

# ROTATION FLAPS FOR COVERAGE AFTER TOTAL KNEE ARTHROPLASTY

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## ABSTRACT

**Objective:** To evaluate the results obtained using local myocutaneous rotation flaps in cases of wound dehiscence after total knee arthroplasty. **Methods:** Patients undergoing these surgical procedures were selected in the 2000-2012 period. The nine selected cases during this period were subjected to flap coverage due to skin dehiscence associated with infection. In eight cases we used rotation flaps of the medial gastrocnemius, and in one case we used advancing skin. **Results:** Eighty nine percent of the cases were successful in the coverage of the prosthesis and the viability of the flaps. In four cases it

was possible to maintain or review the prosthesis. Four other cases progressed to amputation due to failure on treatment of infections, and one case remained without the prosthesis. The functional evaluation showed an unsatisfactory outcome in 89% of cases. **Conclusion:** Coverage flaps are a good option for the treatment of cases of dehiscence with exposure of the prosthesis and the functional failure was associated with the inability to control the infection and the damage it caused.

**Level of Evidence IV, Case Series.**

**Keywords:** Arthroplasty. Infection. Surgical flaps. Knee.

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## INTRODUCTION

Total knee arthroplasty (TKA) is a well-established surgery, successfully used for many years for the treatment of knee osteoarthritis or osteoarthritis. It presents a high level of clinic satisfaction and durability higher than 90% in 15 years.<sup>1-4</sup>

Reflecting the significant increase in the number of arthroplasties, the number of revisions and complications also increased, among which we can mention the wound dehiscence, associated or not to infecção.<sup>4-8</sup>

Problems with wound healing after total knee arthroplasty reach 20% of cases in some series;<sup>9,10</sup> however, wound dehiscence with total exposure of the prosthesis without the possibility of primary closure or secondary healing is very rare, and there are few publications that describe its treatment.<sup>5,7,11-15</sup>

Among the treatment options for these cases, the local myocutaneous rotation flaps stand out because they are anatomically available around the knee, show little morbidity and are technically viable.<sup>1,5-7,11,13-16</sup> In a literature review, we found variable results. Some series show good results, healing the infection with satisfactory cutaneous coverage of the knee; others show bad results with loss of retail, stiffness and pain in the knee and persistence of infection, which can lead to treatment failure and indication for amputation.<sup>11,12,14,16-18</sup>

The aim of this study was to evaluate the results obtained with the use of myocutaneous local rotation flaps in cases of wound dehiscence after total knee replacement surgery at the Instituto de Ortopedia e Traumatologia, Hospital das Clínicas, Faculdade de Medicina, Universidade de São Paulo (IOT/HCFM-USP).

## MATERIALS AND METHODS

We performed a survey on the medical records at the IOT-HCFM-USP registry sector in search of patients who underwent surgical rotation flaps complication after TKA in the last eleven years (2000-2012). We collected retrospective data from medical records of these patients. Patients were recalled for updated clinical assessment and informed about the study. They received the Statement of Informed Consent (SIC) for participation. Patients who met the following criteria were included: any age and gender, patients who underwent TKA and developed wound dehiscence; any etiology for primary arthroplasty; any cause for wound dehiscence; patients undergoing myocutaneous local rotation flaps for dehiscence or microsurgical flap coverage. Exclusion criteria were: insufficient information about the type of retail; lack of data in the medical record that preclude completion of the desired of the later information, not completing the SIC or lack of understanding by the patient.

All the authors declare that there is no potential conflict of interest referring to this article.

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The information collected from the patients were: clinical and functional evaluation using rating scales Knee Society Score (KSS),<sup>19</sup> Medical Outcomes Study Questionnaire 36 - Item Short - Form Health Survey (SF-36),<sup>20,21</sup> assessment of final range of motion of the knee and preservation of the prosthesis and limb. The information collected from medical records included gender and age at surgery, diagnosis and KTA indication, postoperative complications, number of surgeries before and after the flap, type of flap used, complications resulting from these procedures and if they were associated with infection and length of hospital stay.

Descriptive analysis was performed correlating gender, age at TKA, date and etiology of complications, date of flap rotation with evolution and current clinical status of the patient.

The Knee Society Score is based on the assessment of pain, stability, and range of motion of the knee. The score considered was that 12 months following completion of the flap. Scores greater than or equal to 90 points were considered excellent, 80-89 points, good; 70-79 points, regular, and less than 70 points, poor. Scores greater than or equal to 80 points were considered as functional success in treatment. Scores less than 80 points were considered functional unsuccessful.<sup>6</sup>

We also considered a successful treatment the preservation of the prosthesis and limb.

