AMPUTATION RISK FOR DERMATOLOGICAL CONDITIONS AND DIABETES MELLITUS COMPLICATIONS

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Summary

Diabetes mellitus represents a predisposing factor for dermatological conditions, 25% of the patients developing foot ulcer pathology with possible further complications. The foot ulcer is a pathological entity which puts the patient at risk for amputation and death, being an intense favorable condition for peripheral artery disease (PAD), neuropathies and local infections.

***Aim**. Assessment of amputation risk in dermatological conditions compared to diabetes mellitus and DALY (Disability Adjusted Life Years) analysis.*

***Material and method.** The electronic data from 2018 of the dermatology and diabetes departments patients were analyzed, comprising a total of 1,770 admissions, to determine the diagnosis and to asses the risk of amputation.*

***Results.** A number of 681 dermatological patients and 1,089 diabetes mellitus patients were included in this study. Death rates were 0.44% (n=3) for dermatological patients and 3.3% (n=36) for diabetic patients. A number of 123 amputations were performed in the diabetes department (11.29%) compared to only 2 amputations (0.29%) in the dermatology department. Odds ratio OR for amputation is 44.0223 times higher for diabetics compared to non-diabetics (95% CI 10.8512- 178.5942; P < 0.0001). Total DALY reached 669 years, 355 Years of Life Lost YLL due to premature mortality, and 314 Years Lost due to Disability YLD.*

***Conclusion.** The dermatological conditions associated with diabetes mellitus present a high morbidity rate through infectious complications and amputations, both of them being medical conditions leading to notable death rates.*

***Keywords:** dermatological conditions, diabetes mellitus, amputations, relative risk*

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Introduction

Diabetes mellitus prevalence has reached a value that in some countries exceeds four times the neoplastic disease [1]. Diabetic foot is a frequent complication of diabetes, having multifactorial pathogenesis, peripheral neuropathy being the primary causative factor along with peripheral vascular disease, repetitive trauma and culminating in foot infections [2]. Foot infections are the main reason why hospitalization of these patients is prolonged and represent more than 90% of cases with non-traumatic limb amputations [3].

Periodic evaluation of the diabetic patient for maintaining the therapeutic level of glycemia and extremities vitality are a family doctor, diabetologist and dermatologist attributions. A medical interdisciplinary team can support the diabetic patient at a normal standard of quality of life without the threat of mutilation by limb amputation.

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Material and method

The analysis design follows the stages of an epidemiological study based on the year 2018 electronic data of the hospital, using rates, percentages, disease odds ratio OR, relative risk RR and Disability Adjusted Life Years DALY, along with Years of Life Lost YLL due to premature mortality, Years Lost due to Disability YLD.

Dermatological disorders in diabetic and non-diabetic patients and their upper and lower extremities complications were analyzed, according to diagnostic classification standards ICD-10-AM, 2010, including ROviDRG for medical procedures as amputation, excluding all related code-disease to peripheral vascular disease (PAD), atherosclerosis of the arteries of the extremities, embolism or thrombosis of lower extremity arteries.

Data were: demographic data as age, gender, occupation, education level, residence rural/urban, patient evolution, duration of hospitalization. The amputation risk was calculated for extremities ulcer/gangrene, in both patients categories, with DALY. Statistical collection, organization, analysis, interpretation, and presentation of data were performed with *IBM SPSS Statistic 20, MedCalc version 14.8.1.*

Results

Results may represent morbidity and mortality profile, along with amputation determinants in 2018, in Arad County, for dermatology and diabetes inpatients. Data were explored for normal distribution according to the Kolmogorov-Smirnov test ($p < 0.002$).

The average age was 63 in diabetes and metabolic disorders department (n = 681 inpatients) versus 58 in dermatology department (n= 1089 inpatients). Death rates were 3,3% (n=36) for diabetic patients and 0.44% (n = 3) for non-diabetic patients. Amputations (n = 125) were performed to 11.29% (n = 123) of diabetic patients compared to 0.29% (n = 2) of dermatologic patients.

Patients characteristics in table 1. The incidence of DALY was calculated to 473,946 persons.

