Skin closure using barbed sutures improves patient satisfaction with wound healing compared to interrupted sutures in total knee arthroplasty: a prospective single-blind randomized controlled trial

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INTRODUCTION:

The surgical incision site after total knee arthroplasty (TKA) is an easily noticeable area for patients as it remains visible postoperatively, allowing for self-assessment. However, few reports have quantitatively assessed the postoperative wound condition after TKA. Furthermore, it remains unclear whether a relationship exists between patient-reported outcome measures (PROMs) related to the knee and postoperative wound condition.

Recently, barbed sutures have gained popularity, and their use not only reduces operative time but also provides benefits such as reducing bleeding. However, whether barbed sutures provide cosmetic benefits remains controversial. Several studies have reported the use of barbed sutures for subcuticular closure in TKA; however, most have evaluated the surgical wound complication outcomes, and it is not clear whether the use of barbed sutures affects the cosmetic wound healing outcomes in TKA.

The aim of this study was to investigate whether skin closure using barbed sutures improves postoperative cosmetic outcomes compared to interrupted sutures, and whether cosmetic outcomes correlate with knee-specific patient-reported outcome measures (PROMs) in TKA.

METHODS:

This prospective, single-blind, randomized controlled trial assessed the cosmetic outcomes in patients who underwent TKA for osteoarthritis of the knee at a single institution. The patients were randomly allocated to receive skin closure with barbed or interrupted sutures (Figure 1).

The primary outcomes were cosmetic outcomes, assessed using the Patient Scar Assessment Scale (PSAS) from the Patient and Observer Scar Assessment Scale (POSAS; version 2.0), and wound-related complications at one year postoperatively. The PSAS is a subjective wound assessment tool evaluated by patients that consists of six items: pain, itching, color, stiffness, thickness, and irregularity. Each scored from 1 (normal skin) to 10 (worst scar imaginable), with the highest or best possible score of 6 and the worst possible score of 60 points (Figure 2). The secondary outcomes were PROMs: Knee Society Score 2011 (KSS-2011) and Forgotten Joint Score-12 (FJS-12). The relationship between cosmetic outcomes and PROMs was statistically analyzed.

Statistical analyses were conducted utilizing the R software (version 4.3.1; R Foundation for Statistical Computing, Vienna, Austria). Statistical significance was set at a *P*-value of <0.05.

RESULTS:

There were 83 knees included in this study (44 in the barbed suture group and 39 in the interrupted group) (Table 1).

A total of two knees in the interrupted suture group had superficial incisional surgical site infection requiring debridement, but there was no difference in surgical wound complication rates between the two groups (0 vs. 5%, $P = 0.42$). Due to the inability to perform accurate wound assessment, the two cases requiring debridement were excluded, leaving 44 knees in the barbed suture group and 37 knees in the interrupted suture group for PSAS evaluation.

The barbed suture group demonstrated lower PSAS scores than the interrupted suture group in the following items: pain score (1.9 ± 1.0 vs. 2.8 ± 2.3, $P = 0.02$), stiffness score (2.5 ± 2.1 vs. 3.8 ± 3.0, $P = 0.03$), and total score (14.9 ± 7.7 vs. 20.0 ± 13.7, $P = 0.04$) (Table 2). There were no differences in the KSS-2011 and FJS-12 at one year postoperatively between the two groups.

The PSAS total score was negatively correlated with the KSS-2011 symptoms ($r = -0.39$, $P < 0.01$), satisfaction ($r = -0.26$, $P = 0.02$), and expectation subsections ($r = -0.37$, $P < 0.01$), as well as with the FJS-12 total score ($r = -0.25$, $P = 0.03$) (Table 3).

DISCUSSION AND CONCLUSION:

The use of barbed sutures for subcuticular skin closure resulted in better PSAS scores than the use of interrupted sutures in TKA. In addition, the PSAS total score was negatively correlated with KSS-2011 symptoms, satisfaction, expectation, and FJS-12 scores, suggesting that better cosmetic outcomes were associated with better PROMs after TKA. To the best of our knowledge, this is the first study to investigate the relationship between cosmetic outcomes and PROMs after TKA.

