

Report

Skin problems in amputees: a descriptive study

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Abstract

Background Skin problems are common in amputee patients. These problems may restrict the normal use of a prosthetic limb. We aimed to determine the range, incidence, causes and patterns of dermatological problems seen in a population of amputees.

Materials and methods One hundred and forty two amputees, were enrolled to the study. Age, sex, age at the time of amputation, level of amputation, reason for amputation, and types of prosthesis were noted. Dermatological problems were recorded. Stumps were swabbed for bacteriological and mycological examination, and patch tests were performed in suspected patients.

Results Of these 142 patients, 139 (97.9%) were males and 3 (2.1%) were females. The reasons for amputation in the majority of the cases were wounds due to mine explosion ($n = 114$, 80.3%) and gunshot wounds ($n = 19$, 13.4%). The other reasons were arterial diseases, traffic accidents, congenital absence of the tibia, and vascular complication of diabetes. At least one skin problem was detected in 105 (73.9%) of 142 cases. Positive reactions to allergens have been detected in 28 (43%) of 65 cases with dermatitis. Bacterial infection was detected in 12 patients and fungal infection was detected in 4 patients.

Conclusion Our descriptive study shows that skin problems have a high prevalence, up to 73.9% in amputee patients. This high percentage indicates that dermatological problems are important in amputees. Early recognition and treatment of these problems can prevent the amputee's mental, social, and economic losses.

Introduction

Skin problems are common in patients who use a prosthesis for an amputated lower extremity.¹⁻³ Clinical symptoms may vary from simple abrasions to very serious clinical conditions. The most common problems are burning sensation, erythema, and desquamation. With chronicity, painful fissures, secondary eczematization, blisters and erosions, skin thickening, lichenification, callosities, and hyperkeratosis may also occur.²⁻⁵ Epidermoid cysts, circulatory disorders, bacterial or fungal infections, contact dermatitis, miliaria, neoplasms, squamous cell carcinoma, verrucous hyperplasia,²⁻⁵ symptomatic follicular keratoses,⁵ Kaposi-like acroangiokeratosis,⁶⁻⁸ and verrucous carcinoma⁹ have also been reported. These may cause mental, social, and economic distress for patients.¹⁻⁴

In Turkey, two types of prosthesis are most commonly used. The first is the soft socket prosthesis, or "classical" prosthesis, and the second is the silicone prosthesis, or "modern" prosthesis, which has become more widespread in recent times. The soft socket prosthesis produces a negative pressure, which allows a closer union with the amputation stump. In the silicone prosthesis, the silicone liner is the only material in contact with the skin, and silicone is considered to be hypoallergenic.

Over the last two decades, as a result of a nearly continuous stream of terrorism-related skirmishes and the frequent use of land mines by terrorist groups in Turkey, hundreds of young people have had limbs amputated after being wounded by mine explosions or gunshots. This has enabled a descriptive study and analysis of dermatologic problems in amputees to be performed. In the general population, the main cause of amputation is peripheral vascular diseases, especially those associated with diabetes mellitus.¹ By contrast, most of our amputees were young and otherwise healthy persons without any underlying systemic diseases. For this reason, the dermatologic findings in this study can be directly related to the amputation itself, or to amputation-related factors, such as prosthesis, wound repair, etc.

To date, there have been several studies dealing with dermatologic problems in amputees. These studies have been either retrospective studies or reviews of case reports.^{1,10-12} To our knowledge, this is the first descriptive clinical study on dermatologic findings in amputees.

Materials and Methods

One hundred and forty-two amputees were enrolled in the study. Some of these were amputees who were admitted to the

orthopedics and dermatology departments at Gulhane Military Medical Academy between September 2004 and April 2006 for any reason. To include as many amputees as possible, we also visited all amputees who were being rehabilitated at the Turkish Military Rehabilitation Center (Ankara, Turkey), where the vast majority of amputees in our region are registered. The age, sex, age at the time of amputation, level of amputation, reason for amputation, and type of prosthesis were noted, and dermatologic examinations were performed by experienced dermatologists. The diagnosis of skin problems, if any, was recorded. In cases of suspected infection, the amputation stumps were swabbed for bacteriologic and mycologic examinations. Patch tests were performed for all patients with persistent or recurrent dermatitis affecting the amputation stump.

Statistical analysis was performed using chi-squared test and Fisher's exact test, and $P < 0.05$ was considered to be statistically significant. SPSS for Windows 11.5 software was used for statistical analysis.

Results

Of the 142 patients who were enrolled in the study, 139 (97.9%) were males and three (2.1%) were females. The average age was 29.2 ± 9.7 years (range, 4–73 years). The average age at the time of amputation was 23.6 ± 6.8 years (range, 2–64 years). The time interval between amputation and the time at which the patients were enrolled in the study varied between 1 and 21 years; in most, it was 5–10 years.

