Bone growth stimulators

Electrical current, electromagnetic fields, and ultrasound have been shown to influence osteogenesis and thereby bone growth and healing, possibly as a result of affecting some combination of the following: calcium influx through voltage-gated channels, modulation of gene expression in connective tissues with a resultant increase in production of various bone morphogenic proteins (BMP)

There a number of commercially available bone growth stimulators (BGS) for spine fusions that can be implanted internally (at the time of surgery), or, more commonly, worn externally after surgery in accordance with specific protocols established by the manufacturer for each device.

Since there is controversy regarding the criteria for determination of spinal fusion, and with the correlation of fusion with good outcome (some patients without fusion have a good outcome), the efficacy and cost-effectiveness of BGS is unknown.

Available technologies

BGS technologies typically employed in spine fusions include:

● DCS: direct current stimulation using electrodes implanted at the time of surgery

● CCS: capacitance coupling stimulation using 2 electrodes placed on the skin over a fusion site

● PEMFS: pulsed electromagnetic field stimulation using coils typically embedded in a brace

Indications & contraindications

According to the National Coverage Determination (NCD), electrical Osteogenic Stimulators (BGS) are effective in increasing the fusion rate as an adjunct to spinal fusion surgery in patients at high-risk for pseudoarthrosis shown in the practice guideline below.

Technologies recommended for payer coverage for spine fusion include: DCS, CCS & PEMFS.

Technologies with insufficient information to recommend payer coverage for spine fusion include LIPUS (low-intensity pulsed ultrasound) and CMF (combined magnetic field = DC field & AC field).

Practice guideline: Nationally covered indications for bone growth stimulators in spine fusions

● previously failed spinal fusion at the same site

● fusion involving 3 or more vertebrae

Other factors that the NASS Coverage Policy recommended for consideration for BGS include the presence of one or more of the following: diabetes, inflammatory arthritis requiring long-term corticosteroids, immunocompromise (e.g. chemotherapy and radiation therapy to the spine, hypogammaglobulinemia, granulocytopenia, acquired immune deficiency syndrome, chronic granulomatous disease), systemic vascular disease, osteopenia or osteoporosis, cigarette smokers who cannot stop smoking in preparation for surgery. In addition to those not qualifying for BGS based on the above, BGS is not indicated: in patients with malignancy, as an adjunct for primary bone healing for spinal fractures, or as a nonsurgical treatment for established pseudoarthrosis.

The safety of BGS in the following situations is not fully known: pregnancy, infection, patients with cardiac pacemakers or defibrillators (consult a cardiologist), skeletally immature patients (children). With implanted BGS: MRI procedures must follow specific guidelines related to magnet strength and spatial gradient (confer with your MRI facility).

Specific recommendations for the type of BGS in the lumbar spine:

- DCS & CCS: for posterolateral fusion using autograft + extender
- PEMFS: for lumbar interbody fusion