Selecting a suture technique that has a favorable effect on skin condition may contribute to improved patient satisfaction in TKA.

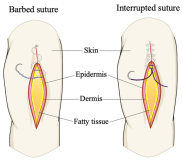

Figure 1: Schema of two suture types for subcuticular skin closure. Subcuticular skin was closed using monofilament barbed sutures (left picture) or single-stitched interrupted polyfilament sutures (right picture).

Figure 2: Representative photographs of patient wounds after TKA along with the PSAS scores. (A) Photograph of the surgical wound in the barbed suture group, and (B) photograph of surgical wound in the interrupted suture group, both photographs depict the right knee one year after TKA. The PSAS is a subjective wound assessment tool evaluated by patients, and consists of six items each scored from 1 (normal skin) to 10 (worst scar imaginable).
TKA, total knee arthroplasty; PSAS, Patient Assessment Scar Scale.

Table 1. Patient demographics

Parameters	Barbed suture group n = 44	Interrupted suture group n = 39	*P*-value
Demographic characteristic			
Age at the time of operation, years	74.7 ± 6.5	73.8 ± 8.0	0.56
Woman, n	30 (68)	30 (77)	0.52
BMI, kg/m²	26.3 ± 4.1	26.2 ± 4.6	0.94
Right, n	20 (45)	21 (54)	0.59
Preoperative status			
Knee ROM, degrees	115.9 ± 16.9	121.7 ± 18.9	0.15
FTA, degrees	185.4 ± 6.2	183.7 ± 5.3	0.19
Intraoperative status			
Operative time, min	106.3 ± 13.1	107.2 ± 22.5	0.83
Subcuticular suture time, sec	355.8 ± 38.1	537.8 ± 107.5	< 0.01*
Blood loss, mL	357.2 ± 216.1	356.3 ± 221.8	0.98

The values are presented as mean ± standard deviation or count (percentage).
*$P < 0.05$ was considered statistically significant.
BMI, body mass index; ROM, range of motion; FTA, femorotibial angle.

Table 2. Cosmetic outcomes at 1 year after TKA

Parameters	Barbed suture group n = 44	Interrupted suture group n = 37	*P*-value
PSAS score, points			
Pain	1.9 ± 1.0	2.8 ± 2.3	0.02*
Itching	2.0 ± 1.3	2.6 ± 2.3	0.14
Color	2.5 ± 1.8	3.3 ± 3.0	0.14
Stiffness	2.5 ± 2.1	3.8 ± 3.0	0.03*
Thickness	2.8 ± 2.0	3.7 ± 2.9	0.11
Irregularity	3.1 ± 2.6	3.7 ± 3.1	0.36
Total score	14.9 ± 7.7	20.0 ± 13.7	0.04*

The values are presented as mean ± standard deviation.
*$P < 0.05$ was considered statistically significant.
TKA, total knee arthroplasty; PSAS, Patient Scar Assessment Scale.

Table 3. Correlations between the cosmetic outcome and PROMs at 1 year after TKA

Parameters	KSS-2011 symptoms	KSS-2011 satisfaction	KSS-2011 expectations	KSS-2011 functional activities	FJS-12 total score
PSAS total score	$r = -0.39$; $P < 0.01$*	$r = -0.26$; $P = 0.02$*	$r = -0.37$; $P < 0.01$*	$r = -0.10$; $P = 0.37$	$r = -0.25$; $P = 0.03$*

The values of correlation coefficient are presented as *r*.
*$P < 0.05$ was considered statistically significant.
PROMs, patient-reported outcome measures; TKA, total knee arthroplasty; KSS, Knee Society Score; FJS, Forgotten Joint Score; PSAS, Patient Scar Assessment Scale.