Heparin dosing during vascular procedures should be monitored by ACT levels to be safe and effective.

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Heparin and ACT.

Heparin:
- Discovery: Mc Lean or Howell?
- Introduced in surgery in humans by Murray 1940, landslide
- Permitted clamping arteries without clotting
- Vascular surgery developed rapidly
- Extended to the heart: heart lung machine 1953
- First PTA Charles Dotter 1964
- Heparin incorporated in all (endo)vascular procedures worldwide

Heparin and ACT.

Heparin:
- Advantage is self evident
- Disadvantage also ...
  - Increase peri- and post-procedure bleeding
  - Blood loss, blood transfusions, increase procedure time
  - Hematoma: pain, infection
  - HIT
  - “Devil in disguise..?”

Heparin and ACT.

Heparin:
- Worldwide used by vascular surgeons and interventional radiologists
- AAA repair: 80-85%, other procedures almost 100%
- But surveys show large variation present in:
  Dosage, repeat, regional use, protamine use
  Measuring the effect: 0-35 %, more in USA.
- Guidelines?:
  - Dutch guidelines: Nothing
  - ESVS: Nothing
  - SVS: Systemic heparinization, by almost all surgeons;
    75-100 U/kg; AAA: heparin may be omitted, no literature
  - ACCP: Systemic heparinization, 100-150 U/kg, repeat
    44-50 min with 50 U/kg, literature RCT 1996.
Heparin and ACT.

Heparin:

• Unpredictable effect in the individual patient!
• At least 35% of patients either too high or too low
• Could have (major?) influence on all results of vascular procedures:
  - Patency open and endovascular
  - Occlusion in PEVAR/BEVAR, chimneys, periscopes
  - Complication rate: bleeding and thrombotic
• Protamine use? More in US than Europe/UK.
• Alternatives: Dextran, iloprost, anti-thrombin, LMWH, bivalirudin

Heparin and ACT.

Test:

• Considering all this about heparin, measuring the actual effect of heparin in the patient during all vascular procedures should be obligatory
• To insure tailor-made peri-procedural anticoagulation individual patient
• What test?
  - Activated Partial Thromboplastin Time (APTT)
  - Thrombin Time (TT)
  - Prothrombin Time (PT)
  - Antithrombin-III (AT-III)
  - Fibrinogen
  - Heparin concentration

Heparin and ACT.

Test:

• What does literature shows us?
• Abundant in cardio-vascular procedures, open and endovascular
• Sparse in non-cardiac vascular procedures, open and endovascular
• "Consensus": Activated Clotting Time (ACT):
  - Less bleeding complications
  - Reliable with high concentrations of heparin
  - Point of Care (POC) on (hybrid)OR, angiosuite

Heparin and ACT.

ACT:

• "Proof" from literature:
  • Lee et al Surg Gyn Obst 1982;156(6):806-12.
  • Shammas et al J Invasiv Cardiol 2003;15:242-246
  • Kasapis et al Circ Carentess Intens. 2001;5:593-601

• Conclusion: Variability of patient response to heparin makes it impossible to achieve or maintain adequate levels of anticoagulation without measuring the effect of heparin

Heparin and ACT.

ACT:

• What can we learn from that "older" and sparse data?
• No known optimal ACT, but 200 ± 20 sec or 2 x baseline seems rational
• Data essential in non-cardiac arterial procedures
  • VUmc Amsterdam: "RetroVasc" and "HepaVasc"
• Role of measuring and calculating individual heparin requirements
• In order to project individual dosing
• Value proven in cardiovascular procedures: HMS Medtronic.
Heparin and ACT.

- It is time that during non-cardiac vascular procedures the individual patient receives tailor made anticoagulation.
- It should be mandatory therefore to measure the actual effect of heparin by using the ACT.
- Data are warranted in order to establish optimal values of ACT.
- Further research to optimize heparin use to make sure results of vascular procedures are not negatively influenced by inadequate anticoagulation.