Implantable micro-technology to remotely monitor bypass function

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Disclosures

- WL Gore
- Vascular Flow Technologies
- Cormatrix
- Graftworxs

Graft surveillance

Duplex scan surveillance during the first year after infranigual autologous vein bypass grafting surgery: Costs and clinical outcomes compared with other surveillance programs

Karen Visser, MSc, Mirza M. Idu, MD, PhD, Jacob Buth, MD, PhD, Gerard L. Engel, PhD, and M. G. Myriam Hunink, MD, PhD
Rotterdam, Eindhoven, and Maastricht, The Netherlands, and Boston, Mass

Conclusion: Duplex scan surveillance is highly effective for patients treated for critical limb ischemia, leading to a reduction of major amputations and consequently to a reduction in costs compared with other surveillance programs. (J Vasc Surg 2001;33:123-30.)


Society for Vascular Surgery Lower Extremity Guidelines Writing Group

Graft surveillance program

- Return of symptoms, increased severity of symptoms
- Pulse exam
- Ankle Brachial Index
- Duplex ultrasound
- Graft stenosis
  - 10% managed with endovascular techniques
- Failed graft
  - 5% managed with open techniques
  - Re-operation more complex
  - Mortality 5%
- 3, 6, 12 months, annually

“Intelligent graft” concept

- Piezoelectric polymer
- Convert electromagnetic forces to electrical transduction
- Small mechanical deformations into electrical signals
- Microchip - interact with external monitor
- Battery
- External monitor – radiofrequency communication

Initial in vitro experiments

- Recirculating flow system
  - Pulsatile flow pump
  - Compliance matched polyurethane tubing
  - Variable pressure and stroke volume
- Wireless transmission of signal

Quantification of stenosis signal

- Sensor placement attached to outer wall of ePTFE graft
- Wireless transmission of signal
- Identification of numerical parameter allowing accurate quantification of stenosis

In vivo experiment

*Ovine carotid artery bypass model*

30 day harvest
Sensor wrap around patent ePTFE Occluded CCA

In vivo Flow Measurement

*Harvest at 30 days post implantation*

- Wireless transmission of signal
- Comparison to flowmeter over one cardiac cycle