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Optimizing Lower Extremity Amputation Outcomes: The Impact of Multidisciplinary Consultations on Revision Rates in Non-Traumatic Lower Extremity Amputations

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ABSTRACT

Purpose: This study aims to identify factors leading to revision after non-traumatic lower extremity amputations and assess the accuracy of initial amputation levels based on multidisciplinary consultations (MDC).

Methods: This retrospective study included diabetic foot patients undergoing below-knee amputations. Two groups were formed: the revision group (35 patients from transtibial to transfemoral amputation) and the control group (35 without revisions). Gender, etiology, amputation levels, time to revision, follow-up, vascular status, and multidisciplinary consultations were analyzed. The MDC team included specialists from orthopedics, cardiovascular surgery, plastic surgery, and infectious diseases. Each patient's adherence to MDC recommendations was evaluated.

Results: The average follow-up time was 4.84 years. All amputations in the revision group were transtibial. In control group, 20% were transfemoral, and 80% transtibial. MDC recommended transfemoral amputation (TFA) to 80% and transtibial amputation (TTA) to 20% in the revision group, and TFA to 20% and TTA to 80% in control group. Overall, 60% adhered to MDC guidelines, while 40% didn't. All patients who deviated from MDC recommendations underwent revision. Among those adhering to recommendations, 83.3% didn't require revision, while 16.7% did, indicating a significant reduction in revision need with MDC adherence ($p<0.0001$). Patients under 65 ($p=0.0001$), males ($p=0.028$), and those recommended transtibial amputations by MDC ($p=0.036$) had longer revision-free intervals.

Conclusion: Non-compliance with MDC recommendations was strongly linked to revisions, while adherence significantly reduced the need for them. These findings emphasize the importance of following MDC recommendations to aid patients and their families in making informed decisions about initial amputation levels.

Level of Evidence: Level 3 (a retrospective cohort study)

Keywords: Amputation, diabetic foot, surgical revision, amputation stump, multidisciplinary recommunication

ÖZET

Amaç: Bu çalışma, travma dışı alt ekstremite ampütasyonları sonrası revizyon gerektiren faktörleri belirlemeyi ve multidisipliner konsültasyonlar (MDK) temelinde ilk ampütasyon seviyelerinin doğruluğunu değerlendirmeyi amaçlamaktadır.

Gereç ve Yöntemler: Bu retrospektif çalışmada, diz altı ampütasyon geçiren diyabetik ayak hastaları incelenmiştir. İki grup oluşturulmuştur: diz altından diz üstü ampütasyona geçen 35 hastanın bulunduğu revizyon grubu ve revizyon gerektirmeyen 35 hastanın bulunduğu kontrol grubu. Cinsiyet, etiyoloji, amputasyon seviyeleri, revizyon süresi, takip süresi, vasküler durum ve MDK önerileri analiz edilmiştir. MDK ekibi, ortopedi, kalp ve damar cerrahisi, plastik cerrahi ve enfeksiyon hastalıkları uzmanlarından oluşmuştur. Her hastanın tedavisinde MDK seviye önerilerine uyum değerlendirilmiştir.

Bulgular: Ortalama takip süresi 4,84 yıl olarak belirlenmiştir. Revizyon grubundaki tüm ampütasyonlar diz altı seviyede yapılmıştır. Kontrol grubunda ise hastaların %20'si diz üstü, %80'i diz altı ampütasyon geçirmiştir. MDK, revizyon grubunda %80 oranında diz üstü amputasyon (TFA), %20 oranında diz altı ampütasyon (TTA) önermiştir. Kontrol grubunda ise TFA %20, TTA %80 oranında önerilmiştir. Genel olarak, hastaların %60'ında MDK rehberliğine uyulurken, %40'ında uyulmamıştır. MDK önerilerine uyulmayan tüm hastalar revizyon geçirmiştir. MDK önerilerine uyulan hastaların %83,3'ü revizyon geçirmemiş, %16,7'si revizyon geçirmiştir, bu da MDK önerilerine uyumunun revizyon ihtiyacını önemli ölçüde azalttığını göstermektedir ($p<0,0001$). 65 yaş altındaki hastalar ($p=0,0001$), erkek hastalar ($p=0.028$) ve MDK tarafından TTA önerilen hastalar ($p=0,036$) daha uzun revizyonsuz dönemlere sahip olmuştur.

