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Regenerating Lumbar Discopathy: A Case Report of a New Enhanced Orthobiological Treatment Option and a New Enhanced Bone Marrow Aspirate Technique (B.E.S.T.B.M.A. — Bringing Excellence and Safety Technique for Best Marrow Aspirate)

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Abstract

Background: Bone marrow aspirate (BMA) for orthobiologic use is conventionally harvested from the posterior superior iliac spine (PSIS) through a postero-anterior corridor. When the gluteal and posterior iliac skin is compromised — by prior surgery, radiation, infection, or subcutaneous implants — that corridor may be unavailable, and no widely described alternative exists for the office-based orthobiologic setting. Progenitor yield is further limited by the well-documented dilution of marrow with peripheral blood when large volumes are drawn from a single site.

Case presentation: A 46-year-old man presented with two years of chronic low back pain and radicular symptoms. Magnetic resonance imaging showed L4–L5 disc degeneration with posterior bulging. Conservative management had failed, and a course of orthobiologic treatment performed one year earlier at another centre — BMA plus platelet-rich plasma (PRP) alone, three monthly sessions — had produced only about two weeks of relief after each session. Three months before the index procedure the patient had received bilateral hormone pellet implants in the superior gluteal region, which compromised both

conventional BMA entry points. He declined all non-orthobiologic options.

Intervention: Marrow was harvested with a new technique, designated B.E.S.T.B.M.A. (Bringing Excellence and Safety Technique for Best Marrow Aspirate). A single trocar was introduced tangentially to the lateral iliac crest, parallel to the cortical bone, and advanced in a cranio-caudal direction along the crest, away from the implanted gluteal zones. Six sequential 10 mL aspirations were performed, with the needle withdrawn 10 mm between each, for a total of 60 mL. The aspirate was processed into bone marrow aspirate concentrate (BMAC; 580 g for 10 min, then 1400 g for 6 min). Sixty millilitres of venous blood yielded PRP (400 g for 9 min) and a second, more concentrated preparation designated PRP plus (300 g for 15 min, then 700 g for 10 min). Lipoaspirate was emulsified for 15 min and passed through a 0.15 mm filter to produce nanofat, and a mechanically obtained stromal vascular fraction (SVF/VSF) was prepared (800 g for 15 min, then 1000 g for 10 min). The six products — native BMA, BMAC, PRP, PRP plus, nanofat and SVF — were injected together into the paravertebral compartment at the symptomatic level; no intradiscal injection was performed.

Outcomes: At six months the visual analogue scale (VAS) score for pain fell from 7 to 3 and the Oswestry Disability Index (ODI) from 48% to 22%, both exceeding accepted thresholds for minimal clinically important change [2,3]. Magnetic resonance imaging showed reduced paravertebral inflammatory signal and improved disc parameters. At twelve months the patient reported no pain and had returned fully to physical activity, and the treating team described the imaging appearance as complete regeneration of the discopathy. No adverse events were recorded.

Conclusions: In this single patient, a lateral cranio-caudal fractionated harvest allowed marrow to be obtained when both conventional posterior entry points were unusable, and a combined paravertebral orthobiologic injection was followed by sustained clinical and radiological improvement. A case report cannot establish efficacy: the natural course of low back pain, regression to the mean and placebo effects cannot be excluded [4–6], six biologics were given simultaneously so no component can be credited individually, no cell counts were obtained to confirm the presumed yield advantage of the harvest, and the claim of complete disc regeneration requires independent blinded radiological confirmation. The technique and the combined protocol are presented as hypothesis-generating and require controlled evaluation.

Keywords

Bone marrow aspirate; Bone marrow aspirate concentrate; Platelet-rich plasma; Stromal vascular fraction; Nanofat; Lumbar disc degeneration; Iliac crest harvest; Batson plexus; Orthobiologics; Case report.

Introduction

Degenerative disc disease is among the most common structural correlates of chronic low back pain, and a substantial proportion of patients remain symptomatic after exercise therapy, analgesia and image-guided injections [7,8]. Interest in orthobiologic treatment of the degenerative lumbar segment has grown accordingly, and the published clinical experience now includes intradiscal bone marrow concentrate [9,10], intradiscal culture-expanded and non-expanded mesenchymal stromal cells [11-13], intradiscal PRP and PRP releasate [14-16], intradiscal stromal vascular fraction with PRP [17], cell-based nucleus pulposus and chondrocyte products [18-20], and epidural platelet lysate for radicular pain [21]. Systematic reviews of this literature consistently report an acceptable short-term safety profile alongside low-certainty evidence of benefit and marked heterogeneity of preparation and delivery [22-26].

