SCREENING TECHNIQUES TO IDENTIFY OCCURRENCE OF DIABETIC FOOT ULCERATION AMONG PEOPLE AT HIGH RISK

Sanae Mohamed Alaa Elden; Hoda Wadie El-Gawly; Maha Adel Salem; HamdyAhmed Sliem; *Elsaida Gamal Bagdady*

The department of Adult Nursing Faculty of Nursing Alexandria University,
The department of Pharmacology Faculty of Medicine Suez Canal University ,
The department of Adult Nursing Faculty of Nursing Alexandria university,
The department of Internal Medicine Suez Canal University

Abstract

Background Foot ulceration is an important health issue associated with significant levels of disability, pain and financial expense for those affected. Furthermore, foot ulcers can become life threatening when complicated by infection and might result in amputation when lesions don't heal.

Aim: -. Screen the occurrence of diabetic foot ulceration among people at high risk.

Subjects and methods

Prospective (cohort) study at Port Said city, 300diabetic patients were screened and followed twice, after three and six months. Three tools were used for data collection. Diabetic patient knowledge schedule, diabetic foot examination checklist, and foot ulcer checklist assessment. The patients were examined for presence of diabetic peripheral neuropathy , autonomic neuropathy ,sensory deficit , peripheral vascular disease , foot deformity , skin and nail problems . Patients were graded using (The international consensus on diabetic foot risk category 1999), according to their risk category.

Results: - The following variables were significant risk factors with occurrence of diabetic foot ulcerations: previous foot ulcer, peripheral neuropathy, autonomic neuropathy, presence of other diabetic complications, retinopathy, diabetes duration and mean age group (53.14 ± 9.20). Ulcerations occur in 7.3% of studied sample after three and six months. Assessment of foot perception using monofilament had the best sensitivity. Peripheral neuropathy was observed in (27.3%) ,peripheral vascular disease was diagnosed in (40%) of studied sample , foot deformity (10.3%) .Recommendations .All patients with diabetes should be screened at least annually for evidence of risk factors for foot ulceration including neuropathy and vascular disease. Foot screening programs that identify those feet at risk should to be taught to all health care professionals involved in the care of the diabetic patient .

Conclusion:-previous foot ulcer, peripheral neuropathy, autonomic neuropathy, presence of diabetes complications, retinopathy , mean age group (53.14 ± 9.20) and long duration of diabetes were significant risk factors related to occurrence of diabetic foot ulceration

Key words: - Diabetic foot ulceration – Risk factors – Screening techniques

Introduction

Foot ulceration is an important health issue associated with significant levels of disability, pain and financial expense for those affected. Furthermore, foot ulcers can become life threatening when complicated by infection and might result in amputation when lesions don't heal. **(*Freeman, May &Wraigh, 2008)***

Diabetic foot ulceration is full-thickness penetration of the dermis of the foot in a person with diabetes; ulcer severity is often classified using the Wagner system. **Grade1.** Ulcers are superficial ulcers involving the full skin thickness but no underlying tissues. **Grade 2** ulcers are deeper, penetrating down to ligaments and muscle, but not involving bone or abscess formation. **Grade 3** ulcers are deep ulcers with cellulitis or abscess formation, often complicated with osteomyelitis. Ulcers with localized gangrene are classified as **Grade 4**, and those with extensive gangrene involving the entire foot are classified as **Grade 5** *(Ogrin, 2006)*

(Campbell et al., 2000 ;Hunt ,2009) reported that the risk factors of diabetic foot ulceration are peripheral neuropathy, peripheral vascular disease, previous ulceration, foot deformity, poor glycemic control, other diabetic complications ,absence of foot care education and low socioeconomic status.

So, identifying people at risk for foot problems is important to ensure. They are targeted for appropriate management to prevent foot complication. Identifying patient's risk category for foot ulceration helps determine the frequency needed for provider foot examination. The level of emphasis for self care of foot and patient responsibilities foot screening and timely referral to appropriate specialist team are particularly important for prevention of diabetic foot *(Meijer et al., 2005;* American podiatric medical association, *2009)*

Nurses have significant opportunities to promote maintenance of healthy feet, identify emerging problems, advice clients of their risk status, and positively influence and support appropriate self-care practices. Five primary risk factors for diabetic foot ulcers and lower extremity amputation can be quickly assessed and screened by nurses. These factors are previous history of foot ulcers, sensation, structural and biomechanical abnormalities, circulation, and self-care behavior and knowledge. The presence of one or more of these risk factors is consistent with increased risk for foot ulcers and lower extremity amputation. .By identifying such factors, informing, and

providing appropriate referrals for clients at risk, nurses contribute a key element to prevention strategy *(Delmas2006; Broersma 2004)*

Aim of the Study

The aim of this study was screen the occurrence of diabetic foot ulceration among people at high risk.