The average age for dermatologic patients was under 60, there are living in comparable proportion both in urban or rural residence and are equilibrated in term of gender ratio. Three deaths occurred in 79-86 age category patients, in the presence of multiple comorbidities and with multiple inferior limb cellulitis and skin abscesses.

The average age for diabetes and nutrition diseases patients was over 60 years, gender ratio

Table 1. Patients Characteristics

Patients	**Dermatology**	**Diabetes and nutrition disease**	**Age category (years)**	**Dermatology**	**Diabetes and nutrition disease**
Number	681	1, 089	Under 14	42	4
F	344	623	15-19	14	5
M	337	460	20-24	10	5
Average Age	58	63.48	25-34	19	8
Average Age F	59.3	64.54	35-44	33	41
Average Age M	56.06	62.03	45-54	93	143
Urban	302	553	55-64	197	337
Rural	379	536	65-74	149	366
Deaths F	2	18	75-84	107	155
Deaths M	1	18	85 +	17	25
Amputation F	0	37	Total	681	1, 089
Amputation M	2	86	**Admission incidence**	1.66‰	2.66‰

F: M being 1.35:1. Mortality was registered in patients with different ages, extreme values being 48-89 years.

Age category distribution for dermatologic patients shows a rate of 3.83:1 for those under 34 years old, young patients being almost four times more compared to diabetic and nutrition diseases patients; above 35 years old this rate is overturned to 1.7:1 for diabetes and nutrition diseases patients, image 1 and 2.

There is no statistically significant difference between these two categories of inpatients in terms of education level. In both situations, 82% of them have a level of education that does not exceed 10th grade. The only difference is in the category of patients with higher education, which represents 1.49% of the total number of assisted persons in diabetes and nutrition department, compared with 3.52% for those assisted in dermatology.

Average for the duration of hospitalization was 8.23 days in diabetes and nutrition diseases and 7.28 days in dermatology, 7.91 for all 1,770 patients.

Admission diagnosis in dermatology were dominated by ulcers and inflammation of varicose vein of lower extremities (n = 266; 39%), skin ulcers at the level of lower limb (n = 82; 12.4%) and skin abscess, boil and boil anthracoid of torso and extremities (n = 75; 11.01%), a longer duration of hospitalization over 15 days being necessary in 18 cases (2.64%).

Admission diagnosis in diabetes and nutrition diseases department were: type 2 diabetes mellitus with complications (n=770; 70.70%) and diabetic peripheral angiopathy with gangrene (171; 15.7%) with the longest duration of hospitalization, over 14 days in 43 cases and 25 cases, respectively.

Current medical procedures on dermatological patients (n = 556) represented 81.64% of the total. Wound debridement, incisions, and drainage of skin abscesses represented 18.306% (n = 121).

Current medical procedures on diabetic and nutrition diseases patients (n = 921) represented 84.57% of the total; a number of 168 patients (15.42%) were treated both for primary diagnosis and for dermatologic complications, which reached more than those in dermatology department, (n = 125), table 2.

Lower-extremity amputations were the majority of amputations (n = 121; 96.8%), most of them due to type 2 diabetes with peripheral angiopathy with gangrene (n = 113; 93.38% of the total lower-extremity amputations), a condition which led also to 4 upper-extremity amputations, table 3.

Odds ratio OR for amputation is 44.0223 times higher for diabetic patients compared to others (95% CI 10.8512 - 178.5942; z statistic 5.297; $P < 0.0001$).

Relative Risk RR for amputation depending on gender in diabetic patients is 3.1479 times

