Cx in Aneurysm Coiling: Avoidance (& General principles of Mx)

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STATEMENT OF INTERESTS:

Neuroradiology lead NHS England Neurosciences Clinical Reference Group

Chief Investigator randomised controlled PISTE, STABILISE, TOPSAT 2 trials

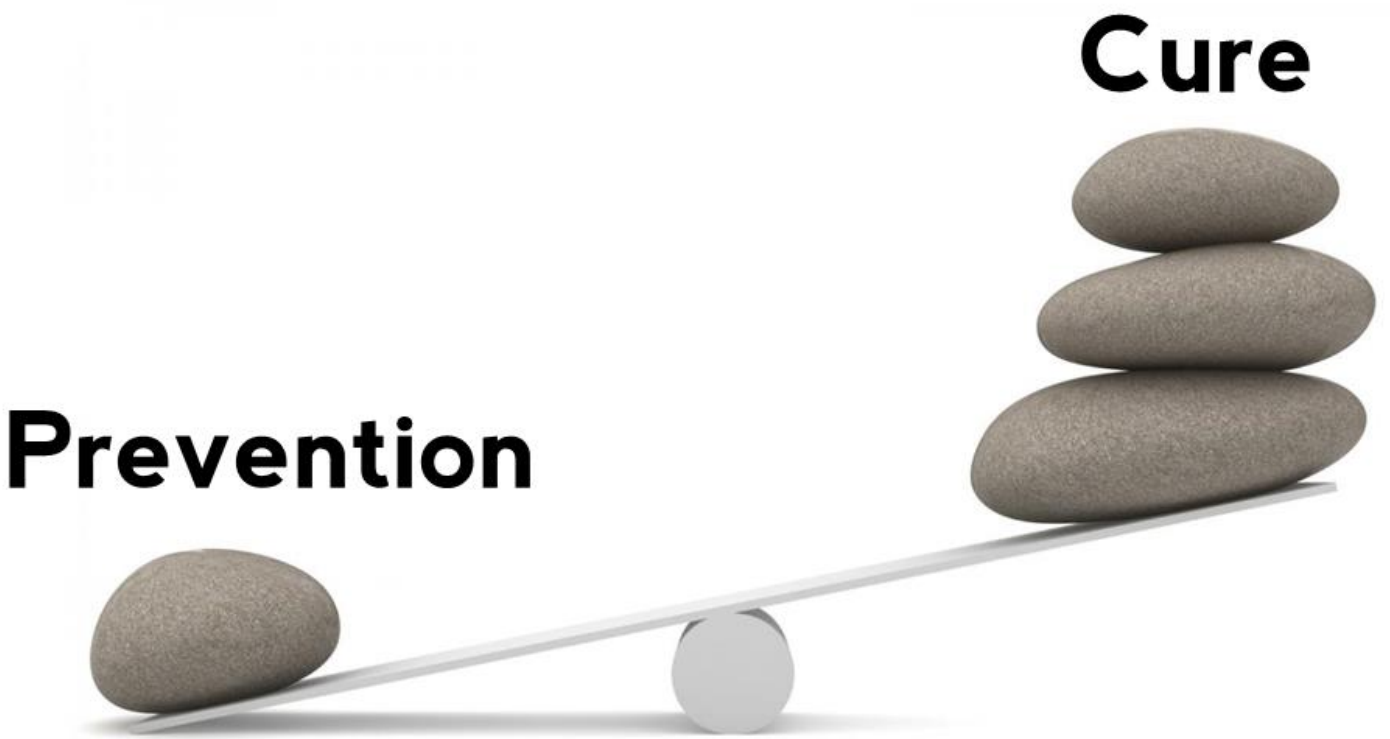
Institutional Research/Educational funding from: Codman, Medtronic, Microvention, Stryker

Consultancy work with Microvention/Stryker

BSNR committee & UK Neurointerventional Group Chair

RCR rep on intercollegiate stroke working party

Prevention is better than cure (Erasmus)



Prevention strategies

Reconnaissance & preparation……

Preventing complications in aneurysm intervention:

1. General environment
2. Procedural Complication types & Prevention
   - Haemorrhagic
   - Thrombo-embolic
   - Puncture site
   - Other
3. Delayed risks

Short key reference provided list separately

Is intervention required?