Sonuç: MDK önerilerine uyumsuzluk, revizyonlarla güçlü bir şekilde ilişkilendirilmiş, uyum ise revizyon ihtiyacını önemli ölçüde azaltmıştır. Bu bulgular, hastaların ve ailelerinin önerilen ampütasyon seviyeleri hakkında bilinçli kararlar almasına yardımcı olmak için MDK önerilerine uyumun önemini vurgulamaktadır.

Kanıt Düzeyi: Düzey 3 (retrospektif kohort çalışma)

Anahtar Kelimeler: Ampütasyon, diyabetik ayak, cerrahi revizyon, ampütasyon güdüğü, multidisipliner iletişim

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The diabetic foot represents a profoundly debilitating complication in patients afflicted with diabetes. Its pathophysiological basis comprises a confluence of factors, including neuropathy, vascular insufficiency, mechanical deformities in foot architecture, hyperglycemia, and susceptibility to infection (1). Individuals presenting with an acute diabetic foot in the emergency department often manifest hyperglycemia, sepsis, acute renal failure, and cardiac decompensation (2,3). To prevent septic shock and its complications, consequently, the decision for acute amputation is warranted.

Amputation surgeries serve not only as limb salvage procedures but also pose psychological challenges and impose financial burdens on healthcare systems due to potential long-term and recurrent hospitalizations. Despite progress in industry, technology, and medicine, amputation remains a significant contributor to disability (4). Losing a limb is becoming more common worldwide (5,6), and those who experience it often face various health challenges and comorbidities. To ensure the best possible care, it's crucial to assemble a diverse team of experts who can collaborate to meet the patient's needs effectively (7). This multidisciplinary team should start working with the patient early on, ideally before the amputation and continue after the surgery, to provide guidance, education, and support throughout the process of recovery and beyond (8). Despite advancements, revisions following lower extremity amputations remain prevalent. Re-amputation following major lower limb amputation is a frequent and severe complication (9). Infections, wound detachment due to uncontrolled metabolic status or nutrition level of the patients etc. might be the reasons for the amputation revision. The revision surgery hampers functional rehabilitation, prolongs hospital stays, and is linked to notable morbidity and mortality rates (10).

In our study, we hypothesize that multidisciplinary consultations (MDC) conducted prior to amputation surgeries lead to a decrease in the requirement for revision surgeries. Our study seeks to identify spesific factors contributing to revision surgeries in non-traumatic lower extremity amputations and explore the relationship between these revisions and recommendations from multidisciplinary consultations. Thus, our objective is to assess the accuracy of the initial determination of the level of amputation.

Material and Methods

The study included patients from 2016 till 2021 in our clinic who underwent below knee amputations due to diabetic foot and consented to participate in the research. Patients who we cannot contact, who did not come to regular examinations, who refused to participate, those who had undergone any minor or major surgical operation, such as skin grafting, on the lower extremity other than amputation following a diabetic foot wound, and patients who had undergone amputation for reasons unrelated to diabetes like traumatic amputations were excluded from the study. Our focus remained solely on major amputations necessitated by diabetic foot complications. In this study, two groups were determined, one of which was the revision group, and the other was the control group. Patients were evaluated retrospectively. A total of 70 patients meeting the inclusion criteria were included in our study. The revision group consisted of 35 patients who firstly underwent transtibial amputation and as a revision surgery transfemoral amputation and the control group of 35 patients who underwent either transtibial or transfemoral amputation. The control group did not encounter any revision procedures and was determined randomized. We evaluated patients' gender, etiology, amputation levels, the time interval between the first operation and revision, follow-up time, vascular status via computerized tomography or doppler ultrasound, and multidisciplinary consultation recommendations. The relationship between surgeon's amputation level and those factors were evaluated meticulously. The determination of amputation levels was carried out through a multidisciplinary approach involving evaluations from the departments of orthopedics, cardiovascular surgery, plastic surgery, and infectious diseases. For the decision of amputation, the patients were consulted the plastic surgery whether they decide to perform minor amputation. If they reject minor amputation decision, cardiovascular surgery was consulted for determining the level of amputation by analyzing the imaging modalities to determine the efficient vascular supply. As multidisciplinary consultations for major amputations, doctors for infectious diseases and internal medicine were included preoperatively for the proper antibiotic treatment and blood glucose regulation. We as orthopedists perform the amputation procedure. Physical therapy and rehabilitation doctors were consulted postoperatively for timely rehabilitation. Preoperative antibiotic prophylaxis was administered with 2 grams of cefazolin sodium before general anesthesia and maximum 1 hour before the surgery. 5 patients had cefazolin allergy, therefore 600mg clindamycin was used instead of it. Tourniquets were not used during surgery for all patients and surgical procedures commenced at the predetermined level of amputation, without deviation during the operation for all the patients. After the bone cut and removal of the amputate the myodesis procedure was implemented as part of the surgical protocol. Closure techniques varied depending on the level

