquent	0
eloquent	1
Pattern of venous drainage	
superficially only	0
deep	1

Surgical Resection

Spetzler - Martin grading system

Sum of the scores is equal to the grade

Low Risk Surgical Resection	Grade I- III
High Risk Surgical Resection	Grade IV , V

Radiosurgery

- in general radiosurgery is recommended for lesions less than 3cm
- delayed treatment effect (upto 3yrs)
- rate of hemorrhage greatly reduced after 3yrs
- complications: seizures, hemorrhage, radionecrosis, progressive edema, venous congestion
    - 1.4% incidence of permanent deficit
    - 5.2% incidence of transient deficit

Embolization

- involves injecting occlusive substance into feeding arteries and nidus of the AVM
- may be curative in lesions < 1 cm
- may be a useful adjunct to surgery

Aneurysms and AVMs

- aneurysms may be found iin up to 58% of patients with AVMs
- may be on feeding artery or within the nidus or separate from the AVM
- clipping or endovascular coiling of feeding artery aneurysms performed if >7mm
- if aneurysm is <5mm it may potentially regress with treatment of the AVM