Subjects and Methods

The design used for conduction of this study was prospective (cohort) study***)***

Subjects: - A total 300 adults diabetic patients were recruited from diabetic clinics of six main hospitals and primary health care centers in Port Said city by stratified random sample

Setting: - Port Said General Hospital, Omer Iben Elkhatab Health care center, Port Foad Thane "Elamal'. Health care center,Port Foad General Hospital, Markez ELManakh Health care center ,Elmabara Hospilal.

Tools of data collection:-

• Tool I Diabetic patient knowledge scaduale

Tool II

Diabetic foot examination checklist

It contained two items

• General examination

Highet , weight , BMI , heart rate , blood pressure

Specific foot examination

It contain six main items :

1- Diagnosis of autonomic neuropathy

2- Diagnosis of diabetic peripheral Neuropathy

3- Sensory assessment

4- Vascular assessment

5- Deformity, musculoskeletal Assessment

6- Dermatological assessment

Patients were graded according to risk category

Tool III Foot ulcer assessment checklist

- First part: Report any changes that happened since last foot examination caused by diabetes or its complications
- Second part: - Foot ulcer assessment

It included questions about ulcer type, etiology, location, grade, presence of swelling, color, odor, presence of discharge

Procedure

Phase I

Patient was interviewed individually to gain information about age, education, occupation, work hours, address, telephone number. Past medical history, present health status. **Phase II.** In a private examination area, patient was asked to remove shoes and socket, general examination, specific foot examination were completed using diabetic foot examination sheet (tool II) .Patients were followed twice after three months and six months from the first examination using foot ulcer assessment sheet (Tool III) to document any changes or complication .

Results

Table (1) shows that 39.7% of studied patients were of age group 50-61, the mean age of patients was (53.86±9.25).The female patients represented two thirds (65%) , the patients who had higher education were only(13%) ,while illiterate , read and write were(4.75%,) .The majority of studied patients (88.7%) reported that they had active hours less than 8 per day and(99.3%) of studied sample had unsatisfactory income, while (70.7%) of patient's reported primary health care centers as medical facility available for them.

Table (2) shows that Poor self care practice was the most prevalent abnormality found in (98%) of patients ,(97%) had abnormal BMI, followed by peripheral vascular disease (40%)surprisingly higher than abnormal foot pressures (insensate foot) (11%),peripheral neuropathy(27.3%) , tenia pedis was seen in (23.3%), ingrown nails (16%); presence of foot deformity was frequently noted in (10.3%) of studied sample , intractable keratosis (7.7%). Lastly past foot ulcers was reported in (7.7%) of them.

Table (3) shows that patients who had mean age (53.14±9.20), longer diabetes duration, had past foot ulcer, retinopathy, presence of diabetes complications, during physical examination were diagnosed with peripheral neuropathy and autonomic neuropathy at a significant higher risk for diabetic foot ulceration . Ulceration was not significant with other risk factors as smoking, foot self care ,body mass index,

peripheral vascular disease , limited joint mobility , foot deformity ,calluses , cracking heels , blood glucose level and tenia pedis .

Table (4) Using logistic regression analysis, interactions of the univariate associations were evaluated, patients with past foot ulcer were 6.2 more likely to have ulcer, patients with abnormal pressure perception were 6.0 more likely to develop ulcer followed by autonomic neuropathy 5.6 compared with patients had no previous ulcer or autonomic neuropathy, had intact sensation.

Discussion

The present study documented the foot examination for 300 diabetic patients. Two thirds of studied sample were females because the diabetic clinic is scheduled in the morning when the majority of male patients are at work. Cigarette smoking was reported only on (9.3%) male patients this was pointed to the patient's negative perception about smoking behavior, awareness regarding a particular health hazard to a patient with diabetes .

Regarding univariable logistic analysis **(Model1)** for all potential risk factors of diabetic foot ulceration, the present study showed that, mean age 53.14 ± 9.20 ,diabetes duration ,presence of retinopathy ,other diabetic complications ,autonomic neuropathy, peripheral neuropathy , and previous foot ulceration were the significant risk factors associated with diabetic foot ulcer .Various risk factors have been identified by different studies. The variability may be due to variation in the study designs, difference in genetic profile and cultural features of the population studied. Regarding age, the present study found that mean age 53.14 ± 9.20 or younger patients had diabetic ulceration in average more than older age. From the researcher point of view, younger people are more mobile, liable to foot trauma or stressors and falling. Also the present study found a relationship between foot ulceration and longer duration this was in line with (*Hokkam, 2009)*

The present study revealed a significant relationship between foot ulceration and presence of diabetes complications (macro and micro vascular complications).This was in line with *(Rossing , 2006;Abbott et al., 2002)* who mentioned that macro & micro vascular dysfunction and peripheral nerve damage create a very high risk for the patient with diabetic foot ulcer.