of amputation. The fish-mouth technique was utilized for transfemoral amputations, while the posterior flap method was employed for transtibial cases. Skin closure was achieved using staples. Hemovac drainage was employed intraoperatively and subsequently removed either after 24 hours or once drainage decreased to less than 50 cc/day. Postoperative infectious disease consultations guided antibiotic therapy for each patient. Following surgery, hospitalized patients received continuous monitoring, while those discharged underwent weekly outpatient follow-ups for wound assessment during the initial three weeks postoperatively. Stitch removal was scheduled for the third week. General controls were conducted at the 6th,12th weeks, and 6th, and 12th months postoperatively. Within the scope of the study, the number of samples was calculated with power analysis. As a result of the power analysis performed with G*Power (Version 3.1.9.6), the reliability was 95%, the effect level was 0.70 and the power value was 0.80. In this context, the minimum number of samples was calculated as 68. Accordingly, the study can be conducted by taking at least 34 samples from each group. In this study, IBM SPSS Statistics 24.0 software was used for analysis and statistical evaluation of the data. The following methods and tests were applied during statistical analysis: Descriptive Statistics: Frequency, percentage, mean (X), standard deviation (SD), minimum, maximum and median (M) values were calculated to present the demographic and clinical characteristics of the participants. The distributions of these variables are given through tables. Cross Tables and Chi-Square Test: Cross tables were created to examine the relationship between two categorical variables and the chi-square test was applied to determine whether the relationships were significant. Particularly in terms of amputation level, patient group and MDC level recommendation variables, the relationships with factors such as gender, age group and follow-up year were examined. Mann-Whitney U Test and Kruskal-Wallis Test: To compare the median differences between groups, the non-parametric Mann-Whitney U test (for two groups) and the Kruskal-Wallis test (for more than one group) were used to evaluate the differences between categorical variables and duration variables. With these tests, the time to revision and follow-up times were compared in terms of factors such as age group, gender, amputation level and group. Significance Level: In all analyses, $p < 0.05$ was accepted as the statistical significance level. With these analyses, it was evaluated whether there were differences between the groups according to the demographic and clinical characteristics of the participants in the study and statistical findings were presented.

Results

The demographic and clinical characteristics of the patients included in the study are comprehensively detailed in Table 1. The chi-square test yielded no statistical significance between the amputation level, revision/control group status, MDC recommendation and variables such as year, age group, and gender (detailed in Table 2). 100.0% (n = 35) of amputations in the revision group were transtibial. There is no amputation at the transfemoral level. Of the participants in the control group, 20.0% (n = 7) were at the transfemoral level and 80.0% (n = 28) were at the transtibial level. MDC recommended TFA to 80.0% (n = 28) and TTA to 20.0% (n = 7) of participants in the revision group. MDC recommended TFA to 20.0% (n = 7) and TTA to 80.0% (n = 28) of participants in the control group (Table 2).

Table 1: The demographic and clinical characteristics of the patients included in the study.

		n	%	MIN	MAX	X	SD
Year	2016	6	8.6				
	2017	16	22.9				
	2018	24	34.3				
	2019	14	20.0				
	2020	5	7.1				
	2021	5	7.1				
Age				40	96	64.84	13.12
Age groups	<65	36	51.4				
	>65	34	48.6				
Gender	Male	44	62.9				
	Female	26	37.1				
Level of amputation	TFA	7	10.0				
	TTA	63	90.0				
Group	Revision	35	50.0				
	Control	35	50.0				
Etiology of amputation	Diabetes	70	100.0				
Time till revision in months				1	15	6.11	4.15
Follow-up time				2	7	4.84	1.30
MDC recommendation	TFA	35	50.0				
	TTA	35	50.0				

TFA= transfemoral, TTA= transtibial, MDC= multidisciplinary consultation, X= mean value, SD= standard deviation, MIN= minimum, MAX= maximum

Table 2: The relationships between the amputation level, the group (revision or control), the MDC recommendations (for amputation levels TFA or TTA) variables and year, age group, and gender.

