Vascular Access Creation Under General or Regional Anesthesia Should be the Standard

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Disclosures: none

Why are we having this debate?

We want to make AV fistulas for our patients!

We want fistulas that are Better Stronger Faster

Problem: Fistulas can fail

Why do fistulas fail?
- Patient characteristics
- Surgical technique
- Small vein diameter
- Low fistula blood flow
- Vasospasm
**Fistula Failure**

What can we do?
- Utilize *anesthetic techniques* that create an *optimal environment* for fistula success

**GA/Regional are Superior to LA**

Why?
- Vasodilation/Hemodynamic benefits
  - Faster maturation, better patency
  - Increase avf options
- LA not really “safer”
- GA not really “riskier”

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**Anesthetic Techniques**

**Problems with Local-MAC**
- Increased arterial and venous *spasm*
  - Decreased flow … thrombosis
- Pain control often marginal
  - Cautery
  - Tunneling
- Sedation required to maintain “quiet operative field”
  - Risks of hypoventilation
  - Hypo-tension
  - Unprotected airway … crash intubation

- Distortion of tissues/surgical field
  - Edema, hematoma
- Can be difficult to maintain
  - Prolonged or extensive procedures
  - i.e. Transpositions
- May not tolerate upper arm tourniquet
There is a better way!

Benefits of General Anesthesia
- Vasodilation
- Motor block
- Airway control
- Rapid onset

Benefits of Regional (Brachial Plexus Block)
- Local vasodilation
  - Less hypotension vs GA
  - Increase avf options
  - Higher fistula flow
    - Better maturation, better patency

Benefits of Regional (Brachial Plexus Block)...
- Motor block
- Facilitates upper arm tourniquet
- Faster recovery than GA (no emergence)
- Prolonged duration of action
  - Postop sympathectomy
  - Postop analgesia

Hemodynamic Benefits of BPB
- Increased brachial/radial artery diameter
- Increased cephalic/basilic vein diameter
- Decreased resistance (RI, PI)
- Increased brachial/radial artery blood flow
- Increased diastolic flow
- Increased fistula flow

>11 Studies Demonstrating Hemodynamic Benefits of BPB in Dialysis Access Surgery

2012: Li, Chinese University of Hong Kong

Regional Hemodynamic Changes After an Axillary Brachial Plexus Block, A Pulsed-Wave Doppler Ultrasound Study.

Regional Anesthesia & Pain Medicine

- 8 patients
- USG Axillary nerve block
- Regional hemodynamic parameters
  - PSV
  - EDV
  - Mean velocity
  - Time averaged mean velocity
  - PSV/EDV Ratio
  - Diameter
  - Resistive index (RI)
  - Pulsatililty index (PI)
  - Brachial artery blood flow

Baseline: Triphasic waveform

5min: Monophasic
  - Loss of reversed flow
  - Increased diastolic flow

% Changes in Regional Hemodynamic Parameters After USG Axillary BPB

Hemodynamic Benefits of General Anesthesia

2006: Shemesh, Shaare Zedek Medical Center, Jerusalem

Sympathectomy-like Effects of Brachial Plexus Block in Arteriovenous Access Surgery

Ultrasound in Medicine and Biology

- Supraclavicular brachial plexus block
- General anesthesia
- Hemodynamic parameters
  - Pulsatility index (PI)

2006: Shemesh

Hemodynamic Benefits of General Anesthesia

Block

PI: 3.92

PI: 3.67

GA
Hemodynamic Benefits of General Anesthesia

1989: Mouquet, Hôpital de la Pitié-Salpêtrière, Paris

Anesthesia for Creation of a Forearm Fistula in Patients with Endstage Renal Failure

36 patients

- 9: Local anesthesia-MAC
- 9: Supraclavicular brachial plexus block
- 9: GA (Isoflurane)
- 9: GA (Halothane)

Regional Anesthesia Increases Options for AVF Creation and Increases AVF Prevalence

2013: Al-Basheer, Journal of the Royal Medical Services
2010: Schenk, The American Surgeon

2007: Laskowski et al, NYU

Regional nerve block allows for optimization of planning in the creation of arterio-venous access for hemodialysis by improving superficial venous dilation.