Almost all of that experience shares two design features. The first is the route of delivery: the biologic is placed inside the disc. Intradiscal delivery targets the nucleus pulposus directly, but it requires annular puncture, which carries a small but real risk of discitis and epidural abscess [27–30], and the puncture itself has been implicated in accelerating degeneration of the treated segment. The second is the source of the cells: marrow is aspirated from the posterior superior iliac spine (PSIS) through a postero-anterior corridor, a route supported by comparative yield data [31,32], by computed tomography and magnetic resonance corridor analyses [33,34] and by an extensive haematology safety record [35,36].

Both assumptions can fail in ordinary practice. The posterior corridor becomes unattractive or unusable when the overlying gluteal and posterior iliac soft tissue is compromised — after surgery, radiation, local infection, extensive scarring, or the presence of subcutaneous implants. Subcutaneous hormone pellets are implanted in exactly this region in very large numbers [37–39], and although the reported complication rate is low, local granulomatous and inflammatory reactions do occur [40] and most operators would not aspirate marrow through, or immediately adjacent to, a recently implanted pellet bed. To our knowledge, no alternative harvest corridor has been described specifically for the office-based orthobiologic setting in this situation.

A second, independent limitation applies to every harvest. Progenitor concentration in a marrow aspirate falls steeply as the volume drawn from a single site increase, because the aspirate is progressively diluted with peripheral blood. This has been demonstrated repeatedly since the original aspiration-volume study of Muschler and colleagues [41-44] and it is the reason the small-volume, multiple-position, fractionated harvest is recommended in technique descriptions written for orthobiologic practice [45,46].

This report describes the management of a patient in whom both problems were present at once. Both conventional posterior entry points were occupied by recently implanted hormone pellets, and the patient had already failed a conventional BMA-plus-PRP protocol at another centre. A harvest technique was therefore devised that enters lateral to the crest, runs tangentially and cranio-caudally along the iliac wing, and is fractionated by design. The technique is designated B.E.S.T.B.M.A. — Bringing Excellence and Safety Technique for Best Marrow Aspirate — and each letter maps onto a specific operational requirement (**Figure 1, Table 2**). The harvested marrow was combined with five other autologous preparations and delivered paravertebrally rather than intradiscally.

The report has three aims: to describe the harvest technique in sufficient detail for it to be reproduced and criticised; to document the preparation parameters of all six biologic products (All In - One Step Procedure), since incomplete reporting is the principal weakness of the orthobiologic literature [47-49]; and to set out honestly what a single uncontrolled observation can and cannot support.

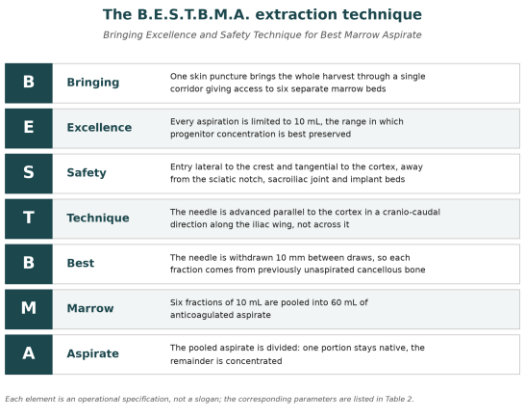

Table 1: Patient and baseline characteristics | Items marked as not recorded were not available in the source clinical record and must be completed before submission.

VAS, visual analogue scale; ODI, Oswestry Disability Index; BMA, bone marrow aspirate; PRP, platelet-rich plasma; PSIS, posterior superior iliac spine; SLR, straight leg raise; BMI, body mass index.

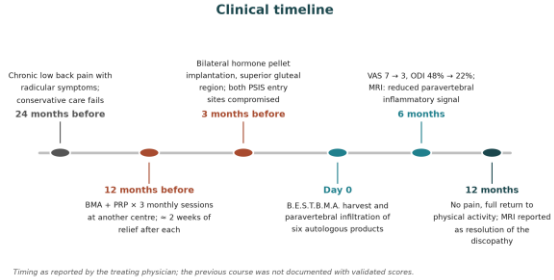

Figure 2: Clinical timeline | Sequence of events from symptom onset to the twelve-month assessment, including the failed conventional orthobiologic course and the gluteal pellet implantation that determined the choice of harvest corridor.

The B.E.S.T.B.M.A. Harvest Technique

Rationale and naming

The technique was designed to satisfy four constraints simultaneously: to avoid the compromised gluteal soft tissue bilaterally; to remain within cancellous bone along a long, predictable corridor; to keep every individual aspiration small so that peripheral blood dilution is minimised [41-43]; and to sample distinct marrow beds rather than repeatedly emptying one. The acronym B.E.S.T.B.M.A. — Bringing Excellence and Safety Technique for Best Marrow Aspirate — encodes these requirements as a teaching mnemonic (**Figure 1**, **Table 2**) gives the operational specification behind each letter. The mnemonic is a description of the technique, not a validated scoring instrument.