		LEVEL OF AMPUTATION				p value of chi-square test	AMPUTATION GROUP				p value of chi-square test	MDC RECOMMENDATION				p value of chi-square test
		TFA		TTA			REVISION		CONTROL			TFA		TTA		
		n	%	n	%		n	%	n	%		n	%	n	%	
Year	2016	2	33.3	4	66.7	1.000	3	50.0	3	50.0	1.000	5	83.3	1	16.7	0.195
	2017	0	0.0	16	100.0		8	50.0	8	50.0		7	43.8	9	56.3	
	2018	3	12.5	21	87.5		12	50.0	12	50.0		13	54.2	11	45.8	
	2019	0	0.0	14	100.0		7	50.0	7	50.0		4	28.6	10	71.4	
	2020	1	20.0	4	80.0		3	60.0	2	40.0		4	80.0	1	20.0	
	2021	1	20.0	4	80.0		2	40.0	3	60.0		2	40.0	3	60.0	
Age groups	<65	3	8.3	33	91.7	0.467	19	52.8	17	47.2	0.632	17	47.2	19	52.8	0.632
	>65	4	11.8	30	88.2		16	47.1	18	52.9		18	52.9	16	47.1	
Gender	Male	4	9.1	40	90.9	0.521	21	47.7	23	52.3	0.621	19	43.2	25	56.8	0.138
	Female	3	11.5	23	88.5		14	53.8	12	46.2		16	61.5	10	38.5	

TFA= transfemoral, TTA= transtibial, MDC= multidisciplinary consultation

As a result of the Kruskal-Wallis test, no significant difference was found between years in terms of time to revision (p = 0.488). The Mann-Whitney test revealed a significant difference in time until revision between age groups (<65 vs. ≥65) (p = 0.0001), indicating that patients under 65 experienced longer periods (8.37 vs. 3.44 years) without revision. The average time until revision for male participants was 7.24 months (SD = 4.06, M = 8), whereas for female participants, it was 4.43 months (SD = 3.82, M = 3) on average. Additionally, a statistically significant difference was found between men and women in terms of time until revision (p = 0.028), with male participants showing longer durations without revision. Among patients who underwent TTA in the revision group, the average time to revision was calculated as 6.11 months (SD = 4.15, M = 5). The average time until revision was 5.39 months (SD = 4.15, M = 4) for patients recommended TFA by MDC, and 9.00 months (SD = 2.83, M = 9) for those recommended TTA. A significant difference was found between TFA and TTA recommendations in time until revision (p = 0.036), indicating longer periods without revision for TTA-recommended patients. The average follow-up period for participants under 65 was 4.86 years (SD = 1.13, M = 5), and for those aged 65 and over, it was 4.82 years (SD = 1.49, M = 5). No statistically significant difference in follow-up time between age groups was found (p = 0.875), suggesting similar follow-up durations. Moreover, there were no statistically significant differences in follow-up period among age groups, genders, types of amputations, groups, and MDC level recommendations (p > 0.05) (details and exact p values in Table 3), indicating similarity in follow-up duration across these factors.

Table 3: The results of Mann-Whitney and Kruskal-Wallis tests comparing the variables Year, age groups, gender, amputation level, group (revision or control), and MDC recommendation with time till revision in months, and follow-up time in years.

		TIME TILL REVISION IN MONTHS			p value	FOLLOW-UP TIME IN YEARS			p value
		X	SD	M		X	SD	M	
YEAR	2016	4.33	1.53	4	0.488	7.00	0.00	7	0.0001
	2017	4.50	4.69	2		6.00	0.00	6	
	2018	5.83	3.74	5		5.00	0.00	5	
	2019	8.14	4.22	9		4.00	0.00	4	
	2020	7.33	4.73	9		3.00	0.00	3	
	2021	8.00	7.07	8		2.00	0.00	2	
AGE GROUPS	<65	8.37	3.71	9	0.0001	4.86	1.13	5	0.875
	>65	3.44	2.90	3		4.82	1.49	5	
GENDER	Male	7.24	4.06	8	0.028	4.77	1.08	5	0.334
	Female	4.43	3.82	3		4.96	1.64	5	
AMPUTATION LEVEL	TFA	-	-	-	-	4.86	1.86	5	0.888
	TTA	6.11	4.15	5		4.84	1.25	5	
GROUP	Revision	6.11	4.15	5	-	4.86	1.29	5	0.976
	Control	-	-	-		4.83	1.34	5	
MDC RECOMMENDATION	TFA	5.39	4.15	4	0.036	4.97	1.38	5	0.376
	TTA	9.00	2.83	9		4.71	1.23	5	