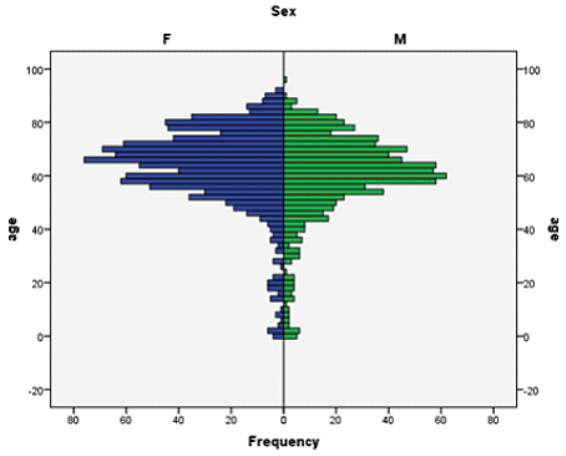

Image 1. Population Pyramid for 1,770 Inpatients in 2018

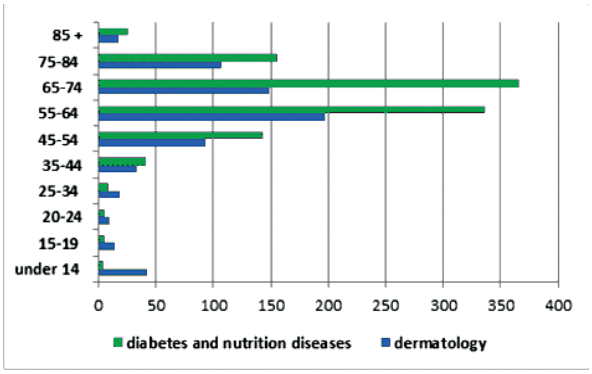

Image 2. Age Category Patients Distribution

Table 2. Medical procedures, a comparison between departments

Procedures	**Diabetes and nutrition diseases**	**Dermatology**
Current	921	556
Amputation	123	2
Soft tissues debridements	39	98
Incision and drainage of abscesses of the skin and subcutaneous tissue	5	23
Excision of skin lesions and subcutaneous tissue of the foot	1	2
Total	1,089	681

Table 3. Distribution of amputations by diagnosis and level

Diagnosis	**Lower-extremity amputation**	**Upper-extremity amputation**
Cellulitis of lower limb	1	
Type 1 diabetes with diabetic peripheral angiopathy with gangrene	1	
Type 2 diabetes with other specified complications	1	
Type 2 diabetes with diabetic peripheral angiopathy with gangrene	113	4
Type 2 diabetes with diabetic peripheral angiopathy without gangrene	4	
Chronic skin ulcer, NOS	1	
Total	121	4

Table 4. OR and RR for amputation, soft tissues debridements, incision and drainage of abscesses of the skin and subcutaneous tissue in diabetic patients compared to others

OR for amputation in diabetes versus others	**44.0223**	**RR for amputation in diabetes M versus F**	**3.1479**
95% CI z statistic	10,8512 to 178,5942 5,297	95% CI z statistic	2.183 to 4.5393 6.141
Significance level	P < 0,0001	Significance level	P < 0.0001
OR soft tissues debridements dermatology versus diabetes	**4,5257**	**OR incision and drainage of abscesses of the skin and subcutaneous tissue ermatology versus diabetes**	**7.5781**
95% CI	3.0806 to 6.6486	95% CI	2.8671 to 20.0301
z statistic Significance level	7.693 P < 0.0001	z statistic Significance level	4.084 P < 0.0001

Table 5. Annual deaths in the two departments

Death	**Diabetes and nutrition**
Type 1 diabetes with diabetic peripheral angiopathy with gangrene	1
Type 2 diabetes mellitus with ketoacidosis with coma	1
Type 2 diabetes with specified complications	19
Type 2 diabetes with diabetic peripheral angiopathy with gangrene	11
Type 2 diabetes with unspecified complications	3
Type 2 diabetes mellitus with diabetic polyneuropathy	1
Total	**36**
Deaths in dermatology	
Cellulitis of lower limb	2
Skin abscess, furuncle, and carbuncle of limb	1
Total	**3**

Table 6. DALY, YLL, and YLD in 2018, in Arad, due to dermatological lesions, amputations, and deaths