Letter	Term	Operational specification in this technique
B	Bringing	A single skin puncture provides access to six separate marrow beds, so the entire harvest is brought through one corridor
E	Excellence	Every aspiration is limited to 10 mL, the volume range at which progenitor concentration is best preserved [41,43]
S	Safety	Entry is lateral to the crest and tangential to the cortex, keeping the trajectory away from the sciatic notch, the sacroiliac joint and the compromised gluteal implant beds
T	Technique	The needle is advanced parallel to the cortical bone in a cranio-caudal direction along the iliac wing rather than postero-anteriorly through it
B	Best	The needle is withdrawn 10 mm between consecutive aspirations, so each 10 mL sample is drawn from previously unaspirated cancellous bone

Letter	Term	Operational specification in this technique
M	Marrow	Six fractions of 10 mL are pooled into a total of 60 mL of anticoagulated aspirate
A	Aspirate	The pooled aspirate is divided: one portion is kept native for injection and the remainder is concentrated (Table 4)

Table 2: Operational specification of the B.E.S.T.B.M.A. acronym | Each letter corresponds to a defined, reproducible step rather than to a descriptive quality.

Positioning, entry point and trajectory

The patient was placed prone. The iliac crest was palpated and marked along its whole length; the posterior superior iliac spine and the bilateral gluteal pellet beds were marked separately as zones to be avoided. The skin entry point was chosen on the lateral aspect of the crest, well anterior and lateral to the pellet zone. After antisepsis and local anaesthesia of the skin, subcutaneous tissue and periosteum, a 13-gauge trocar was introduced tangentially to the lateral iliac crest so that the shaft lay parallel to the cortical bone rather than perpendicular to it, and was advanced in a cranio-caudal direction within the cancellous bone of the iliac wing (**Figures 3 and 4**). Advancing along, rather than across, the wing provides a long intraosseous corridor and keeps the tip between the two cortical tables throughout.

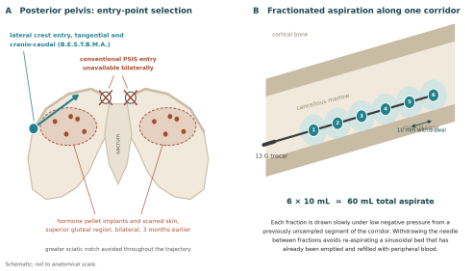

Figure 3: Entry-point selection and fractionated aspiration | (A) Posterior view of the pelvis. The conventional posterior superior iliac spine entry points are crossed out because both were occupied by hormone pellet implant beds; the lateral cranio-caudal corridor used instead is shown in teal. (B) The six sequential aspiration positions along that corridor, each of 10 mL, with the needle withdrawn 10 mm between consecutive draws. Schematic; not to anatomical scale.

Figure 4: The technique in practice | (A) Illustration of the lateral cranio-caudal trajectory in lateral hemipelvic and posterior pelvic views. (B) Intraoperative photograph of the harvest in the prone patient, showing the 13-gauge trocar and aspirating syringe entering lateral to the left iliac crest and directed obliquely along the wing. Reproduced with the patient's written consent. The illustration in panel A was created in BioRender and requires a publication licence before submission.

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Fractionated aspiration

Aspiration was performed with syringes pre-loaded with anticoagulant. Six sequential aspirations of 10 mL each were taken. Before each subsequent aspiration the needle was withdrawn by 10 mm along the same corridor, so that every fraction was drawn from a segment of cancellous bone that had not previously been aspirated. Aspiration was performed slowly with gentle, intermittent negative pressure. The six fractions were pooled to give 60 mL of anticoagulated bone marrow aspirate. The rationale for this fractionation, and the contrast with a conventional harvest, are shown in (**Figure 5 and Table 3**).

Parameter	Conventional PSIS harvest	B.E.S.T.B.M.A. (this case)
Patient position	Prone	**Prone**
Entry point	Posterior superior iliac spine	**Lateral aspect of the iliac crest**
Needle orientation relative to cortex	Perpendicular	**Tangential (parallel to cortex)**
Direction of advancement	Postero-anterior, across the wing	**Cranio-caudal, along the wing**
Skin punctures	1–2 (often bilateral)	**1**
Distinct marrow beds sampled	1–2	**6 (one per 10 mm withdrawal)**
Volume per aspiration	Frequently 20–60 mL from one bed	**10 mL**
Needle repositioning between draws	Variable / none	**10 mm withdrawal before each draw**
Total volume aspirated	Variable	**60 mL**
Needle gauge	11–13 G	**13 G**
Anticoagulation	Yes	**Yes**
Guidance	Landmark, fluoroscopic or ultrasound [33,34]	**Landmark (palpation)**
Feasible with compromised gluteal soft tissue	No	**Yes**

Table 3: Conventional posterior harvest compared with the B.E.S.T.B.M.A. technique | The conventional column describes common practice as reported in the cited technique and imaging literature and is provided for orientation; it is not a comparator arm.

