

# Degree of Preoperative Subchondral Bone Marrow Lesion Is Associated With Postoperative Outcome After Total Knee Arthroplasty

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**INTRODUCTION:** Bone marrow lesion (BML) is commonly detected in patients with knee osteoarthritis (OA). It is identified as poorly marginated subchondral areas of increased signal intensity compared with adjacent epiphyseal marrow on fluid-sensitive MRI sequences. Several studies have reported that BML has association with progression of cartilage degeneration(1-3). Furthermore, BML has been reported to be associated with long term risk of knee joint replacement(2, 4, 5), which clearly demonstrates clinical importance of BML. In this study, we evaluated 1) prevalence of BMLs in patients with severe knee OA and 2) correlation of clinical outcomes before and after the surgery with preoperative BML scores of each sublesions.

**METHODS:** 39 patients with advanced knee OA were included in this study prospectively. All patients were scheduled to undergo total knee replacement surgery. This study was designed in accordance with the Helsinki Declaration and approved by our institutional review board. Written informed consent was obtained from each patient. Demographic data included patient age, gender, height, weight and body mass index at the time of surgery. The passive flexion-extension knee range of motion were measured with a goniometer in the supine position, the femorotibial angle and Kellgren and Laurence grade were evaluated with the weight-bearing full leg radiographs, and the knee extensor and flexor strength, the 10-m walking test (10MWT), the timed up-and-go test (TUG) were assessed before the surgery. Knee Society Score (KSS) and 2011 Knee Society Score (2011KSS) were evaluated as clinical outcomes before and 1 year after the surgery. MR imaging of the knee joint was performed 1-4 days before the surgery. A 3.0-T MR unit (Vantage; Toshiba Medical Systems Co., Ltd., Otawara, Japan) and a 4ch Flex SPEEDER coil were used. Using the whole-organ MRI scoring method (WORMS), the BMLs of each knees were scored blinded to other clinical data. In that method, BMLs were scored 0 to 3 in each of the 14 articular surface regions as well as the region of the tibia beneath the tibial spines based on the extent of regional involvement. The correlation of clinical variables with BML scores of each sublesion was calculated using Spearman's rank correlation analysis.

**RESULTS:** The average age of subjects was 71.4 years, and 64.9% were women. The mean body mass index was 27.2. Most patients had severe OA with Kellgren and Lawrence grade 3 or 4 (27% and 70.2 %, respectively). BML score of each sublesion was evaluated using WORMS scoring method, and shown in Table 1. BML score was highest in Medial femorotibial joint ( $5.19 \pm 4.25$ ). Of note, Subspinous lesion showed second highest BML score ( $1.05 \pm 0.97$ ), which was higher than Lateral femorotibial joint ( $0.59 \pm 1.52$ ) and Patellofemoral joint ( $0.54 \pm 0.93$ ). To understand the relationship between preoperative BML in each sublesion and clinical outcomes, correlation of clinical outcomes with preoperative BML scores in each sublesion was evaluated using Spearman's rank correlation test. Preoperative BML scores in each sublesions had no significant correlation with preoperative KSS and 2011 KSS. However, preoperative BML scores in subspinous lesion had statistically significant correlation with Symptoms ( $p < 0.05$ ), Functional activities (total) ( $p < 0.05$ ) and Discretionary activities ( $p < 0.05$ ) 1 year after the surgery (Table 2). Moreover, preoperative BML scores in each sublesions had also statistically significant correlations with delta Function score ( $p < 0.05$ ), delta Symptoms ( $p < 0.05$ ), delta Functional activities (total) ( $p < 0.01$ ), delta Walking and standing ( $p < 0.05$ ), delta Standard activities ( $p < 0.05$ ) and delta Discretionary activities ( $p < 0.05$ ) (Table 3).

**DISCUSSIONS:** In this study, we showed that subspinous lesions in patients with severe knee osteoarthritis had second highest BML scores. We also demonstrated that degree of preoperative bone marrow lesion in subspinous lesion was positively associated with postoperative outcomes after total knee arthroplasty.

**SIGNIFICANCE/CLINICAL RELEVANCE:** Preoperative BML had no negative influence of postoperative clinical outcomes. Surgeons do not need to hesitate to perform total knee arthroplasty in patients with severe bone marrow lesions.

References:.