TFA= transfemoral, TTA= transtibial, MDC= multidisciplinary consultation, X= mean , SD= standard deviation, M= median

In the revision group, 80% (n = 28) of patients who underwent TTA were recommended TFA by the MDC, while 20% (n = 7) received a TTA recommendation. This discrepancy indicates that the majority (80%) of the patients needing revision were initially operated on at a lower level than recommended. Of the total sample, 60.0% (n = 42) underwent surgery aligning with MDC guidelines, while 40.0% (n = 28) underwent procedures deviating from the recommended level. Notably, revision was required for 50.0% (n = 35) of participants, indicating a significant occurrence rate (Table 4). All patients (n = 28, 100%) not adhering to MDC recommendations underwent revision, highlighting a strong association between non-compliance with the MDC recommendation and revision necessity. Conversely, among those adhering to recommendations, 83.3% (n = 35) did not require revision, while only 16.7% (n = 7) required it, showcasing a significant decrease in revision need when adhering to the MDC recommendation. The obtained p-value (<0.0001) from the statistical test signifies an exceptionally high level of significance, emphasizing the relationship between compliance with the MDC recommendation and revision necessity (Table 5). These results advocate for strict adherence to MDC recommendations to reduce revision need and postoperative complications.

Table 4: The Distributions of Multidisciplinary Consultation Recommendations by Amputation Level in Revision and Control Groups.

		AMPUTATION LEVEL IN REVISION GROUP				AMPUTATION LEVEL IN CONTROL GROUP			
		TFA		TTA		TFA		TTA	
		n	%	n	%	n	%	n	%
MULTIDISCIPLINARY CONSULTATION RECOMMENDATION	TFA	0	0.0	28	80.0	7	100.0	0	0.0
	TTA	0	0.0	7	20.0	0	0.0	28	100.0

TFA= transfemoral, TTA= transtibial

Table 5: The relationship between adherence to MDC recommendations and whether a revision was performed, along with the statistical significance of this relationship.

		ADHERENCE TO MDC RECOMMENDATION				p value
		NO		YES		
		n	%	n	%	
REVISION PERFORMED	NO	0	0.0	35	83.3	<0.0001
	YES	28	100.0	7	16.7	

MDC= multidisciplinary consultation

Discussion

In this study, we examined whether multidisciplinary consultations conducted prior to amputation surgeries lead to a decrease in the requirement for revision surgeries. Non-compliance with MDC recommendations was strongly associated with revision necessity, while adherence significantly reduced the need for revision. Moreover, patients under the age of 65 and male patients remained without revision for longer periods of time. Besides, patients for whom MDC recommended a TTA remained without revision for longer than those for whom TFA was recommended. These results highlight the importance of following MDC recommendations to determine appropriate amputation levels and reduce postoperative complications.

In 2005, 1.6 million Americans lived with limb loss, largely due to dysvascular disease and diabetes. By 2050, this number is expected to double to 3.6 million. Reducing dysvascular disease rates by 10% could lower this estimate by 225,000. These findings stress the importance of addressing limb loss and its causes to curb the projected increase in affected individuals (6). Globally, approximately 131 million people have diabetes-related lower-extremity complications, leading to diabetic foot ulcers and lower extremity amputations (LEA) (11). Around 6.8 million amputations, comprising 61% to 69%, were LEAs. Diabetic patients face a significantly higher risk of LEAs—up to 39 times more than non-diabetic patients—and have a higher mortality rate within five years post-amputation, ranging from 40% to 79% according to the study by Tuglo in 2022 (11). Re-amputation, a frequent and severe complication following major lower limb amputation (9), significantly impedes functional recovery, often prolongs hospital stays, and is linked to substantial morbidity and mortality (10). Many authors emphasize notable re-amputation rates following transmetatarsal and transtibial amputations, with diabetes identified as a critical risk factor for unsuccessful healing specifically at the transmetatarsal level (9,12,13). A multidisciplinary team approach to patients with acute diabetic foot is essential and has been demonstrated to lower the amputation rate by Cahn et al. (1). A retrospective study by Huizing et al. (14) revealed that a dedicated multidisciplinary team for diabetic foot care significantly improved limb salvage and ulcer healing rates. In managing diabetic foot ulcerations, teams consistently addressed glycemic control, local wound management, vascular disease, and infection promptly