Gender	Deaths	Deaths to 1000	Average Age at death	Standard LE	YLL	YLL to 1000
Male	19	0.08	68.9	71.6	160	0.7
Female	20	0	71.6	79.1	195	0.8
Agw category male		**Deaths**	**Deaths to 1000**	**Average Age at death**	**YLL**	**YLL to 1000**
45-59		4	0.1	55.1	55	1.1
60-69		5	0.2	64.7	49	1.9
70-79		8	0.6	75.0	48	3.8
80+		2	0.3	82.4	8	1.4
Total		19	0.1	68.9	160	0.7
Age category female						
45-59		4	0.1	53.9	68	1.3
60-69	4	0.1	63.9	51	1.6	
70-79	7	0.4	74.0	58	3.0	
80+	5	0.4	88.5	18	1.6	
Total	20	0.1	71.6	195	0.8	
Male	**Incidence**	**Incidence to 1000**	**Age at onset**	**Duration (years)**	**YLD**	**YLD to 1000**
0-4	0	0	2,5	0,0	-	0,0
5-14	0	0	10,0	0,0	-	0,0
15-29	0	0	22,5	0,0	-	0,0
30-44	1	0	37,5	0,0	-	0,0
45-59	24	0	52,5	0,0	-	0,0
60-69	35	2	65,0	10,0	151	5,8
70-79	20	10	75,0	5,0	46	3,7
80+	8	30	85,0	3,0	11	1,9
Total	88	0,4	65,4	5,4	208	0,9
Feminin						
0-4	0	0	2,5	0,0	-	0,0
5-14	0	0	10,0	0,0	-	0,0
15-29	0	0	22,5	0,0	-	0,0
30-44	0	0	37,5	0,0	-	0,0
45-59	1	0	52,5	0,0	0	0,0
60-69	13	3	65,0	10,0	56	1,8
70-79	19	15	75,0	5,0	44	2,3
80+	4	40	85,0	3,0	6	0,5
Total	37	0,2	72,0	6,4	106	0,4
Age	**DALY M**	**DALY M to 1000**	**DALY F**	**DALY F to 1000**	**DALY total**	**DALY total to 1000**
45-59	55	1,1	68	1,3	123	1,2
60-69	200	7,7	107	3,4	307	5,3
70-79	94	7,4	102	5,2	196	6,1
80+	20	3,2	24	2,1	43	2,5
Total	369	1,6	301	1,2	669	1,4

higher for men compared to women (95% CI 2.183 – 4.5393; z statistic 6.141; P < 0.0001).

Odds Ratio OR for medical procedures implying soft tissues debridements (OR 4.5257), incision and drainage of abscesses of the skin and subcutaneous tissue (OR 7.5781) is higher in dermatology, table 4.

Death ratio is 12:1 for diabetic patients compared to dermatological ones without diabetes, and 4:1 for diabetes with dermatological complications compared to others, table 5.

Disability-Adjusted Life Years (DALY) was calculated according to Arad demographic data [4], considering life expectancy LE 79.1 years for women and 71.6 years for men [5]. Years of Life Lost due to premature death YLL was calculated by totaling all deaths at every age category between 0 – 79.1 years for women and 71.6 for men, multiplying with all left years, according to LE, using preexisted calculation template available on World Health Organization site [6].

All 39 deaths represent Years of Life Lost YLL due to premature mortality of 355 years, (160 years for men and 195 years for women), mainly for 45-69 age category in men (n = 104) and in 45-79 age category for women (n = 177), table 6. YLL represents 53.06% of DALY.

Years Lost due to Disability YLD were 314, of which 66.34% in men. The most affected age category in term of disability is 60-69 years both in women and men and means 47.08% of DALY due to upper and lower-extremity lesions in 2018 in dermatology and diabetes and nutrition departments. The 60–69 age category patients are responsible for 65.71% of DALY. Table 6.

Conclusions

The steady increase in the number of diabetes cases is a challenge for health care systems everywhere, for diabetes is increasing the risk of complications affecting the skin, soft tissues and leads to amputations. The diabetic foot changes dramatically patient's quality of life by amputation and induces premature death by infection.

Cellulitis of the lower limb, diabetes with diabetic peripheral angiopathy with gangrene, chronic skin ulcers, skin abscess, furuncle and carbuncle of the limb are the most common causes of nontraumatic amputations.

The burden of disease DALY from deaths and remaining disabilities induced by upper and lower-extremity amputation in one year is 669 years. The most affected by disabilities YLD age-category is 60-69 years, both in men and women and represents 47.808% of DALY, in 2018 in dermatology and diabetes and nutrition departments.

YYL, as DALY component is high and sometimes amputation may precipitate death. The most important DALY component it is still YLD because amputated patients will live with physical and irreversible limitations.

Health programmes have to be adapted to these facts, taking into account that the most vulnerable categories of people to the amputated-related condition are those with elementary or secondary studies, diabetics, and dermatological patients.

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Conflict of interest
NONE DECLARED

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