1. Kothari A, Guermazi A, Chmiel JS, Dunlop D, Song J, Almagor O, Marshall M, Cahue S, Prasad P, Sharma L. 2010. Within-subregion relationship between bone marrow lesions and subsequent cartilage loss in knee osteoarthritis. Arthritis Care Res (Hoboken) 62:198-203.
2. Tanamas SK, Wluka AE, Pelletier JP, Pelletier JM, Abram F, Berry PA, Wang Y, Jones G, Cicuttini FM. 2010. Bone marrow lesions in people with knee osteoarthritis predict progression of disease and joint replacement: a longitudinal study. Rheumatology (Oxford) 49:2413-9.
3. Crema MD, Felson DT, Roemer FW, Wang K, Marra MD, Nevitt MC, Lynch JA, Torner J, Lewis CE, Guermazi A. 2013. Prevalent cartilage damage and cartilage loss over time are associated with incident bone marrow lesions in the tibiofemoral compartments: the MOST study. Osteoarthritis Cartilage 21:306-13.
4. Scher C, Craig J, Nelson F. 2008. Bone marrow edema in the knee in osteoarthritis and association with total knee arthroplasty within a three-year follow-up. Skeletal Radiol 37:609-17.
5. Nielsen FK, Egund N, Jorgensen A, Jurik AG. 2017. Risk factors for joint replacement in knee osteoarthritis; a 15-year follow-up study. BMC Musculoskelet Disord 18:510.

Table 1. Bone marrow lesion scores of each sublesions

Bone marrow lesion score	
<b>Medial femorotibial joint (MFTJ)</b>	<b>5.19 ± 4.25</b>
MTa	1.48 ± 1.35
MTc	1.32 ± 1.20
MTp	0.70 ± 1.20
MFc	1.11 ± 1.07
MFp	0.57 ± 0.87
<b>Lateral femorotibial joint (LFTJ)</b>	<b>0.59 ± 1.52</b>
LTa	0.16 ± 0.60
LTc	0.16 ± 0.50
LTp	0.03 ± 0.16
LFc	0.19 ± 0.57
LFp	0.05 ± 0.23
<b>Patellofemoral joint (PFJ)</b>	<b>0.54 ± 0.93</b>
MFa	0.32 ± 0.78
LFa	0.03 ± 0.16
MP	0.05 ± 0.23
LP	0.14 ± 0.42
<b>Subspinous lesion (S)</b>	<b>1.05 ± 0.97</b>
<b>Total</b>	<b>7.38 ± 5.49</b>

Table 2. Correlation of KSS and 2011KSS at 1 year post-surgery with preoperative BML scores of each sublesions

	Preoperative BML scores of each sublesions							
	MFTJ BML score		LFTJ BML score		PFJ BML score		S BML score	
	r	p	r	p	r	p	r	p
Knee score	-0.133		-0.014		-0.343		0.159	
Function score	0.127		-0.186		-0.166		0.267	
Symptoms	-0.034		0.047		-0.270		0.349	<0.05
Patient satisfaction	0.090		0.156		-0.200		0.258	
Patient expectation	0.129		0.282		-0.107		0.079	
Functional activities (total)	0.193		0.151		-0.320		0.371	<0.05
Walking and standing	0.238		0.033		-0.256		0.291	
Standard activities	0.056		0.247		-0.256		0.259	
Advanced activities	0.189		-0.005		-0.229		0.187	
Discretionary activities	0.053		0.182		-0.326		0.386	<0.05

Table 3. Correlation of ΔKSS and Δ2011KSS with preoperative BML scores of each sublesions

	Preoperative BML scores of each sublesions							
	MFTJ BML score		LFTJ BML score		PFJ BML score		S BML score	
	r	p	r	p	r	p	r	p
ΔKnee score	0.072		0.011		-0.239		0.266	
ΔFunction score	0.064		-0.238		0.201		0.359	<0.05
ΔSymptoms	-0.098		-0.074		-0.155		0.352	<0.05
ΔPatient satisfaction	0.083		0.284		-0.148		0.120	
ΔPatient expectation	0.039		0.313		-0.058		0.052	
ΔFunctional activities (total)	-0.005		0.221		-0.100		0.558	<0.01
ΔWalking and standing	-0.127		0.052		-0.232		0.439	<0.05
ΔStandard activities	-0.082		0.417		0.077		0.402	<0.05
ΔAdvanced activities	0.131		0.080		-0.143		0.329	
ΔDiscretionary activities	0.089		0.069		0.104		0.356	<0.05