- Particularly relevant in UIA
  - *It is impossible to "beat" natural history risk of a small stable cavernous carotid aneurysm no matter how good you are*
- Decision making:
  - **Via MDT**
    - Decide on factors MDT will take into account & weight given
  - As evidence based as possible taking patient factors into account *(e.g. all 70y olds are not equal)*
  - Stick to one risk assessment score (ISUIA, PHASES, UIATS)
  - Patient wishes
- Use minimum risk strategy for the patient
  - NB. Try & avoid changing strategy last minute or during case

Be aware of the main EVT Cx

Procedural:

- Rupture – *aneurysm or vessel*
- Stroke – *large artery, small artery, distal embolism*
- Foreign body – *coil (stretch/detach/protrusion/migration), other*
- Arterial puncture site – *pseudoaneurysm, infection, PAO/critical ischaemia, retroperitoneal haematoma*
- Infection – standard antiseptic procedures must be applied
- Technical failure – will occur. **Know when to stop**. Phone a friend!

Delayed:

- Inflammatory – *idiosyncratic response, no definite device link*
- Haemorrhagic – *[re]bleed aneurysm, distal parenchymal (FD)*
- Nerve compression
- Recurrence (Rx failure)

Aneurysm risk factors to be aware of:

- Very small, very distal, atypical or giant aneurysms– risk ↑
- Adverse neck or branches related to neck
- Specifically:
  - WNA (>4mm)/adverse DNR [aspect ratio <1.5]
  - In WNBA >180^0 angle
  - Tolerance for coil oversizing is very limited in small lesions
  - Take time with the first coil
  - Be dynamic with microcath.- alter position and tension with coil
  - Have a variety of coil types for small lesions
    - Be aware of compatibility issues with coils and microcatheters
- Knowing when to stop is not easy, but remember the phrase: 'the enemy of good is better'
    - Especially in ruptured aneurysms **don't** always coil until Mcath backs out or coil can't be delivered into aneurysm = absolutely no space
    - ISAT: coiling achieved was often pretty ropey *(I did it!)* but it worked

What are the risks? - Haemorraghic

- Aneurysm rupture
  - 2-8% in acutely ruptured aneurysms
    - Increased in: first 24h post ictus, very small aneurysms, tortuous anatomy, distal locations or if bleeding diathesis
  - 1-2% in UIAs
  - Outcome approximately rule of 1/3s
- Vessel rupture/dissection
  - <1% but be wary if severe spasm or hypoplastic vessel esp if using more complicated technique (balloon/multiple or large microcaths etc.)
- Delayed bleeding
  - Aneurysm (1-2% in FD) or small vessel perforation
    - HTI & reperfusion injury

What are the risks? - Thromboembolic

- Wider variability in literature ~3-10%
- Many will not lead to overt clinical sequelae (if recognised & managed promptly)
- Types of TE Cx:
  - Catheterisation related from arch/cervical vessel atheroma
  - Guide catheter related
  - Spasm related
  - Distal device (flow restriction)
  - Coil related (protrusion or migration)

What are the risks: Puncture site

- Haematoma not uncommon but <2% incidence where active Rx required should be the norm. 1% ballpark
  - Careful attention to arterial puncture. Use smallest sheath size possible for the case; US guidance
  - Radial lower risk than CFA
- Haematoma or Pseudoaneurysm – acute critical ischaemia or more chronic
- Stenosis – esp. in association with dissection or use of VCD
- Infection
- Side branch avulsion/damage
- **Caution in use of VCD** – relative & absolute CAIs
- Proper post op care/obs of puncture site & limb distal to it
  - Be conservative with aftercare & mobilisation (don't rush it)