PSIS, posterior superior iliac spine. No nucleated cell counts or colony-forming unit–fibroblast assay was performed in this patient, so the presumed yield advantage of the fractionated corridor is a design rationale rather than a measured outcome.

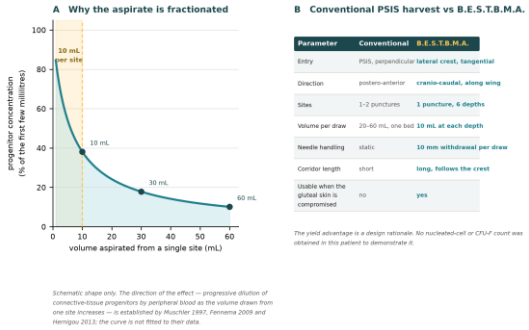

Figure 5: Why the harvest is fractionated, and how it differs from the conventional route | (A) Schematic representation of the established inverse relationship between the volume drawn from a single site and the concentration of connective-tissue progenitors in the aspirate. (B) Parameter-by-parameter contrast between the conventional posterior harvest and the technique used here.

Preparation of the Six Biologic Products – all in – One Step Procedure

Six autologous preparations were used. All processing was performed on the day of the procedure, in a closed system, using centrifugation only; no enzymatic digestion, no culture expansion, no

cryopreservation and no addition of non-autologous substances were involved. Mechanical, non-enzymatic isolation was chosen for the adipose-derived products because it avoids collagenase digestion and its associated regulatory classification [50–52]. (**Table 4**) gives the full parameter set and (**Figure 6**) shows the workflow.

Product	Starting material	Processing	Use in this case
Native BMA	60 mL anticoagulated marrow (B.E.S.T.B.M.A. harvest)	None beyond pooling; an aliquot reserved unprocessed	Injected unmodified
BMAC	Pooled marrow aspirate	580 g for 10 min, then 1400 g for 6 min	Concentrated nucleated cell and progenitor fraction
PRP	60 mL peripheral venous blood	400 g for 9 min	Standard single-spin platelet concentrate
PRP plus	Peripheral venous blood	300 g for 15 min, then 700 g for 10 min	Second, more concentrated platelet preparation
Nanofat	Lipoaspirate	Mechanical emulsification for 15 min, then filtration through a 0.15 mm filter	Emulsified adipose product
SVF (VSF)	Lipoaspirate	800 g for 15 min, then 1000 g for 10 min	Mechanically obtained stromal vascular fraction

Table 4: Preparation protocols for all six autologous products | Centrifugation is expressed as relative centrifugal force (g) and duration exactly as performed.
BMA, bone marrow aspirate; BMAC, bone marrow aspirate concentrate; PRP, platelet-rich plasma; SVF, stromal vascular fraction (VSF in the original record). No platelet, leucocyte, nucleated cell or viability count was obtained for any product. Consequently, none of the preparations can be placed within the PAW [53], DEPA [54] or MARSPILL [55] classifications, and the report does not meet the composition-reporting standards recommended for orthobiologic studies [47–49]. Cells within the SVF and nanofat preparations were not characterised against the IFATS/ISCT [56] or ISCT [57] criteria and are therefore described by their method of preparation rather than by phenotype.

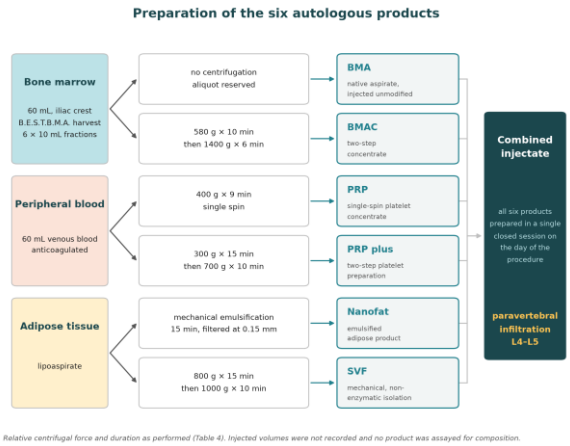

Figure 6: Preparation workflow | Three autologous starting materials — bone marrow, peripheral blood and lipoaspirate — were processed by centrifugation and mechanical emulsification into six products, which were combined into a single injectate. Relative centrifugal force and duration are shown for each step.