## RESULTS

Nine cases were identified from 2000 to 2012, seven females and two males, aged between 56 and 82 years, mean 70 years. Among the indications for TKA, rheumatoid arthritis accounted for six cases (~ 66%), two cases secondary osteonecrosis (~ 22%), and a case of revision TKA (~ 11%). (Table 1)

A postoperative infection was associated with 100% of cases of dehiscence, seven acute infections (~ 77%) and two chronic infections (~ 23%). The treatment of these infections were performed as previously standardized procedures, such as culture collection, surgical cleaning, debridement, polyethylene exchange, exchange of prosthesis by cement spacer and antibiotic therapy.<sup>22</sup> In 100% of cases with positive culture, bacteria were multi-resistant in antibiogram analysis. (Table 2)

**Table 1.** Epidemiological data.

Patient	Gender	Age	Comorbidities	Indication TKA	Side
1	M	62	RA+DM	RA	R
2	F	82	nenhuma	Revision	L
3	F	56	DM+SAH+RA	RA	R
4	F	58	RA	RA	R
5	F	70	DM/SAH/HC	RA	R
6	F	78	SAH+Asma	ON	R
7	F	81	RA+SAH	RA	R
8	M	74	DM	ON	L
9	F	70	RA	RA	R

TKA: Total Arthroplasty of the knee; RA: Reumatoid Arthritis; DM-Diabetes Mellitus; SAH-Hipertension; HC-Hepatitis C; ON- Osteonecrosis

The flap coverage as salvation procedure was performed in these nine cases, and in eight (~ 89%) rotation of the medial gastrocnemius flap (MG) was the option treatment and in one (~ 11%) the option was flap skin side advancement.

The number of surgical procedures (cleaning and debridement) performed before the making of the flap ranged from one to nine (average 3.44) and after the flap there was also the same variation from one to nine procedures (mean 3.67), in which three cases required one or less, and six cases required at least four other procedures after the flap. In only one case there was loss of the flap, in which case the patient presented severe peripheral vascular insufficiency; on all the others (~ 89%), the flap showed to be viable and effective in coverage.

As a final result we found four patients who progressed with the need for amputation of the lower limb at transfemoral level due to failure on the infection treatment and consequent risk to the patient's general condition. In four patients we observed healing of the infection and the prosthesis revision was performed. And in one case we observed the resolution of the infection, but due to the patient's option, the revision procedure was not performed and the patient did not retain the prosthesis.

The four patients who retained prostheses were submitted to

**Table 2.** Data on infection treatment

Patient	Etiology	Time	Before	Surgery/flap	After	Hospitalization time	Culture	Culture
1	Infection	Acute	7	MG	4	54 days	<i>S.aureus</i>	<i>F.vairium</i>
2	Infection	Chronic	2	MG	7	89 days	<i>S.aureus</i>	<i>P.mirabilis</i>
3	Infection	Acute	1	MG	9	105 days	<i>A.baumani</i>	<i>A.baumani</i>
4	Infection	Acute	3	MG	0	49 days	<i>E.cloacal</i>	<i>A.baumani</i>
5	Infection	Acute	3	Advance	6	74 days	<i>S.aureus</i>	<i>Corinebacterium sp</i>
6	Infection	Acute	4	MG	0	39 days	<i>E.cloacal</i>	<i>E.cloacal</i>
7	Infection	Acute	1	MG	1	72 days	<i>A.baumani</i>	<i>A.baumani</i>
8	Infection	Acute	9	MG	5	8 months	<i>S.aureus</i>	<i>E.aerogenes</i>
9	Infection	Chronic	1	MG	1	78 days	Negativo	Negativo

MG: Medial Gastrocnemius; Poli: Polymicrobial; R: resistant.

the KSS assessment and showed variation in their results. Patient number 5 had a score of 52, patient number 6 had a score of 51, both considered bad results by the scale; patient number 7 had a score 80, considered a good result, and patient number 9 had a score 78, considered a fair result. Patient number 8, despite maintaining active ADM was not subjected to evaluation by KSS because it was not submitted to a review procedure and remains without the prosthesis.