What are the risks? - Other

- Other - Procedural
  - Navigation related:
    - Long femoral sheaths in tortuous anatomy
    - Avoid traversing ICA stenosis with guide
    - Judicious use of triaxial system
    - Entry into aneurysm over coil
  - GA related
  - contrast related: careful use, LOCM, renal function awareness
  - radiation related: cf my other lecture this week!
- Other – Disease (SAH) related
  - If hydrocephalus EVD or lumbar drain etc.?
  - Treat within 48h of ictus (well before spasm period)
  - Immobility related – pneumonia, PE etc... (~6% in SAH, ~2% UIA) – *Bekelis et al 2014*

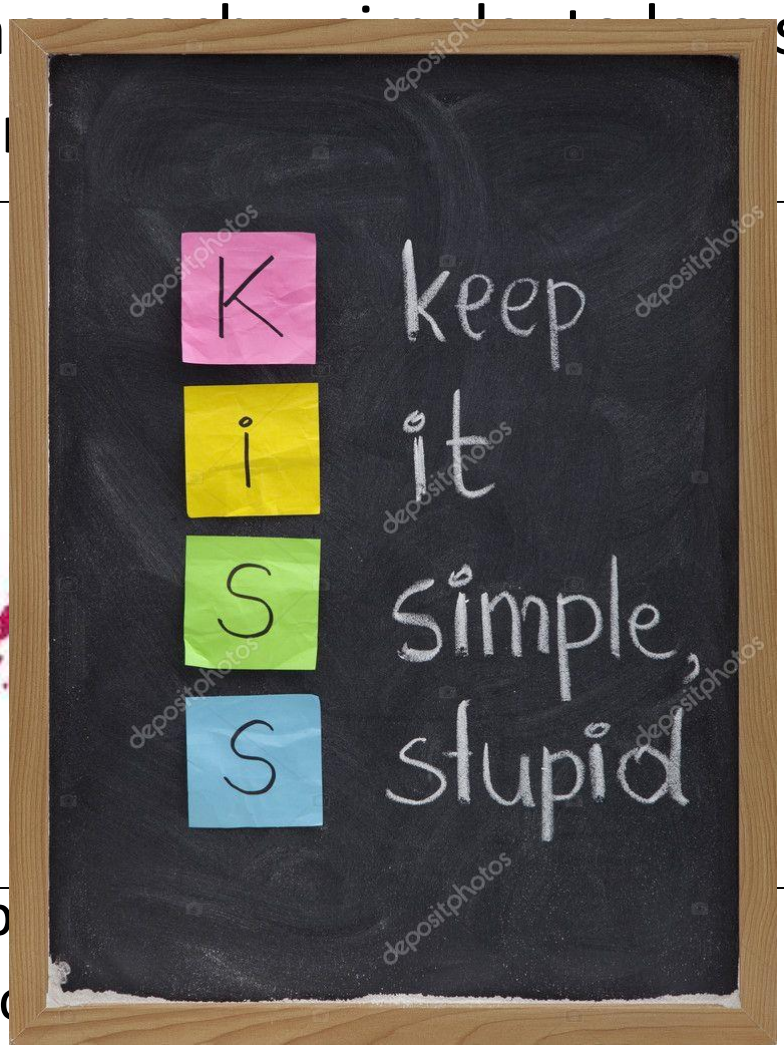
Preventing Cx during coiling

Preventing complications - working environment

- Minimise the number of people in the room and potential distractions
- Aneurysm Rx on a biplane unit unless dire emergency
- Utilise the ‘surgical pause’
- Plan case early and discuss the strategy with your team
- Do not rush
- Turn your mobile off/onto ‘flight mode’: nothing is more important than what is in front of you
  - *Do not go off to take phone calls etc. They will wait – your patient won’t*
- Ensure you have available all emergency kit & medications you may need during a case, and that your team know where to find them

