

Comparison of Radiographic and Clinical Outcomes between Bone Morphologic Protein-2 and Tricalcium Phosphate plus Iliac Bone Graft in Single level Extreme Lumbar Interbody Fusion Surgery

Werasak Sutipornpalangkul (Bangkok, Thaïlande), Panlop Tirawanish (Bangkok, Thaïlande), Apicha Leardthanadee (Bangkok, Thaïlande)

Introduction

Extreme lateral lumbar interbody fusion (XLIF) has become a preferred minimally invasive option for degenerative lumbar spinal disorders. Fusion success is influenced by a large cage with the grafting materials. Bone morphologic protein 2 (BMP-2)-based graft material promotes reliable osteogenesis but carries substantial expense and possible side effects. A mixture of β -tricalcium phosphate (β -TCP) and iliac bone graft (IBG) harvested from the iliac crest has been proposed as a more economical substitute. This study aimed to compare radiographic and functional outcomes between BMP-2 and β -TCP + IBG in single-level XLIF.

Materials and Methods

Seventy-nine consecutive cases were analyzed. The study included single-level XLIF procedures performed between 2015 and 2024 (45 patients, BMP-2 and 34 patients, β -TCP + IBG). Patient-reported scores (Oswestry Disability Index [ODI], EQ-5D-5L, and EQ-VAS) and radiographic parameters (disc and foraminal height, lumbar alignment, and fusion grade) were assessed up to 24 months. Fusion was graded using the Bridwell scale. Comparative statistics were conducted with t-tests and either chi-square or Fisher's exact tests, as appropriate. Repeated-measures ANOVA and kappa statistics were applied to assess interobserver reliability, and statistical significance was accepted at $p < 0.05$.

Results

Preoperative demographic and clinical data were comparable between cohorts. Fusion at 12 months reached 75.6% for BMP-2 and 55.9% for β -TCP + IBG ($p = 0.065$). Fusion rate at 24 months were 100% and 97.1%, respectively ($p = 0.247$). Marked postoperative improvement was observed in both groups for ODI and EQ-5D-5L scores, with no significant differences between them. Radiographic parameters showed stable disc and foraminal heights at two years.

Conclusion

Both BMP-2 and β -TCP + IBG yielded equivalent long-term radiologic and clinical recovery following XLIF procedure. Although BMP-2 may promote earlier consolidation, β -TCP + IBG achieved comparable final results at 24 months while reducing material cost without donor-site morbidity.

Table 3: Comparison of clinical outcomes at baseline and 24 months after XLIF.

Parameters	BMP-2			TCP+IBG			24 months
	Preoperative	24 months	p-value	preoperative	24 months	p-value	
ODI	39.22 ± 18.39 (20.00 – 53.89)	20.31 ± 15.96 (8.89 – 24.44)	0.002**	36.80 ± 21.71 (20.00 – 53.68)	17.22 ± 17.06 (5.55 – 35.56)	0.018*	0.348
EQ-5D-5L	-0.617 ± 0.296 (-0.700 – 0.368)	0.858 ± 0.151 (-0.089 – 0.976)	<0.001	0.646 ± 0.259 (0.471 – 0.861)	0.876 ± 0.184 (0.739 – 1.000)	0.015*	0.431
EQ-VAS	66.94 ± 22.37 (50.00 – 85.00)	77.78 ± 19.34 (70.00 – 90.00)	0.095	65.00 ± 16.92 (51.25 – 80.00)	85.17 ± 21.52 (75.00 – 100.00)	0.014*	0.131

** Significant at $p < 0.05$ (Wilcoxon signed rank test).

BMP-2: Bone morphologic protein-2; TCP, Tricalcium phosphate; IBG, Iliac bone graft

Table 4: Radiographic Parameters at Baseline and 24-Month Follow-Up¶

Parameters□	BMP-2□		p-value□	TCP+IBG□		p-value□	24 months□ p-value□
	Pre-op□	24 months□		Pre op□	24 months□		
Intervertebral disc height□	1.01 ± 0.29□	1.38 ± 0.24□	·< 0.001*□	0.90 ± 0.27□	1.29 ± 0.24□	·< 0.001*□	0.980□
Lumbar lordosis□	16.84 ± 7.16¶	2.04 ± 1.64¶	·< 0.001**□	·14.65 ± 7.39¶	1.82 ± 1.49¶	·< 0.001**□	0.575□
	17.00 (11.00 ~	·2.00 (1.00 ~		13.00 (8.75 ~	2.00 (1.00 ~		
	1.00)····□	3.00)····□		19.25)····□	3.00)····□		
Foraminal height□	2.01 ± 0.26□	2.10 ± 0.38□	0.109□	2.00 ± 0.33□	2.10 ± 0.31□	0.179□	0.983□
Sacral slope□	31.73 ± 7.82□	32.56 ± 6.50□	0.351□	31.97 ± 7.12□	31.71 ± 6.39□	0.770□	0.564□
Pelvic tilt□	22.62 ± 9.20□	21.78 ± 8.97□	0.305□	22.00 ± 7.29□	21.71 ± 8.31□	0.740□	0.971□
Pelvic incidence□	·54.36 ± 9.86□	54.33 ± 10.32□	0.975□	53.97 ± 8.61□	53.41 ± 8.53□	·0.505□	0.674□

*Significant at $p < 0.05$ (Paired t-test), **Significant at $p < 0.05$ (Wilcoxon signed rank test).¶

BMP-2: Bone morphologic protein-2; TCP, Tricalcium phosphate; IBG, Iliac bone graft¶