and cohesively to mitigate the occurrence of major amputations (15). Although a multidisciplinary team was intended to decrease the LEAs rate due to the diabetic foot, if LEA is still required, MDCs have to be conducted prior to surgery to exactly determine the level of the LEA. So, a multidisciplinary team approach is an obligation both prior to the surgery to prevent it (16) and for preparation and aftercare of the surgery. Keszler et al. stated continuous lifelong care to be essential to monitor for complications arising from comorbidities or the emergence of secondary disabling conditions, aiming to improve the overall quality of life (5). Lepaentalo et al. emphasized the importance of cardiovascular surgeons consultation, who possess expertise in various revascularization methods, prior to the amputation decision to enhance leg salvage rates in diabetic patients with foot lesions (17). Poehler et al. developed a multiple criteria decision analysis tool to understand patient preferences for amputation-level selection and compare them with healthcare providers' perceptions of these preferences (18). They suggested that shared decision making process shall be improved with patient priorities and provider perceptions of them to reach the optimal, and patient-centered amputation results (19). In the decision-making process regarding amputation for diabetic foot complications, families also play a significant role by providing emotional support and evaluating the financial implications. They participate in seeking multiple opinions and considering the impact on the family's well-being before patients ultimately decide to undergo amputation (20). In our study, the determination of amputation levels and pre- and postamputation care involved a multidisciplinary approach consistent with the literature, with input from orthopedics, cardiovascular surgery, plastic surgery, and infectious diseases departments. Patients were consulted by plastic surgery for minor amputation decisions; if rejected, cardiovascular surgery analyzed imaging modalities to determine the appropriate amputation level based on vascular supply. For major amputations, infectious diseases and internal medicine doctors were consulted preoperatively for antibiotic treatment and blood glucose regulation, while we performed the procedure. Postoperatively, physical therapy and rehabilitation doctors were involved for timely rehabilitation. Although we recommended patients' families the MDC results, 28 of them rejected the recommended level and gave informed consent for lower levels. All patients not following MDC recommendations underwent revision, while among those adhering, 35 (83.3%) did not require revision, highlighting the significant decrease in revision need with MDC recommendation adherence.

Conclusion

In conclusion, the present study examined the impact of multidisciplinary consultations on the necessity for revision surgeries following amputation procedures. Our findings underscore a robust association between non-compliance with multidisciplinary consultation (MDC) recommendations and the need for revisions, while adherence to MDC guidelines significantly reduces the likelihood of revisions. These results emphasize the critical importance of adhering to MDC recommendations in determining appropriate amputation levels and mitigating postoperative complications. Furthermore, our study suggests that younger patients and male patients generally experience longer durations without requiring revision surgeries after amputation procedures. Additionally, patients recommended transtibial amputations through multidisciplinary consultations tend to have extended revision-free periods compared to those recommended transfemoral amputations. These findings are expected to inform patients and their families regarding the importance of following MDC-recommended levels, facilitating informed consent for higher amputation levels as the initial surgery, thus potentially reducing financial burdens associated with revision rates. One notable limitation of our study is its retrospective design, which inherently restricts our ability to control for all potential confounding factors. Moreover, this retrospective study contributes to the literature by prompting future research into prospective studies in this domain. Notably, existing literature primarily focuses on multidisciplinary teams' roles in preventing amputations or providing post-amputation care, rather than specifically addressing amputation level determination. Future research should explore prospective cohort studies or randomized controlled trials to validate our findings, particularly focusing on the long-term benefits of adhering to MDC recommendations in diverse populations. Additionally, investigating the specific barriers to adherence, including patient and provider perspectives, could provide valuable insights for improving compliance rates and patient outcomes.

Declarations

Funding

NONE

Conflicts of Interest/Competing Interests

The authors declare that they have no conflicts of interest.

Ethics Approval

This study was approved by the ISTANBUL UNIVERSITY-CERRAHPAŞA RECTORATE Clinical Research Ethics Committee with the number E-83045809-604.01-1016540.

Availability of Data and Material

The data that support the findings of this study are available from the corresponding author, C.D.D. upon reasonable request.

Authors' Contributions

C.D.D. contributed to the conception and design of the study, data collection, data analysis, manuscript drafting and critical revision of the manuscript.

M.Y.A. contributed to the conception and design of the study, data collection, data analysis, manuscript drafting and critical revision of the manuscript.

All authors read and approved the final manuscript.

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