

Anesthesia for Total Hip and Knee Arthroplasty

- Typical approach
 - Describe anesthesia technique
- Rather
 - Describe issues with THA and TKA
 - How anesthesia can modify

Issues

	Total Hip	Total Knee
Blood Loss	++	+
Thromboembolism	++	+
Pain	+	++
Rehabilitation	+	++
Mortality	++	++

Total Hip

- Blood Loss
 - Typical intraop → 500 – 1000 mL
 - Postop → 200 – 500 mL
- Transfusion of homologous blood → 30 – 50% of patients

1. **Bierbaum, B. E. et al:** An analysis of blood management in patients having a total hip or knee arthroplasty. *JBJS [Am]*, 81-A(1): 2-10, 1999.
2. **Rosencher, N. et al:** Orthopedic Surgery Transfusion Hemoglobin European Overview (OSTHEO) study: blood management in elective knee and hip arthroplasty in Europe. *Transfusion*, 43(4): 459-69, 2003.

Epidural / Spinal / Lumbar Plexus Block

- Reduces blood loss by 30 – 50%

Rodgers, A. et al.: Reduction of postoperative mortality and morbidity with epidural or spinal anaesthesia: results from overview of randomised trials. *Bmj*, 321(7275): 1493-7, 2000.

Hypotensive Anesthesia

- Reduces blood loss 30 – 50%

Thompson, G. E. et al: Hypotensive anesthesia for total hip arthroplasty: A study of blood loss and organ function (brain, heart, liver, and kidney). *Anesthesiology*, 48(2): 91-96, 1978.

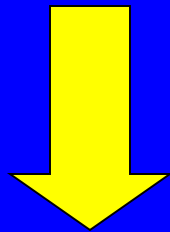
Hypotensive Epidural Anesthesia

- Blood loss 100 – 300 mL
- Transfusion of homologous blood 7%

1. **DiGiovanni, C. W. et al:** The safety and efficacy of intraoperative heparin in total hip arthroplasty. *Clin Orthop*, 379: 178-185, 2000.
2. **Williams-Russo, P. et al.:** Randomized trial of hypotensive epidural anesthesia in older adults. *Anesthesiology*, 91(4): 926-935, 1999.

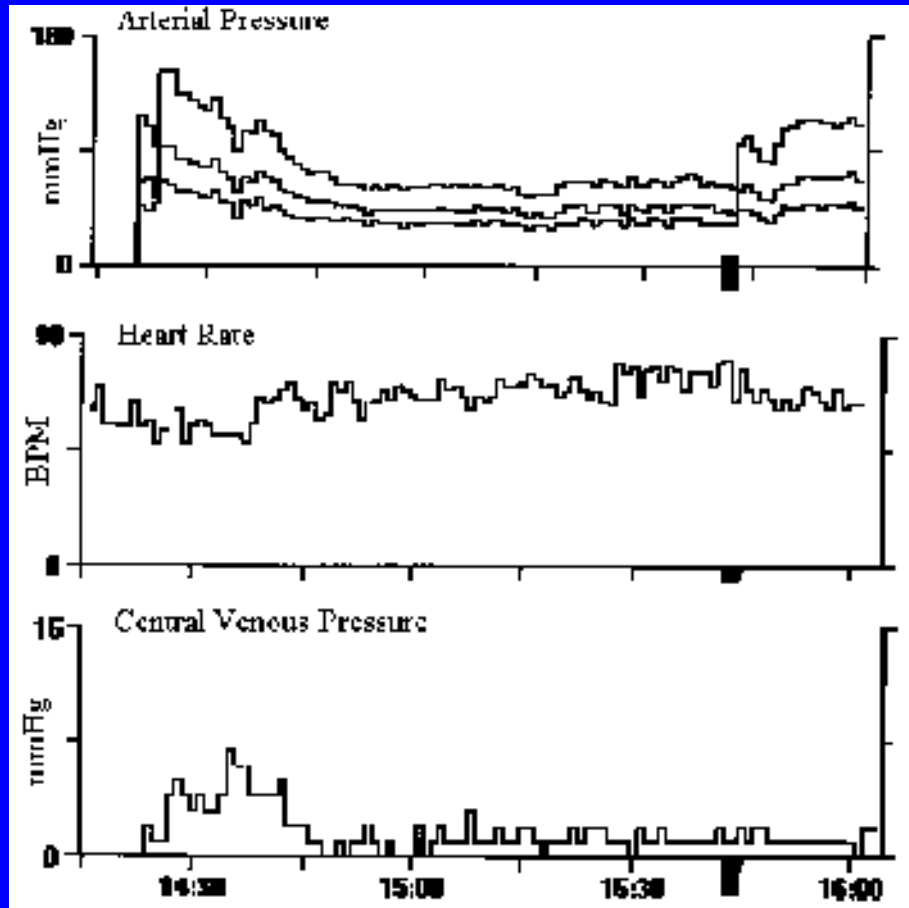
Technique

- Extensive epidural
- Low dose epinephrine infusion (1–5 mcg/min)
- Mean arterial pressure → 40 – 50 mmHg



Normal cardiac output

98 year old female undergoing primary total hip replacement with hypotensive epidural anesthesia



- Mean arterial pressure was maintained at approximately 45 mmHg during surgery
- Preservation of heart rate and central venous pressure
- Total intraoperative blood loss was 150 mL
- Crystalloid administered was 1,400 mL.