The ADM on the evaluations ranged from 0 to 100 degrees in patient number 5; from 10 to 80 degrees in patient number 6; from 0 to 50 degrees in patient number 7; from 5 to 85 degrees in patient number 8; and from 5 to 55 degrees in patient number 9. (Table 3)

In the assessment of quality of life using the SF36 scale, we observed worse results regarding physical aspects in patients who underwent limb amputation than in non-amputees, and better results regarding pain and emotional aspects. Patients number 4 and 9 died and had no SF-36 in their medical records. (Table 4)

**Table 3.** Results

Patient	Flap	Result	KSS scale	ADM (degrees)	Follow up (months)
1	MG	Amputation	0	–	5
2	MG	Amputation	0	–	20
3	MG	Amputation	0	–	6
4	MG	Amputation	0	–	60
5	Advance	Revision	52	100	28
6	MG	Revision	51	70	24
7	MG	Maintained	80	50	8
8	MG	No TKA	0	80	36
9	MG	Revision	78	50	40

MG: Medial Gastrocnemius; TKA: Total knee arthroplasty

**Table 4.** Results SF – 36

Patient	Capacity	Physical Limitation	Pain	General health status	Vitality	Social Limitation	Emotional Limitation	Mental Health
1	0	0	100	95	80	87,5	100	100
2	5	0	74	32	55	50	0	84
3	0	0	61	35	60	25	0	68
4*								
5	0	100	84	50	80	37,5	100	64
6	10	0	62	60	95	50	100	88
7	5	0	31	85	85	37,5	100	100
8	30	50	20	50	45	50	100	44
9*								

(\*) deceased patients.

## DISCUSSION

The flap cover is considered a good option for cases of skin loss and prosthesis exposure.<sup>6,11,14,16,17,23</sup> Nahabedian et al.<sup>24</sup> with 29 cases and Casey et al.<sup>16</sup> with 41 cases overall, 18 of them being of post-TKA flaps cases are some of the largest series, but have quite heterogeneous groups in

which we found cases with and without infection, different types of flaps regarding the donor site and cases not associated with TKA.

In our study, the flaps remained viable in ~ 89% of cases with similar results to those found in the literature<sup>23-25</sup> that demonstrated high rates of success, as Markovich et al.<sup>6</sup> with a 100% rate; and Gerwin et al.<sup>12</sup> with a 92% rate, even though in these studies we also found heterogeneous groups as mentioned above.

The flaps do not appear to have influenced the evolution of the infectious process nor the functional outcome. Of nine cases, four evolved to prostheses preservation or underwent revision procedure (~ 44%); four required amputation (~ 44%); and one remained without the prosthesis, as a patient's option, despite healing of the infection (~ 12%). These results were different from others found in the literature as Nahabedian et al.<sup>24</sup> with 83% preservation of the prosthesis, Centruolo et al.<sup>25</sup> with 91% preservation of the prosthesis, and Markovich et al.<sup>6</sup> also with 83% preservation of prostheses. Possible explanations would be the delay to indicate the retail in some cases, which is reflected by the number of surgeries performed before the indication of retail, and in our series, all cases were associated with infection, in this particular point being different from cited examples, which presented heterogeneous groups.

We can analyze that patients who maintained the prosthesis (~ 44%) showed variable results according to the evaluation of the KSS being considered bad in two cases (50% of cases evaluated by KSS), fair in one case (25% of cases evaluated by KSS) and good in one case (25% of cases evaluated by KSS). Patients who required limb amputation (~ 44%) were considered as treatment failure. Divergently, Adam et al.<sup>11</sup> presented 50% of good functional results, 12% regular and 38% poor results, in a series of 25 cases, where 15 were associated with infection. Adam et al.<sup>11</sup> found that the best results were associated with cases without infection.

In our study 100% of patients presented multidrug-resistant infections and 55% had more than one comorbidity, which probably influenced the unsatisfactory functional results. Factors such as patient age, presence of comorbidities such as DM and AR and multi R bacteria are factors known as worse prognosis in the treatment of complications after TKA.<sup>1,5,9</sup>

The SF-36 evaluation can be analyzed in Tables 3 and 4, and therein we can see that despite amputation have poor acceptance by the public, some aspects of quality of life are better in amputees. And even with unsatisfactory functional results in most patients without amputations (by KSS score), physical limitations were lower.

The indication of flaps in TKA is rare, therefore we found series with few cases and heterogeneous groups, which makes it difficult to compare, and makes it difficult to make an objective recommendation of its use and evaluation of its results.

## CONCLUSION

The flap coverage shows to be an option of treatment in cases of dehiscence after TKA, with satisfactory results regarding its viability avoiding exposure of the prosthesis in approximately 89% of our cases and with good reproducibility. The poor functional outcome of patients was associated with inability to control infections.

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