Basivertebral Nerve Ablation vs. Lumbar Fusion for Vertebrogenic Low Back Pain with Modic Changes: A Literature Review

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Background

Ankylosing conditions and vertebrogenic disease present as chronic axial low back pain (LBP) originating from damaged vertebral endplates with Modic changes. Basivertebral nerve ablation (BVNA) thermally ablates the intraosseous basivertebral nerve to interrupt pain signaling while preserving segmental spinal motion.

In contrast, lumbar interbody fusion mechanically stabilizes the segment to eliminate endplate micromotion, but carries significantly higher perioperative morbidity, recovery burden, and cost. Following failed conservative treatment, both modalities serve as treatment options, but differ fundamentally in invasiveness and long-term biomechanical impact.

Methods

A systematic literature search was conducted through MEDLINE, EMBASE, PubMed, and Cochrane Library for human studies examining BVNA and lumbar fusion in patients with Modic-positive vertebrogenic LBP. Search terms included: *("basivertebral nerve ablation" OR "intraosseous ablation") AND ("lumbar fusion") AND ("Modic changes")*.

Extracted outcomes focused on functional disability (Oswestry Disability Index - ODI), visual analog pain scores (VAS), and bony fusion success rates stratified by Modic subtypes.

Disclosures & Ethics

- **COI:** Authors declare no conflicts of interest.
- **IRB:** Exempt per OBH policy (devoid of patient identifiable data).
- **Off-Label:** No off-label drug or unapproved device use described.

Results / Evidence

Procedure / Study	Design & Population	Key Findings
Fischgrund et al. (2018)	Prospective RCT (n=225, BVNA vs. Sham)	75.6% achieved clinically meaningful ODI improvement (≥15 points) at 3 months vs. sham control.
Smuck et al. (2021)	Multicenter RCT (n=140, BVNA vs. Care)	Significant reduction in pain and disability at 12 months; 64% of BVNA patients achieved >50% pain reduction vs. standard care.
Fischgrund et al. (2020)	5-Year Follow-up Cohort (n=100)	Sustained long-term relief at a mean follow-up of 6.4 years; 66% maintained >50% pain reduction.
Lambrechts et al. (2022)	Systematic Review & Meta-Analysis	Lumbar fusion yields significant functional gains, but clinical success varies significantly depending on specific Modic endplate subtypes.
Li et al. (2021)	Retrospective Cohort (PLIF with Pedicle Screws)	Successful bony fusion rate drops from 95.0% in non-sclerotic endplates to 58.8% in patients with sclerotic Modic Type 2 changes.

Discussion and Conclusions

A key finding is the divergent response to Modic subtype: BVNA trials enrolled both type 1 and type 2 patients with consistent, durable efficacy, whereas fusion outcomes are compromised by type 2 sclerotic changes. The mechanistic explanation is that BVNA interrupts nociceptive transmission along the basivertebral nerve and does not depend on the endplate's capacity to form bone, whereas fusion requires osteointegration that sclerotic, poorly vascularized bone with a pro-inflammatory milieu (IL-6, TNF-α) actively impairs. This suggests BVNA may hold an advantage in type 2 patients, where the sclerosis impairs bony fusion but not nerve ablation.

An important nuance is the dissociation between radiographic fusion and clinical outcome: Modic changes alone do not uniformly worsen fusion results. The more actionable predictor of pseudarthrosis is CT-confirmed endplate sclerosis rather than Modic type on MRI, as sclerotic endplates track with both lower fusion rates and worse final pain and disability scores, prompting recommendations for routine preoperative CT. Given that only a small minority of BVNA patients later proceed to fusion (~6.5% at long-term follow-up), the two may be better viewed as sequential rather than competing options: BVNA as first-line therapy for the vertebrogenic phenotype, with fusion reserved for instability, spondylolisthesis, stenosis requiring decompression, or ablation failure. Limitations include the indirect comparison, heterogeneity in fusion populations, differing outcome measures (clinical response for BVNA versus radiographic fusion for surgery), and inconsistent reporting of sclerosis. Prospective head-to-head trials stratified by Modic subtype and CT-confirmed sclerosis are warranted.

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