Of our 142 patients, 76 (53.5%) were using a soft socket prosthesis and 66 (46.5%) were using a silicone prosthesis.

The reasons for amputation in the majority of patients were wounds as a result of mine explosions ($n = 114$, 80.3%) and gunshots ($n = 19$, 13.4%). The other reasons were arterial diseases ($n = 4$, 2.8%), traffic accidents ($n = 3$, 2.1%), congenital absence of the tibia ($n = 1$, 0.7%), and vascular

Table 1 Reasons for amputation

Reason	<i>n</i>	%
Mine explosion	114	80.3
Gunshot wound	19	13.4
Arterial disease	4	2.8
Traffic accident	3	2.1
Congenital absence of the tibia	1	0.7
Vascular complication of diabetes	1	0.7
Total	142	100

complications of diabetes ($n = 1$, 0.7%). The numbers and percentages of the reasons for amputation in our 142 patients are given in Table 1.

The most common level of amputation was transtibial ($n = 113$, 79.5%; 41 right, 71 left, and one bilateral below-knee amputation). The amputation levels in the other patients, in order of frequency, were transfemoral ($n = 13$, 9.2%; 10 right, two left, and one bilateral above-knee amputation), foot ($n = 4$, 2.8%; two right and two left foot amputations), and Chopart's (mediotarsal) ($n = 12$, 8.5%; 11 right and one left Chopart's amputation).

Dermatologic problems were statistically significantly more common in patients using soft socket prostheses (63/76, 82.9%) than in those using silicone prostheses (42/66, 63.6%) ($P = 0.012$). Thirteen (27.1%) amputees using soft socket prostheses and 24 (36.4%) amputees using silicone prostheses did not have any dermatologic problems. The dermatologic conditions detected in the study and the types of prosthesis are given in Table 2.

After clinical and laboratory investigations, at least one skin problem was detected in 105 (73.9%) of 142 amputees. Of the patients that had a dermatologic problem, 42 (40%)

Table 2 Dermatologic conditions in amputees and types of prosthesis

Dermatologic condition	Total patients Number (%)	Prosthesis type		<i>P</i>
		Soft socket Number (%)	Silicone Number (%)	
Irritant contact dermatitis	32 (30.4)	11 (10.5)	21 (19.9)	0.001
Allergic contact dermatitis	25 (23.9)	18 (17.2)	7 (6.7)	0.242
Infected irritant contact dermatitis	5 (4.8)	3 (2.9)	2 (1.9)	1
Infected allergic contact dermatitis	3 (2.9)	3 (2.9)	—	0.273
Bacterial infection	12 (11.5)	7 (6.7)	5 (4.8)	1
Callus	11 (10.4)	8 (7.5)	3 (2.9)	0.519
Fungal infection	4 (3.8)	4 (3.8)	—	0.148
Erosion	5 (4.8)	3 (2.9)	2 (1.9)	1
Verrucous hyperplasia	3 (2.9)	3 (2.9)	—	0.273
Epidermoid cyst	3 (2.9)	2 (1.9)	1 (0.9)	1
Keloid	1 (0.9)	1 (0.9)	—	1
Haematoma	1 (0.9)	—	1 (0.9)	0.400
Total	105 (100)	63 (60)	42 (40)	

were using silicone prostheses and 63 (60%) were using soft socket prostheses.

No dermatologic problems were noted in 37 (26.1%) patients. Of these, 24 were using silicone prostheses and 13 were using soft socket prostheses. When the patients without any dermatologic problems were classified according to the level of amputation, 33 were transtibial amputees (13 right below-knee, 20 left below-knee) and four were right Chopart's amputees.

More than one dermatologic problem was detected in 13 (12.4%) patients. Of these, five had infected irritant contact dermatitis (CD), three had infected allergic CD, two had callus and irritant CD, one had callus and epidermoid cyst, one had allergic CD and epidermoid cyst, and one had verrucous hyperplasia (Fig. 1) and bacterial infection.

CD of the amputation stump was noted in 65 patients (Fig. 2). Of these, 37 had irritant CD (32 irritant CD and five



Figure 1 Verrucous hyperplasia on the amputation stump area



Figure 2 Contact dermatitis in an area in which the prosthesis contacts the skin

Table 3 Patch test results

Allergen	Soft socket	Silicone	Patient number
Paraphenylenediamine (PPD) 1%	4	1	5
Formaldehyde 1%	3	1	4
Epoxy-resin 1%	2	—	2
Mercapto-mix 2%	3	2	5
Para-tert-Butylphenol	6	2	8
formaldehyde resin 1%			
Fragrance mix 8%	3	1	4
Total	21	7	28

infected irritant CD) and 28 had allergic CD (25 allergic CD and three infected allergic CD).