Safe

- Elderly
- Hypertensive
- Ischemic heart disease
- 2000 patients → no in-hospital death

Thromboembolism – THR

	DVT Risk	PE
General anesthesia	20 – 30%	1 – 2%
Epidural / Spinal	30% reduction	30% reduction

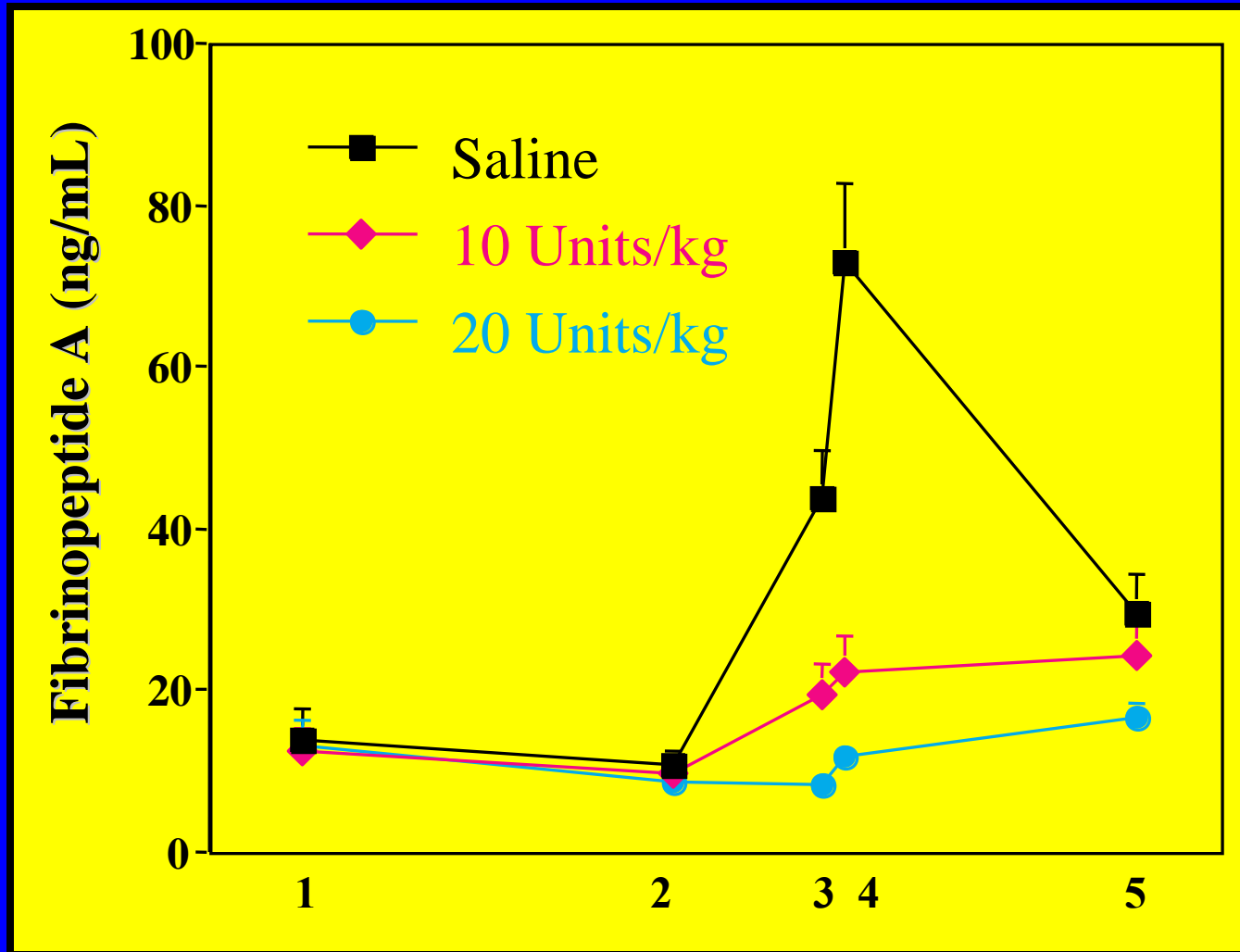
Hypotensive Epidural Anesthesia

- DVT rate \approx 11%

1. **Lieberman, J. R. et al:** The prevalence of deep venous thrombosis after total hip arthroplasty with hypotensive epidural anesthesia. *JBJS [Am]*, 76-A(3): 341-348, 1994.
2. **Sharrock, N. E. et al:** Factors influencing deep vein thrombosis following total hip arthroplasty. *Anesth Analg*, 76: 765-771, 1993.