- 26 patients
- Preop vein mapping ➔ operative plan
- Axillary nerve block ➔ repeat vein mapping
  - Operative plan modified depending upon venous dilation

Results:
Vein Diameter

Pre-Block .29 cm
Post-Block .34 cm (17%)

p = .008

Results:
Operative Plan Modified
29.4% of patients
Plan Modifications

**AV Graft to Fistula (4)**
- Basilic transposition (2)
- Brescia-Cimino (2)

**Plan Modifications ...**

**Proximal to Distal Arm (3)**
- Brachiocephalic to Cimino (1)
- Graft to Cimino (2)

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2007: Laskowski et al, NYU

Regional nerve block allows for optimization ...

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**2007: Laskowski et al, NYU**

Plan Modifications ...

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**Plan Modifications ...**

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2010: Schenk, University of Virginia

Improving dialysis access: regional anesthesia improves arteriovenous fistula prevalence.

American Surgeon 2010

- 193 patients/14 months
- Preop mapping ➔ access plan
  - 131: plan for AVF (local)
  - 62: plan for AVG

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**2010: Schenk, University of Virginia**

Improving dialysis access: regional anesthesia improves arteriovenous fistula prevalence ...

62/193 “planned AVG”

- Brachial Plexus Block
- Re-imaged
- 23/62 (37%) “Recruited AVF”

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2010: Schenk, University of Virginia

Improving dialysis access: regional anesthesia improves arteriovenous fistula prevalence ...

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**Outcomes:**

**Maturation Time**
- Planned AVF (local) 132 days
- Recruited AVF (BPP*) 83 days

Faster!
P = .023
Conclusions

Regional Anesthesia + Vein Mapping
- Shortens AVF maturation time
- Increases AVF prevalence
  \[62 \rightarrow 80\% / 14 \text{ months}\]

- Hemodynamic changes
- More rapid maturation
- Lower thrombosis rate

Local-MAC versus Regional Anesthesia

Randomized Prospective Studies of AV Access Creation Comparing BPB to Local-MAC

2006: Yildirim, Scandinavian Cardiovascular Journal
Recruiting: Montefiore Medical Center, NY
Recruiting: NHS Glasgow, Scotland

Results: Patency
Incidence of Thrombosis @ 1 Week

- BPB: \(0/20\) (0\%)
- LA: \(4/20\) (20\%)

Results: Patency
Incidence of Thrombosis between 1 Week and 100 days

- BPB: \(0/20\)
- LA: \(2/16\) (12.5\%)

2010: Schenk, University of Virginia
Improving dialysis access: \textit{regional anesthesia} improves arteriovenous fistula prevalence...

2011: Lomonte, University of Palermo
Comparison between local and regional anesthesia in arteriovenous fistula creation
Journal of Vascular Access, 2011

- Randomized prospective study
- Local vs BPB
- \(n = 40\)
- Short term patency

2011: Lomonte, University of Palermo
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Isn’t local anesthesia safer?

No
Not Really
Not Necessarily

Surgical risk is NOT related to anesthetic technique per se

Surgical risk IS related to:
- Major hemodynamic alteration
- Blood loss
- Entry into restricted body cavities

1994: Solomonson, Mayo Clinic
Risk Factors in Patients Having Surgery to Create an Arteriovenous Fistula
Anesthesia & Analgesia, 1994

- Retrospective study
- n = 469 patients/5 years
- Morbidity and Mortality of AVF creation
- Effect of anesthetic technique
  - Local, general, regional

Anesthetic technique
- Local 235
- BPB 155
- GA 61
1994: Solomonson, Mayo Clinic

**Risk Factors in Patients Having Surgery to Create an Arteriovenous Fistula**

**Preoperative Variables**
- Age: 63yo
- Sex (M): 60%
- Diabetes: 26%
- Hypertension: 91%
- Prior AVE: 31%
- CAD: 86%
- MI: 42%

**Results...**
- *No association* between type of anesthesia and Morbidity and Mortality
- Power Analysis
  - Confirmed no grossly increased risk of GA

**In Summary**

GA and Regional are **Superior to Local**
- Hemodynamic effects
- Early patency
- Maturation
- Patient comfort
- Motor block
- Surgeon convenience

**Conclusion**

Vascular Access Creation Under **General or Regional Anesthesia** Should be the Standard