A patch test was performed in all 65 patients with CD. The European Standard Patch Test series was used as allergen. According to the patch test results, positive reactions to allergens, varying from (+) to (+++), were detected in 28 (43%) patients. Of these, 21 were using soft socket prostheses and seven were using silicone prostheses. According to these results, patch test positivity was significantly higher in those using soft socket prostheses ($P < 0.01$). In 37 (57%) amputees, patch tests yielded negative results. The results of the patch tests are given in Table 3.

Microbiologic examination was performed in 22 amputees. Bacterial infection was detected in 12 patients. The organisms detected were Group A β -hemolytic *Streptococcus* in five, *Staphylococcus aureus* in two, *Staphylococcus epidermidis* in two, and both *Staphylococcus aureus* and Group A β -hemolytic *Streptococcus* in two.

In mycologic examination using native preparations with 20% KOH, fungal organisms were detected in four amputees.

Discussion

In a retrospective study, Dudek *et al.*¹ reported that the main reasons for amputation were peripheral vascular disease and/or diabetes ($n = 417$, 50.4%) and trauma ($n = 272$, 32.9%). In our study, the main reasons for amputation were mine explosions ($n = 114$, 80.3%) and gunshot wounds ($n = 19$, 13.4%). These were mostly terrorism-related injuries. These patients were mostly young and otherwise healthy, and did not suffer from either vascular or systemic diseases.

Dudek *et al.*¹ found the incidence of skin problems in amputees to be 40.7%. Lyon *et al.*¹⁰ and DesGroseilliers *et al.*¹³ found an incidence rate of 34%. In the 142 patients included in our study, at least one skin problem was detected in the residual limb of 105 (73.9%) amputees. Our result seems to be higher than that found in previous studies. The reason for the higher rate of dermatologic problems in our study may be partly the study design. Our study was a descriptive

investigation in which all amputees were examined to detect whether there was any dermatologic problem, and even minor skin problems were recorded. Moreover, most of the amputees in our study were young persons who lived active lives despite their amputation.

The skin disorders detected in the study of 210 amputees by Lyon *et al.*¹⁰ were dermatitis ($n = 25$), eruption ($n = 11$), epidermoid cyst ($n = 8$), follicular hyperkeratosis ($n = 6$), verrucous hyperplasia ($n = 3$), callus ($n = 1$), ulcer ($n = 3$), bacterial infection ($n = 3$), tinea infection ($n = 2$), pre-existing eruption ($n = 3$), and transient erythema ($n = 5$) (total of 71 patients). Of these 71 patients with a skin problem, 12 had relevant patch test reactions.¹⁰ In our study, patch test results were positive in 28 of 65 patients who were tested. This represents a higher percentage of positivity. The reason for this may be that we only tested patients with CD.

In another study by Dudek *et al.*,¹¹ the most common dermatologic problem was ulcer ($n = 141$, 26.7%), followed by irritation ($n = 93$, 17%), inclusion cyst ($n = 79$, 15.0%), callus ($n = 60$, 11.4%), verrucous hyperplasia ($n = 47$, 8.9%), blister ($n = 35$, 6.6%), fungal infection ($n = 26$, 4.9%), cellulitis ($n = 11$, 2.1%), and others ($n = 36$, 6.8%). In our study, CD was the most common dermatologic problem, followed by bacterial infection and callus. Other less frequent problems were erosion, fungal infection, verrucous hyperplasia, and epidermoid cyst. It is probable that CD was more frequent in our study because our patients were younger and more active. By contrast, ulcers were rare because most of our amputees did not have any vascular or systemic diseases. They were also veterans who benefited from lifelong health insurance, and good management and rehabilitation.

In addition to the studies discussed above, a number of case reports have described dermatologic problems in amputees. In a recent paper, Meulenbent *et al.*¹² reviewed 56 reports comprising 76 cases in the literature. They identified the main disorders in these reports to be, in alphabetical order, acroangiokeratosis, allergic CD, bullous diseases, epidermal hyperplasia, hyperhidrosis, infections, malignancies, and ulcerations.

The level of amputation was found to be a factor affecting the dermatologic problems in amputees. All of the 13 transfemoral amputees had at least one dermatologic problem. Thirty-three transtibial and four Chopart's amputees did not have any dermatologic problems. This shows that dermatologic problems are more common in patients with a higher amputation level. The reasons behind this finding may be the greater loss of anatomic structures and wider amputation stump surface in higher level amputations.

In our study, dermatologic problems were more common in patients using soft socket prostheses than in those using silicone prostheses. Although silicone prostheses seem to be better, serious problems were uncommon with both types of prosthesis, and both were well tolerated.

Conclusion

Amputation is just the beginning and not the end of treatment. Our study shows that, in amputees, skin problems have a high prevalence, up to 73.9%. This indicates that dermatologists can contribute greatly to medical teams supporting amputees throughout their lives. The orthopedic surgeon, prosthetist, dermatologist, and other medical personnel dealing with amputees should be aware of the skin problems that can be seen in amputees, and work together. Early recognition and treatment of these conditions can prevent much mental anguish and avoid a loss of social and economic activity.

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