Regenerative Biologics for Chronic Low Back Pain: Cell-Based, Platelet-Derived and Amniotic Therapies

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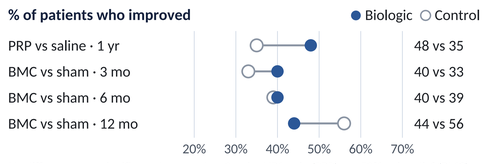
Introduction

Chronic low back pain is one of the leading causes of disability worldwide. Regenerative biologics, including platelet-rich plasma (PRP), mesenchymal stem cells (MSCs), bone marrow concentrate (BMC) and amniotic fluid or membrane-derived products, have emerged as alternatives aimed at treating disc and endplate pathology directly rather than simply modulating pain signaling. This review summarizes current evidence for intradiscal and epidural biologic injections in chronic low back pain, including the more recently studied placental-derived preparations.

Methods

We searched MEDLINE, EMBASE, the Cochrane Library and PubMed using "platelet-rich plasma" OR "mesenchymal stem cell" OR "bone marrow concentrate" OR "amniotic fluid" OR "amniotic membrane" AND "chronic low back pain," combined with each condition and delivery route (discogenic pain, intradiscal injection, epidural injection, intervertebral disc degeneration). To keep populations comparable, we focused on chronic (discogenic) low back pain; studies of radiculopathy or post-surgical populations were excluded.

Biologic vs Control



No difference was significant. Improved = ≥2-point NRS gain (PRP) or ≥50% pain relief (BMC).

No conflicts of interest. IRB-exempt per One Brooklyn Health policy (no patient-identifiable information). No off-label drug use; no IND approval applicable.

Results

In chronic low back pain, controlled trials show small or inconsistent benefits, and no biologic has been rigorously compared head to head.

Treatment and evidence	What they looked at	What they found	What it means
PLATELET **Intradiscal PRP** ●●○ 3 RCTs, mixed	Does intradiscal PRP beat a control? DESIGN 3 RCTs CONTROL contrast · saline · steroid PATIENTS 47 · 89 · 16 FOLLOW-UP 8 wk · 1 yr · 8 wk *Tuakli-Wosornu 2016 · Schepers 2022 · Akeda 2022*	**Mixed results**: better function and best-pain scores than contrast at 8 weeks; no difference from saline at 1 year (48% vs 35% improved by 2+ points, P = 0.24); pain relief similar to steroid at 8 weeks.	*Early benefit was not confirmed at 1 year in the larger, adequately powered trial, and PRP did not outperform steroid. Disc infection after intradiscal PRP has been reported.*
CELL-BASED **Intradiscal stem cells (MSC)** ●●○ RCT meta-analysis	How much do stem cells injected into the disc reduce pain vs placebo? DESIGN Meta-analysis of 3 RCTs CONTROL placebo PATIENTS largest trial 404 FOLLOW-UP 12 mo *Salamanna 2026*	**Pain 4 points lower (0-100)** than placebo at 12 months; little change in disability.	*Statistically significant but small, well under commonly cited thresholds for a change patients notice.*
CELL-BASED **Intradiscal bone marrow concentrate** ●●○ One RCT (63 pts)	Does one injection of the patient's own bone marrow concentrate beat sham? DESIGN Double-blind RCT CONTROL sham procedure PATIENTS 63 (45 BMC, 18 sham) FOLLOW-UP 3, 6, 12 mo *Levi 2025*	**Same as sham**: 33–56% of patients in both groups had at least 50% pain relief, with no significant difference at 3, 6 or 12 months; function was also similar.	*Similar shares of patients improved in both groups, so the benefit seen after BMC likely reflects placebo and natural recovery rather than a biologic effect.*
AMNIOTIC **Epidural amniotic fluid** ●○○ Low (uncontrolled)	Does one epidural amniotic fluid injection help disc degeneration? DESIGN Prospective, uncontrolled CONTROL none PATIENTS 20 (of 60 enrolled) FOLLOW-UP 1 yr *Buttermann 2025*	**Back pain 7.0 to 4.8**; disability barely changed (ODI 41 to 37), and 7 of 20 had fusion or disc replacement within the year.	*Inconsistent results in the only study of this population, and no randomized trial yet in chronic low back pain.*

Strength of evidence: ●●● strong (multiple high-quality RCTs) · ●●○ moderate (an RCT or a meta-analysis of few RCTs) · ●○○ low (small or uncontrolled study)

The gap: no trial has compared cell-based, platelet-derived and amniotic biologics head to head, so we cannot yet say which works best for which patient.

Discussion and Conclusions

Summary of evidence. In controlled trials of chronic discogenic low back pain, intradiscal PRP gave mixed results (early benefit vs contrast, none vs saline at 1 year, no better than steroid), stem cells a small 4-point benefit (0-100), and bone marrow concentrate no benefit over sham. Amniotic fluid has only uncontrolled data. Guidelines rate intradiscal PRP and BMC evidence as Level III (fair).

Three mechanisms. Regenerative biologics span three distinct categories: cell-based (MSC, BMC), platelet-derived (PRP) and placental/amniotic-derived, each with a different mode of action and a different stage of evidence maturity.

Amniotic products. Amniotic fluid is thought to work by reducing inflammation and scarring rather than through cellular repair. In degenerative disc disease its only data come from an uncontrolled study with inconsistent results, so controlled trials are needed.

Limitations. Few, small trials with varied controls (contrast, saline, steroid, sham); stem cell results pool different cell products; large improvements in control groups point to strong placebo and natural-recovery effects.

Conclusion. Direct comparative trials across biologic classes would clarify which mechanism benefits which patient phenotype.

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