

Minimally Invasive Monitoring of Abdominal Aortic Aneurysm Sac Pressure after Endovascular Aneurysm Repair: State of the Art

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Takao Ohki, MD, New York, NY; Jay S. Yadav, MD, Cleveland, OH; David Stern

Despite initially successful endovascular aneurysm repair (EVAR), aneurysms continue to rupture at an annual rate of 0.5 to 2%. This is in part due to the late failure of the endograft but also is due to the failure of current postoperative surveillance methods. In addition, repetitive IV contrast computed tomography (CT) scans may impair renal function. To increase the efficacy and safety of postoperative surveillance, noninvasive pressure monitoring of the abdominal aortic aneurysm (AAA) sac via an implantable wireless sensor has been proposed. Advanced micro-machining techniques are used to fabricate pressure sensors that are biocompatible, highly sensitive, stable, battery-less, and accurate. A proprietary wireless communication system (CardioMEMS) has been developed that uses radiofrequency energy to remotely detect changes in sensor electrical characteristics associated with pressure fluctuations.

We have recently initiated a multicenter clinical trial to investigate the efficacy of this wireless pressure sensor for post-EVAR surveillance (APEX trial). Thus far, 91 patients have been enrolled at 12 centers worldwide with a technical success rate (defined as successful implantation of the sensor and ability to measure pressure wirelessly) of 97%. Sensor implantation was straightforward and safe and did not interfere with the EVAR procedure. Interrogation of the sensor was achieved within 30 seconds in most cases. Excellent correlation was seen between the wireless sensor and the angiographic catheter pressure measurement. Intraoperative pressure measurements were used to guide interventions needed to successfully complete the EVAR. Follow-up office-based measurements of sac pressure were also accomplished quickly and safely. Mean follow-up period was 3 months. Preliminary results suggest a correlation between decrease in sac pressure and decrease in AAA size and absence of an endoleak.

A wireless pressure sensor can be used safely and quickly to monitor aneurysm sac pressure noninvasively, intraoperatively, and on a chronic basis. This technology may be valuable for intraoperative assessment as well as postoperative surveillance in patients undergoing EVAR. It may ultimately eliminate the need for life-long CT, magnetic resonance, or duplex imaging studies; however, further study is needed.