Target Selection and Injection

Why paravertebral rather than intradiscal

The great majority of published disc-directed orthobiologic protocols inject into the nucleus pulposus [9,11,14,15,17,58]. Three considerations led to a paravertebral target in this patient. First, annular puncture is not without hazard: discitis and epidural abscess after intradiscal procedures are rare but well

documented [27–30], and the avascular disc is a poor environment in which to defend against inoculation. Second, needle puncture of the annulus is itself a recognised stimulus to further degeneration, which is difficult to justify in a segment that is already degenerate. Third, the paravertebral compartment contains the structures through which venous drainage of the segment occurs.

The vertebral venous system described by Batson is valveless and continuous with the paravertebral, epidural and pelvic venous networks [59–61]. Distension of this plexus has been proposed, and demonstrated venographically, as a contributor to lumbar radicular symptoms independent of mechanical compression [62,63]. If venous congestion contributes to the inflammatory and nociceptive state of the segment, then a biologic delivered into the paravertebral tissue acts on the compartment in which that congestion occurs, without breaching the annulus. This reasoning is mechanistic and hypothetical; it was not tested in this patient. (**Figure 7**) sets out the anatomical argument.

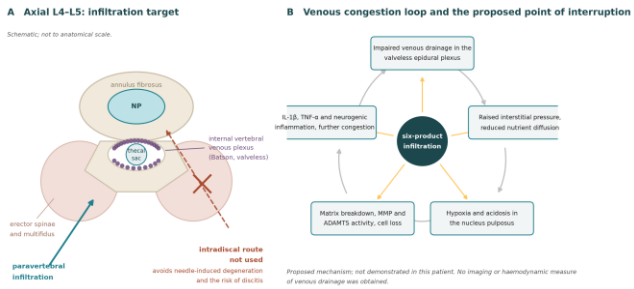

Figure 7: Anatomical rationale for the paravertebral target | (A) Axial schematic at L4–L5 showing the valveless paravertebral and epidural components of Batson's plexus, the paravertebral injection path used, and the intradiscal route that was deliberately avoided. (B) The proposed venous congestion loop and the points at which a paravertebral biologic is postulated to interrupt it. Panel B is a hypothesis, not a measured pathway.

Item	Detail as performed
Target compartment	**Paravertebral soft tissue at the symptomatic level**
Level	**L4–L5**
Laterality	bilateral
Products injected	Native BMA + BMAC + PRP + PRP plus + nanofat + SVF, combined
Volume per product / total volume	20 ml
Needle gauge and length	20 G / 40mm
Image guidance	ultrasound
Intradiscal injection	**Not performed**
Number of sessions	**One**
Post-procedure protocol	activity restriction 7 days, analgesia with paracetamol 500mg 6/6h, rehabilitation immediately

Table 5: Injection map | Fields marked for insertion were not documented in the source record and are required for the procedure to be reproducible.
BMA, bone marrow aspirate; BMAC, bone marrow aspirate concentrate; PRP, platelet-rich plasma; SVF, stromal vascular fraction.

Outcomes and Follow-Up

Follow-up was clinical and radiological at six and twelve months. Pain was recorded on a 0–10 visual analogue scale and function with the Oswestry Disability Index [64,65].

At six months the VAS score had fallen from 7 to 3 and the ODI from 48% to 22%. Both changes exceed the commonly cited thresholds for minimal clinically important change in chronic low back pain — approximately 2 points or 30% for pain, and approximately 10 percentage points for the ODI [2,3,66]. Magnetic resonance imaging at six months showed reduced paravertebral inflammatory signal and improved disc parameters. At twelve months the patient reported no pain and had returned fully to physical activity; the treating team described the twelve-month imaging as showing complete regeneration of the discopathy. A twelve-month ODI was not recorded. No adverse event, infection, bleeding complication, neurological deficit or pellet-related problem occurred at either the harvest or the injection site during the twelve months of observation.

Timepoint	VAS (0–10)	Change from baseline	ODI (%)	Change from baseline	Exceeds MCID?
Baseline	**7**	—	**48**	—	—
6 months	**3**	−4 points (−57%)	**22**	−26 points	**Yes, both**
12 months	**0 (no pain reported)**	−7 points (−100%)	**not recorded**	not calculable	**Yes, VAS**

Table 6: Clinical outcomes against minimal clinically important change | Percentage changes are calculated from the reported scores.

VAS, visual analogue scale; ODI, Oswestry Disability Index; MCID, minimal clinically important change. Thresholds applied: ≈ 2 points or 30% improvement for pain and ≈ 10 percentage points for the ODI [2,3,66]. The twelve-month VAS is derived from the recorded statement that the patient had no pain. The absence of a twelve-month ODI is a reporting gap.