KISS principle

- Hierarchy of a … simple to complex
- Appreciate & …
- Avoid intr… into any case!
  - E.g. try… here, simulator, proctor, … junior new scrub nurse o…
- If any co… tried & tested or resche…
- Communi… before & during case
  - Double scrub…
  - MDT review …



Helpful to implementing KISS principle

- Team brief including WHO Surgical checklist or equivalent + “surgical pause”
- Take time to review anatomy carefully – 3D in particular
- Careful selection of >1 Working projection
- Optimise conditions for case – don’t be afraid to not use new device or not tackle complex case if everything else is not optimum
  - is a simpler approach possible/appropriate?
- **Good communication**

Preventing vessel trauma

- Avoid “blind” catheter/wire manipulation
- Keep wire tip in view
- J shapes
- Adjust “hands” to patient
- Use of roadmap etc…
- Biplane equipment & judicious use of it
- Particular care/caution/kit selection in adverse anatomy
  - Cervical loops, U bend origins, marked tortuosity
  - Triaxial & DAC, buddy wire etc……
- In adverse anatomy use of DAC: provides more stable support & this will assist – reduced rupture risk, quicker coiling

Minimising Rupture risk

- Be aware of key risk points
  - Catheterising aneurysm/first coil/last coil
- Minimise adverse extraneous factors – phones, disturbance, conversations- **communicate with team**
- Consider balloon placement – if not using ? Prep & ready if higher risk case
- Timing of heparinisation – local SOP but be prepared to adjust to circumstances
- Remove tension form systems before deploying coil
- Beware overinflation of balloon especially when straddles 2 different calibre vessels – *use of controlled syringe, blank road map may help*
- **Know when to stop & be prepared to!**

Mx of Rupture during coiling

- Recognition
- Reverse heparin (protamine- 1mg per 100 i.u –NB timing of heparin bolus)
- Address bradycardia/BP/Cardiopulmonary Cx
- Coil aneurysm to occlusion asap
- If balloon in situ inflate over aneurysm & leave 7-10mins
- If Mcatheter perforation
  - **Do not withdraw into aneurysm sac** (plugging some of hole)
  - Consider:
    - Placing balloon if prepped
    - Leave & deploy second Mcath into aneurysm & coil off – quick to do if 6F guide & **double RHV** in situ, not if need further arterial puncture
- On table Xper/Dyna CT and immediate EVD should be considered

Minimising Thromboembolic Cx

- Good flow from flush bags – heparin &/or nimodipine
- Check free flow – of flushes & from guide catheter tip
- Systemic heparin – timing & dose. Monitor ACT or equivalent
- Appropriate use of antiplatelets
  - Will depend on case
  - Single/double
- Avoid unnnecessarily long:
  - Procedures – KISS
  - Manipulation – training vs risk to patient
  - **Know when to stop & be prepared to!**
- Assess final angio in at least 2 planes carefully for: missing vessel or capillary defect, contrast stagnation or extravasation & check unsubtracted views + Consider AngioCT at end of prcodeure

Minimising puncture site Cx

- Attention to risk factors– coagulopathy, PVD, high BMI
  - Mitigate if possible
  - If not consider alternative approach – different side, different site, surgery etc……
  - Radial lower risk
- US guidance/Micropuncture kit
- Arterial run & review prior to VCD
  - Assess for CAIs prior to use of VCD
  - Use U/S if there is NO haemostasis after deployment of closure device: check device is not inside CFA
- Consider use of heparin/antiplatelets & risks at puncture site – protamine?, timing & dose of AP
- Timing of sheath removal & check pre extubation

Preventing complications in aneurysm intervention?

