Risk factors for early septic failure after 2-stage exchange total knee arthroplasty for treatment of periprosthetic joint infection

Hyuck Min Kwon, Byung Woo Cho, Jun Young Park

INTRODUCTION: The cause of early septic failure after 2-stage exchange revision total knee arthroplasty (TKA) for chronic periprosthetic joint infection (PJI) and the factors affecting it are not well known. The purpose of this study was to determine the surgical outcomes and the risk factors for early septic failure after 2-stage revision TKA for chronic PJI.

METHODS:

We identified a total of 246 adult patients who met the Musculoskeletal Infection Society (MSIS) diagnostic criteria for chronic PJI at two academic tertiary hospitals from March 2012 to December 2018. Finally, 151 patients who consecutively received 2-stage exchange revision TKA for chronic PJI and who had a minimum three-year follow-up were enrolled and retrospectively reviewed. Successful surgical treatment was evaluated for 2-stage revision TKA and risk factors for early septic failure were identified.

RESULTS:

Early septic failures occurred within three years after reimplantation in 48 patients (31.8%). After accounting for potentially confounding variables, we found that male patient (odds ratio [OR]=2.753, 95% confidence interval [CI]: 1.099–6.893, p=0.031), fungus or mycobacterial infection (OR=5.224, 95% CI: 1.481–18.433, p=0.01), and positive culture at reimplantation (OR=4.407, 95% CI: 1.255–15.480, p=0.021) were independently associated with early septic failure after 2-stage exchange revision TKA.

DISCUSSION AND CONCLUSION: Male patients, fungus or mycobacterial infection, and positive culture at reimplantation were independently associated with an increased risk of early septic failure after 2-stage exchange revision TKA despite normal C-reactive protein values prior to reimplantation. Further prospective and high-quality studies are needed to determine the risk factors of 2-stage exchange revision TKA for chronic PJI.

Table 1. Patient demographic and clinical characteristics

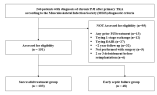
	Successful treatment group (n=103)	Early septic failure group (n=48)	p value
Age, mean ± SD (years)	75.3 ± 5.3	73.1 ± 7.8	0.047
Male	17 (16.5%)	16 (33.3%)	0.02
BMI, mean ± SD (kg/m²)	23.32 ± 3.9	23.78 ± 3.8	0.729
Duration primary to revision, mean ± SD (month)	49.4 ± 58.3	57.0 ± 55.4	0.212
ESR, mean ± SD (mm/hr)	72.4 ± 35.3	78.0 ± 35.0	0.431
CRP, mean ± SD (mg/L)	84.9 ± 102.1	39.8 ± 87.3	0.141
Synovial WBC, mean ± SD (cells/uL)	44771 ± 69147	47666 ± 70018	0.810
Synovial PMN, mean ± SD (%)	83.9 ± 13.8	82.3 ± 21.2	0.700
Known disease			
Hypertension	78 (76.7%)	34 (70.8%)	0.410
Coronary heart disease	28 (27.7%)	16 (28.8%)	0.402
Diabetes mellitus	31 (30.3%)	16 (33.3%)	0.689
Stroke	10 (9.7%)	3 (10.4%)	0.893
Chronic kidney disease	18 (17.7%)	6 (12.7%)	0.436
Intraoperative organism			
Single positive culture	32 (30.9%)	23 (47.9%)	
Multiorganism positive culture	12 (11.7%)	11 (22.9%)	
Negative	59 (57.3%)	34 (29.7%)	
Fungal infection	3 (2.9%)	7 (14.6%)	0.04
Mycobacterial infection	1 (1%)	3 (10.4%)	0.008
Culture positive or nonpathogenic	3 (4.9%)	11 (22.9%)	0.001
Radiologic septic loosening	32 (37.7%)	20 (47.8%)	0.380
Sinus tract	11 (10.7%)	13 (34.8%)	0.002

Table 2. Intraoperative microbial culture results from first surgery

	Successful treatment group (n=103)	Early septic failure group (n=48)	p
No growth	39 (37.9%)	14 (29.2%)	0.297
Methicillin-resistant coagulase-negative *Staphylococcus* species	10 (9.7%)	3 (8.3%)	0.480
Methicillin-resistant *Staphylococcus aureus*	8 (7.8%)	6 (12.5%)	0.318
Methicillin-sensitive *Staphylococcal aureus*	12 (11.7%)	1 (2.8 4%)	0.023
***Enterococcus* species**	8 (8.7%)	1 (2.7%)	0.128
***Streptococcus* species**	7 (6.8%)	2 (4.2%)	0.525
Other *Staphylococcus* species	3 (1%)	0 (0%)	0.493
***Corynebacterium* species**	3 (1%)	1 (2.3%)	0.378
Pseudomonas	1 (1%)	0 (0%)	0.493
Mycobacterium species	1 (1%)	2 (4.2%)	0.198
Fungus	2 (1.9%)	3 (8.3%)	0.108
Polymicrobial organism	12 (11.7%)	11 (22.9%)	0.008

Table 3. Intraoperative microbial culture results at reimplantation

	Successful treatment group (n=103)		Early septic failure group (n=48)	
	Total number	Different species or persistent culture	Total number	Different species or persistent culture
No growth	98 (95.1%)		37 (77.1%)	
Methicillin-resistant coagulase-negative *Staphylococcus* species	2 (1.9%)	0	1 (2.1%)	1
Methicillin-resistant *Staphylococcus aureus*	0		2 (4.2%)	1
Enterococcus species	0		1 (2.1%)	0
Other *Staphylococcus* species	0		1 (2.1%)	0
Mycobacterium species	0		2 (4.2%)	0
Fungus	0		2 (4.2%)	0
Polymicrobial organism	3 (2.9%)	0	2 (4.2%)	2

Table 4. Multivariate logistic regression of independent risk factors of early septic failure after 2-stage exchange total knee arthroplasty to periprosthetic joint infection

Factor	Multivariate analysis	
	OR (95% CI)	p value
Age	0.912 (0.886–1.010)	0.134
Sex		
Female	1.00	
Male	2.753 (1.099–6.893)	0.031
BMI	1.028 (0.957–1.120)	0.401
Intraoperative culture result after first surgery		
NO growth	1.00	
Single culture positive	1.386 (0.166–1.400)	0.401
Polymicroorganism	1.237 (0.388–4.102)	0.732
Fungus or mycobacterial infection	5.224 (1.481–18.433)	0.010
Reimplantation culture positive	4.407 (1.216–15.480)	0.021
Radiologic septic loosening	0.828 (0.280–1.304)	0.240