MRI parameter	Baseline	6 months	12 months
Disc degeneration, L4–L5	**Present, with posterior bulging**	**Improved disc parameters**	**Reported as complete regeneration**
Pfirrmann grade [67,68]	Grade IV	Grade III	Grade I
Posterior bulge (mm)	3	1	none
Disc height (mm or index)	8	9	9
Modic changes [69,70]	Type II	Type I	Type I
Paravertebral inflammatory signal	Increased	**Reduced**	None
Quantitative T2 / T1ρ mapping [71,72]	Not performed	Not performed	Not performed
Independent blinded read	No	No	No

Table 7: Magnetic resonance findings by timepoint | Rows marked for insertion were not quantified in the source record. The narrative descriptions in bold are reproduced as recorded by the treating team.

The statement of complete regeneration is the treating team's interpretation of the twelve-month study. It is an extraordinary claim for a degenerate lumbar disc and cannot be accepted without the source images, graded Pfirrmann scores at each timepoint and an independent blinded radiological read; quantitative T2 or T1ρ mapping would provide compositional rather than morphological evidence [71,72].

Domain	Observation over 12 months
Harvest site	**No infection, haematoma, persistent pain or fracture**
Injection site	**No infection, no neurological deficit, no bleeding**
Discitis	Not applicable — no annular puncture was performed
Hormone pellet beds	No displacement, extrusion or local reaction reported
Systemic events	None reported
Unanticipated events	None reported
Adverse event grading instrument used	None

Table 8: Safety and adverse events | Ascertainment was by clinical review at scheduled visits; no formal adverse-event instrument was applied.

For context, a multicentre analysis of 2,372 patients treated with autologous cell therapy for orthopaedic conditions reported a low rate of serious adverse events [73]. Single-case safety observations carry no inferential weight.

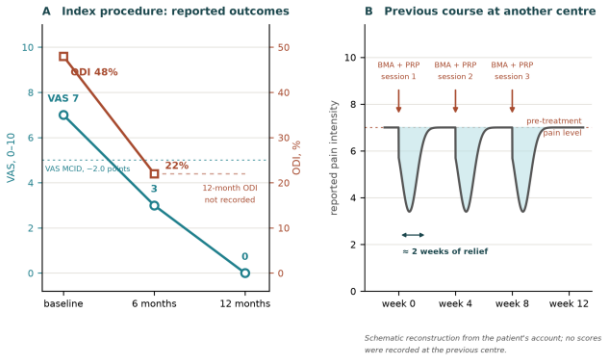

Figure 8: Clinical trajectory | (A) Visual analogue scale and Oswestry Disability Index from baseline to twelve months, with minimal clinically important change thresholds indicated; the twelve-month ODI was not recorded. (B) The patient's previous course of conventional bone marrow aspirate and platelet-rich plasma at another centre, showing approximately two weeks of relief after each of three-monthly sessions.

Discussion

Principal observations

Three things happened in this case. A marrow harvest was completed through a corridor that has not, to our knowledge, been described for office-based orthobiologic practice, in a patient in whom both conventional entry points were unusable. Six autologous preparations were delivered together into the paravertebral compartment rather than into the disc. And the patient improved, by margins exceeding the minimal clinically important change, and remained improved at twelve months after a single session — in contrast to the roughly two weeks of relief he had obtained from each of three previous conventional sessions.

The harvest corridor

The posterior superior iliac spine is preferred for good reasons: it yields more and more proliferative marrow than the anterior crest or the proximal humerus [31,32], the corridor has been mapped in three dimensions [33,34], and its safety record is extensive [35,36]. The lateral cranio-caudal corridor used here trades that evidence base for accessibility. Its theoretical advantages are a long intraosseous path between two cortical tables, which permits several distinct sampling depths from one puncture, and a trajectory that runs away from the sacroiliac joint, the sciatic notch and the pelvic cavity. Its disadvantages are that the marrow content of the lateral iliac wing is likely to be lower than that of the posterior spine, that the corridor has not been characterised radiologically, and that no cadaveric safety study of it exists. This last point should be stated plainly: there is at present no published anatomical validation of this corridor.

Fractionation and yield

The decision to draw six 10 mL fractions, withdrawing the needle 10 mm between each, follows directly from the aspiration-volume literature. Muschler and colleagues showed that the concentration of osteoblastic progenitors falls sharply as aspiration volume from a single site increase [41]; the same

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dilution effect has since been confirmed for mesenchymal stromal cells and for connective-tissue progenitors [42–44], and small-volume multi-site aspiration is now standard advice in orthobiologic technique descriptions [45,46]. The technique described here is a systematic implementation of that principle. Whether it actually delivered a higher progenitor dose in this patient is unknown, because no nucleated cell counts and no colony-forming unit–fibroblast assay were performed. Any future use of this technique should include those measurements; without them the central claim of the acronym remains unverified.