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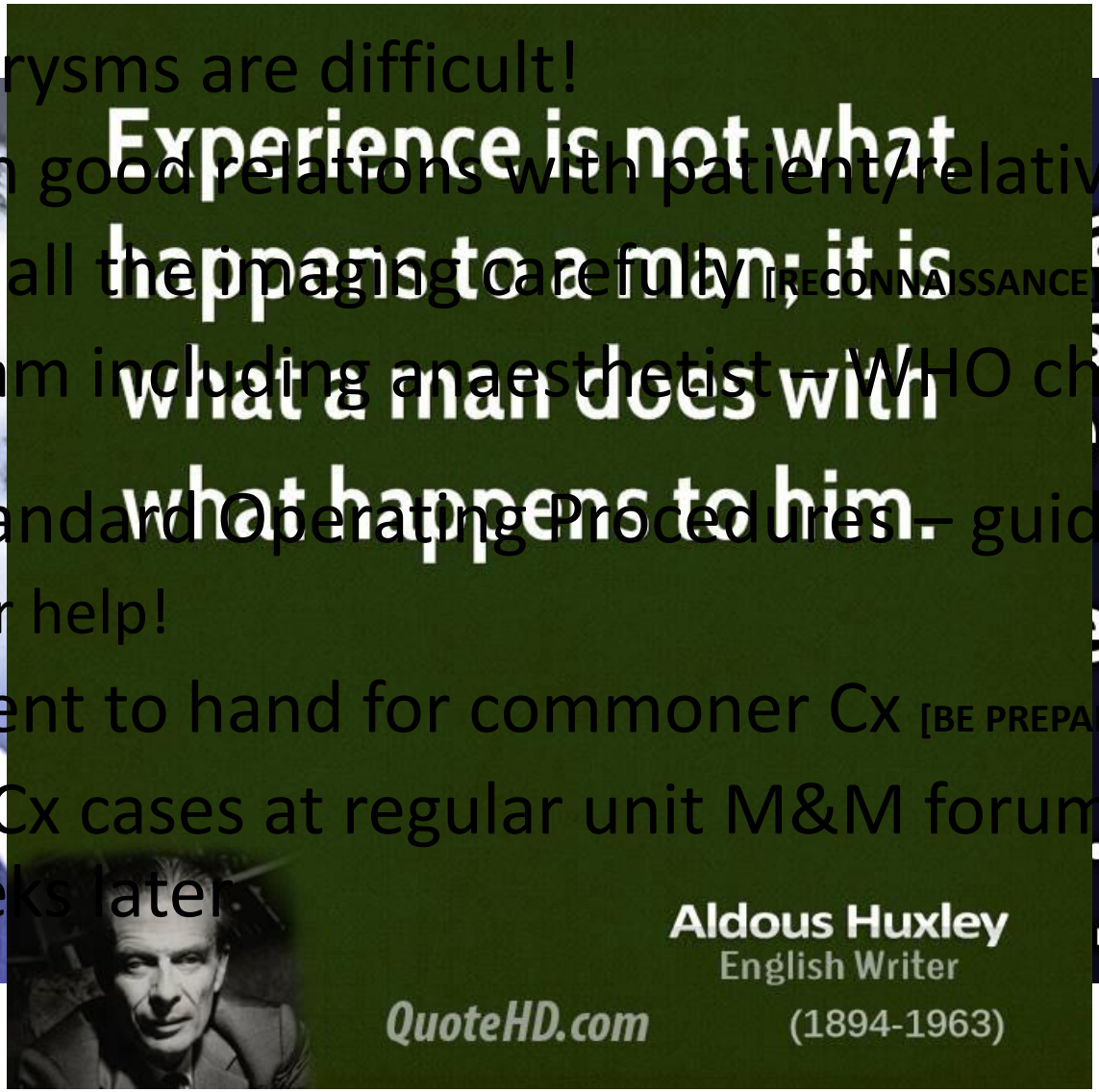
Minimising Delayed Cx:

- General Mx principles:
  - D/C from recovery to appropriate level of care – ICU vs HDU vs Ward
  - Bed rest, BP target and regular obs for all patients
  - Fluid, anticoagulation etc as appropriate & clearly charted - ensure that any antiplatelets you have indicated are needed are prescribed and given as instructed
  - Make sure team caring for the patient know how to contact you
  - Review the patient regularly
- Specific scenarios:
  - Steroids - where perianeurysmal oedema pre Rx or where predicted post *(giant/near giant basilar tip & ophthalmic aneurysms esp. if partly thrombosed)*
  - Established vasospasm – chart Mx plan – liaise closely with ICU & N'Surg – consider EVD if none

General principles re Mx Cx

General principles re Mx Cx

- All aneurysms are difficult!
- Establish good relations with patient/relatives
- Analyse all the imaging carefully [RECONNAISSANCE]
- Brief team including anaesthetist – WHO checklist [BE PREPARED]
- Have Standard Operating Procedures – guide
  - Ask for help!
- Equipment to hand for commoner Cx [BE PREPARED]
- Review Cx cases at regular unit M&M forum, ideally few weeks later



Managing after Cx:

- Try to remain calm
- Do n ds, not durin
- **De-b** ed
- Take alogue
  - Ar
- Talk t
  - Ta
- Atter
- Parti

Avoiding coiling Cx summary:

1. **Optimise working environment**
2. **Reconnaissance & preparation** – be aware of adverse factors
3. Use of: team brief/"WHO Checklist" & surgical pause
4. **Specific protocols/practice to minimise main risks**:
    a. Rupture
    b. Thromboembolic
    c. Puncture site
    d. Delayed problems
5. **If a Cx occurs, don't panic & keep calm**
    a. SOPs & ensure kit in place to handle most anticipated Cx's
    b. Phone a friend
    c. Debrief

Newcastle University

Thank you!

NB. Brainstorm 1st-3rd June 2020
Edinburgh

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Reference list

1. Brinjikji et al. Outcomes Are Better for Unruptured Cerebral Aneurysms Treated at Centers That Preferentially Treat with Endovascular Coiling: A Study of the National Inpatient Sample 2001–2007. *AJNR* 2011;32:1065-1070
2. Bekelis K et al. A predictive model of outcomes during cerebral aneurysm coiling. *JNIS* 2014;6:342-348
3. Molyneux et al. Cerecyte Coil Trial: Procedural Safety and Clinical Outcomes in Patients with Ruptured and Unruptured Intracranial Aneurysms. *AJNR* 2012; 10.3174/ajnr.A2836
4. White PM, du Plessis J & Mitra D. An Overview of the Endovascular Treatment of Intracranial Aneurysms. *PanVascular Medicine.* Springer 2015;https://doi.org/10.1007/978-3-642-37078-6
5. Currie S, Mankad K, Goddard A. Endovascular treatment of intracranial aneurysms: review of current practice. *Postgrad Med J* 2011;87:102341–102350
6. Royal College of Radiologists (2013) Guidance for fellows in implementing surgical safety checklists for radiological procedures. Ref No. BFCR(13)1 © *The Royal College of Radiologists*, London
7. Brinjikji W, McDonald JS, Kallmes DF, Cloft HJ. Rescue treatment of thromboembolic complications during endovascular treatment of cerebral aneurysms. *Stroke 2013;*44(5):1343–1347
8. Taussky P, Lanzino G, Cloft H, Kallmes D. A checklist in the event of aneurysm perforation during coiling. *Am J Neuroradiol* 2010;31(7):E59
9. Connolly ES, Rabinstein AA, Carphuapoma JR et al. Guidelines for the management of aneurysmal subarachnoid hemorrhage. *Stroke 2012;*43:1711–173
10. Patel MR, Jneid H, Derdeyn CP et al. Arteriotomy closure devices for cardiovascular procedures. *Circulation* 2010;122:1882–1893
11. Pinto A, Faiz O, Bicknell C, Vincent C. Surgical complications and their implications for surgeons' well-being. *Brit J Surgery* 2013;100(13): 1748-1755