**Intraoperative heparin
15 Units/kg**

Selective Heparinization during Total Hip Arthroplasty



1. Prior to epidural injection
2. Following insertion of acetabular component
3. Following reaming of femur
4. Following relocation of hip
5. 30 min postop

2000 Patients

- Hypotensive epidural anesthesia
- Intraoperative heparin
- Boots
- DVT → 7%
- PE → 0.6%
- 85% ASA postop

DiGiovanni, C. W. et al: The safety and efficacy of intraoperative heparin in total hip arthroplasty. *Clin Orthop*, 379: 178-185, 2000.

Pain – THA

- Multiple options
- Narcotics
- Epidural analgesia
- Spinal opioids
- Lumbar plexus block

Analgesia

- L1-L4 inclusive
- Obturator + femoral (spares sciatic)
- Excellent analgesia – Single Shot

Mortality

Spinal/Epidural Anesthesia

- 30% decrease in mortality compared to general anesthesia
- 30-day mortality rate $\approx 0.2 - 0.5\%$

Rodgers, A. et al.: Reduction of postoperative mortality and morbidity with epidural or spinal anaesthesia: results from overview of randomised trials. *Bmj*, 321(7275): 1493-7, 2000.

Hypotensive Epidural Anesthesia

- 4-fold reduction

Mortality – HSS

	1981-85	1987-1993	1994-1999
Total Hip	0.36% (13/3622)	0.09% (8/8335)	0.04% (4/8837)

Sharrock, N. E. et al: Changes in mortality after total hip and knee arthroplasty over a ten-year period. *Anesth Analg*, 80: 242-248, 1995.

Total Knee Arthroplasty

Blood Loss

- Majority blood loss postoperatively due to intraoperative tourniquet
- Hypotensive anesthesia reduces blood loss

Juelsingaard, P. et al: Hypotensive epidural anesthesia in total knee replacement without tourniquet: Reduced blood loss and transfusion. *Reg Anesth*, 26(2): 105-10., 2001.

Blood Loss

- **Tranexamic acid – 10 mg/kg after tourniquet deflation**
 - **Juelsgaard, P. et al:** Hypotensive epidural anesthesia in total knee replacement without tourniquet: Reduced blood loss and transfusion. *Reg Anesth*, 26(2): 105-10., 2001.
- **Cell Saver – Useful in bilateral total knee**
 - **Bottner, F. et al:** Blood management after bilateral total knee arthroplasty. *Clin Orthop*, (410): 254-61, 2003.

Thromboembolism

- Epidural anesthesia reduces
 - Risk of DVT 20%
 - Risk of proximal thrombi 50%

Sharrock, N. E. et al: Effects of epidural anesthesia on the incidence of deep-vein thrombosis after total knee arthroplasty. *JBJS [Am]*, 73-A(4): 502-506, 1991.

Mechanism

- Probably enhancement of blood flow immediately following surgery

Epidural anesthesia + Pneumatic compression

- **DVT rate is similar to LMWH**
- **Lower risk of bleeding**

Pain – Total Knee Arthroplasty

- Narcotics alone – Inadequate
- Require local technique for optimal pain control

Options

- Femoral block o
- Femoral catheter x
- Femoral + Sciatic block o
- Lumbar plexus + Sciatic block o
- Epidural analgesia x
- Epidural + Femoral block x

x = Require a Pain Service

o = Can be used with IV PCA or oral narcotics

Rehabilitation

- Optimal pain control hastens rehabilitation
 - Range of motion
 - Milestones, e.g., walking, stairs

References

- **Williams-Russo, P. et al:** Randomized trial of epidural versus general anesthesia: outcomes after primary total knee replacement. *Clin Orthop*, 331(331): 199-208, 1996.*
- **Singelyn, F. J. et al:** Effects of intravenous patient-controlled analgesia with morphine, continuous epidural analgesia, and continuous three-in-one block on postoperative pain and knee rehabilitation after unilateral total knee arthroplasty. *Anesth Analg*, 87(1): 88-92, 1998.
- **Capdevila, X. et al:** Effects of perioperative analgesic technique on the surgical outcome and duration of rehabilitation after major knee surgery. *Anesthesiology*, 91(1): 8-15, 1999.
- Zawadsky M et al. The efficacy of femoral nerve block in conjunction with epidural analgesia for total knee arthroplasty; 2004; San Francisco, CA: American Academy of Orthopaedic Surgeons.*

Mortality

- Epidural anesthesia reduces perioperative mortality

Mortality

	1981-85	1987-1993	1994-1999
Total Hip	0.36% (13/3622)	0.09% (8/8335)	0.04% (4/8837)
Total Knee	0.44% (10/2252)	0.1% (6/5183)	0.08% (5/6384)
Overall	0.39% (23/5874)	0.1% (14/13518)	0.06% (9/15221)

Conclusion

- Optimal anesthesia improves outcomes following THA and TKA.
- Requires skilled staff.
- Worth the effort.