Processing and the composition gap

Concentration systems differ substantially in the cell numbers they deliver from identical starting material [74–76], and mechanical adipose processing methods differ likewise in stromal cell recovery and viability [51,77–81]. Reporting the centrifugation parameters, as done in (**Table 4**), is necessary but not sufficient: without platelet, leucocyte and nucleated cell counts the products cannot be classified under PAW, DEPA or MARSPILL [53–55], and the report falls short of the MIBO and related reporting standards [47–49]. A recent international consensus statement identifies exactly this deficiency as a principal obstacle to interpreting orthobiologic outcomes [82].

Proposed mechanisms

Five mechanisms can be proposed for the observed effect; all are plausible and none was measured (**Figure 9**). First, modulation of the local inflammatory cytokine environment by platelet-derived and marrow-derived mediators. Second, stimulation of endogenous repair within the annulus and adjacent tissue. Third, trophic and paracrine support of resident cells, which is now considered the dominant mode of action of non-expanded mesenchymal populations [7,26,83]. Fourth, differentiation of delivered stromal cells into supportive cell types, a mechanism demonstrated in animal disc models [84,85] but not confirmed in humans. Fifth, reduction of venous congestion within Batson's plexus, with consequent improvement in segmental drainage and reduction of the inflammatory load [59,61,62].

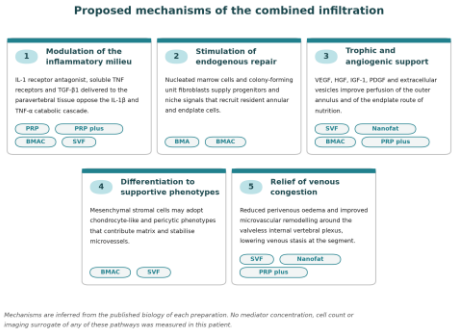

Figure 9: Proposed mechanisms | Five non-exclusive mechanisms by which the combined paravertebral injectate might act, with the products plausibly contributing to each. None of these pathways was measured in this patient; the figure summarises hypotheses.

Study	Biologic	Route	Design as published
Pettine 2015 / 2017 [9,10]	Bone marrow concentrates	Intradiscal	Prospective cohort, 12-month and 3-year reports
Orozco 2011 [11]	Autologous expanded bone marrow MSC	Intradiscal	Pilot study
Noriega 2017 [12]	Allogeneic bone marrow MSC	Intradiscal	Randomised controlled trial

Study	Biologic	Route	Design as published
Elabd 2016 [13]	Autologous hypoxic cultured bone marrow MSC	Intradiscal	Long-term safety and feasibility, five patients
Kumar 2017 [58]	Adipose-derived MSC with hyaluronic acid	Intradiscal	Phase I, one-year follow-up
Comella 2017 [17]	Stromal vascular fraction with PRP	Intradiscal	Prospective open-label study
Tuakli-Wosornu 2016 [14]	Platelet-rich plasma	Intradiscal	Double-blind randomised controlled study
Akeda 2017 [15]	PRP releasate	Intradiscal	Preliminary clinical trial
Levi 2016 [16]	Platelet-rich plasma	Intradiscal	Prospective trial, preliminary results
Centeno 2017 [21]	Platelet lysate	Lumbar epidural	Registry-based series in radicular pain
Present report	**BMA + BMAC + PRP + PRP plus + nanofat + SVF**	**Paravertebral**	**Single case, uncontrolled**

Table 9: Position of this report within the published disc-directed orthobiologic literature | Only the biologic, route and published design are listed. Numerical outcomes are deliberately omitted because the preparations, populations, follow-up intervals and endpoints are not comparable, and a single case cannot be ranked against controlled studies.

MSC, mesenchymal stromal cells; PRP, platelet-rich plasma; BMA, bone marrow aspirate; BMAC, bone marrow aspirate concentrate; SVF, stromal vascular fraction. Systematic reviews of this field report low-certainty evidence and substantial heterogeneity [22-24,26].

Regulatory context

All six preparations were autologous, prepared in a single operative session by centrifugation or mechanical emulsification, without enzymatic digestion or culture. In the United States this is the profile that determines whether a product falls under section 361 of the Public Health Service Act, through the minimal manipulation and homologous use criteria and the same surgical procedure exception [86,87]. In Brazil, advanced therapy products are governed by ANVISA resolutions RDC 505, 506 and 508 of 2021 [88]. Classification is jurisdiction-specific and depends on how the product is characterised and on the intended use; whether a paravertebral injection of adipose-derived material for disc degeneration is homologous use is not settled. Clinicians adopting this protocol must obtain their own regulatory determination. The wider concern that unproven autologous interventions are being offered ahead of evidence is well founded [89-91], and single-case reports such as this one should not be used in the promotion of a service.

Limitations

- This is a single patient with no control and no blinding. No causal claim can be made.
- Chronic low back pain fluctuates, improves substantially under a wide range of treatments, and is strongly subject to regression to the mean; disc herniation and bulging also resorb spontaneously in a large proportion of cases [4–6,92,93]. Natural history and placebo effects cannot be excluded.
- Six biologic products were administered simultaneously. It is impossible to attribute the result to any one of them, to the combination, or to the new harvest technique.
- No nucleated cell count, colony-forming unit–fibroblast assay, platelet count, leucocyte count or viability assessment was performed for any product. The presumed yield advantage of the B.E.S.T.B.M.A. harvest is therefore an unverified design rationale, and the injectate cannot be characterised [47–49].

- The twelve-month claim of complete regeneration of the discopathy is not supported by graded, quantified or independently reviewed imaging. Pfirrmann grades, disc height and bulge measurements at each timepoint, the source images, and a blinded radiological read are all required before such a claim can stand [67,68].
- The twelve-month Oswestry Disability Index was not recorded, so the functional endpoint is incomplete.
- The lateral cranio-caudal corridor has not been validated in a cadaveric or imaging study, and its marrow content relative to the posterior superior iliac spine is unknown.
- The proposed contribution of venous congestion within Batson's plexus is a mechanistic hypothesis. No venographic, dynamic or quantitative imaging assessment of venous drainage was performed.
- Follow-up ended at twelve months. Durability beyond that point is unknown.
- Costs, access and regulatory classification differ between jurisdictions and may make the protocol unavailable to most patients.

Conclusions

In a patient whose conventional posterior marrow harvest sites were both unusable because of recent gluteal hormone pellet implantation, a lateral cranio-caudal fractionated iliac harvest — designated B.E.S.T.B.M.A. — provided 60 mL of bone marrow aspirate through a single puncture, and a combined paravertebral injection of six autologous preparations was followed by clinically important and sustained improvement over twelve months, with no adverse events.

Two conclusions can reasonably be drawn. The harvest technique is feasible and offers a practical option when the posterior corridor is compromised. And a paravertebral target, which avoids annular puncture entirely, deserves formal comparison with the intradiscal route that dominates the current literature.

Neither the technique nor the protocol is validated by this report. What is needed next is a controlled study with cell-count characterisation of every product, blinded and quantified imaging endpoints including Pfirrmann grading and quantitative T2 mapping, a comparison of harvest corridors with progenitor yield as the primary endpoint, and a factorial or stepwise design capable of identifying which components of a combined injectate contribute to effect. Until such studies exist, the observations reported here should be treated as hypothesis-generating.

Reporting Checklist

CARE item	Where addressed
Title identifies the report as a case report	**Title page**
Key words	**End of abstract**
Structured abstract	**Abstract**
Introduction with background and rationale	**Section 1**
Patient information and de-identification	**Section 2.1, Table 1**
Clinical findings	**Section 2.1, Table 1 (partly incomplete)**
Timeline	**Figure 2**
Diagnostic assessment	**Section 2.1, Table 7 (partly incomplete)**
Therapeutic intervention, fully specified	**Sections 3–5, Tables 2–5, Figures 3–7**
Follow-up and outcomes	**Section 6, Tables 6–8, Figure 8**
Adverse and unanticipated events	**Table 8**
Discussion with strengths and limitations	**Sections 7 and 8**
Patient perspective	None
Informed consent obtained	Yes

Table 10: Compliance with the CARE checklist for case reports [1] | Items marked for insertion must be completed before submission.

Declarations

Ethics approval and consent to participate

Institutional review board / research ethics committee approval. The patient provided written informed consent for the procedure.

Consent for publication

Written informed consent for publication of the clinical details, the imaging and the intraoperative photograph reproduced in Figure 4B was obtained from the patient.

Availability of data and materials

All data generated or analysed during this case are included in this article. The source magnetic resonance images are held by the treating institution and can be made available for independent review on reasonable request.

Competing interests

The authors declare no competing interests.

Funding

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Authors' contributions

All authors read and approved the final manuscript.

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The illustration reproduced in (Figure 4A) was created in BioRender

Use of artificial intelligence

Generative artificial intelligence tools were used in the preparation of the manuscript for analytic data and studies comparisons.

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