History of foot ulcer was the strongest variable related to the risk of ulcer events in the univariable and multivariable regression analysis (model 1) - (model 2). This is in line with *(American college of physician(ACP) ,2007*) who mentioned that presence of macro & micro vascular complications, nerve damage places the patient in the high-risk category, increases the risk for developing another foot ulcer and progressive deformity of the foot,

Peripheral neuropathy was a significant risk factor associated with the occurrence of diabetic foot ulceration. This is in accordance with (Boyko ,*Nelson and Aharoni,2006)* who said that peripheral neuropathy has consistently been demonstrated to be associated with a higher risk of foot ulcer in many researches

The current study considered orthostatic blood pressure variation with abnormalities of heart rate (sign of autonomic neuropathy) a significant risk factor related to foot ulceration in univariable and multivariable models. This result is in line with (*Boyko,*Ahroni *and* Forsberg *1999)* who considered orthostatic blood pressure drop as a potential predictor.

In the present study foot deformity was diagnosed in 10.3% of studied sample, who had no significant risk factor related to foot ulceration .This disagrees with *(Ledoux et al., 2005*) who mentioned that there was a strong relationship between foot deformity as (hammer toes ,claw toes and hallux litmus) and foot ulceration**.**

In the present study, peripheral vascular disease and vascular insufficiency were common in about half of studied sample, there was no significant factor related to occurrence of diabetic foot ulceration. Although many studies reinforced the role of peripheral vascular disease (PVD) in occurrence, recurrence and delayed wound, *(Bloomgarden,2008(b))* mentioned that in three randomized controlled trials of 300 high-risk individuals without arterial insufficiency, a 3- to 10-fold reduction in ulceration occurred.

Conclusion

The study proved that diabetic foot ulceration occurs among about (7.3%) of studied sample after three and six months. Univariate analysis was done to determine the risk factors which are associated with diabetic foot ulceration. It was observed that previous foot ulcer, peripheral neuropathy, autonomic neuropathy, presence of

diabetes complications, retinopathy , mean age group (53.14 ± 9.20) and long duration of diabetes were significant risk factors related to occurrence of diabetic foot ulceration.

Recmmendations

The present study emphasizes that foot screening is simple, rapid, low cost reasonable and reproductive method o decrease diabetic foot ulceration. So, it must be performed to every diabetic patient.

The multidisciplinary foot care team is the most effective way to provide patient education, manage foot ulceration, infection and deformity.

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Table (1): Distribution of the studies sample according to socio demographic characteristic

	No	*%*
1- Age(years)		
20- 30	*4*	*1.3*
31 – 40	*15*	*5.0*
41 – 50	*95*	*31.7*
51 – 60	*119*	*39.7*
>60	*67*	*22.3*
Range	*18.0 – 79.0*	
Mean ± SD	*53.86 ± 9.25*	
2- Gender		
male	*105*	*35.0*
female	*195*	*65.0*
3- Education		
Illiterate	*14*	*4.7*
Principal	*130*	*43.3*
Secondary	*117*	*29.0*
University, Post	*39*	*13.0*
4- Occupation		
Skilled worker	*65*	*21.7*
Non skilled worker	*64*	*21.3*
Housewife	*131*	*43.7*
Retired	*38*	*12.7*
Others (Student ,…….)	*2*	*0.7*
5- Marital status		
Married	*274*	*91.3*
Single	*8*	*2.7*
Divorced	*4*	*1.3*
Widow	*14*	*4.7*
6- Children		
Two	*63*	*21.0*
Three	*122*	*40.7*
More than three	*98*	*32.7*
Without	*17*	*5.7*
7- Work hours		
less than 8 hours	*266*	*88.7*
8 hours	*25*	*8.3*
12 hours	*7*	*2.3*
more than 12	*2*	*0.7*
8- Income (Satisfactory)		
Yes	*2*	*0.7*
No	*298*	*99.3*
9- Medical facility		
PHC	*212*	*70.7*
Out patients ,inpatient in Hospitals	*88*	*29.3*

Table (2): Distribution of studied sample according to prevalent risk factors.

	No.	**%**
Risk factors		
1-Poor foot self care practice	294	98.0
2-Abnormal BMI	291	97.0
3-Abnormal blood glucose level	171	57.0
4-Peripheral vascular disease	120	40.0
5-Patients had neuropathy	82	27.3
6-Tenia pedis	70	23.3
7-Cracing	64	21.3
8-Ingrown nails	48	16.0
9-Calluses	33	11.0
10-Presence of foot deformity	31	10.3
11-Abnormal ankle dorsiflexion	29	9.7
12-Abnormal planter dorsiflexion	28	9.3
13-Smoking	28	9.3
14-Past foot ulceration	23	7.7
15-Intractable Keratosis	23	7.7
16-Automatic neuropathy	22	7.3
17-Retinopathy	11	3.7

Part IX Table (3): (Model 1) Univariable logistic regression for all potential risk factors of diabetic foot ulceration.

	Predictive foot ulceration				Test of sig.
	No		Yes		
	No	%	No	%	
Age (years) Mean ± SD	60.40 ± 6.89		53.14 ± 9.20		^{t}p <0.001*
Duration of diabetes Mean ± SD	9.55 ± 6.90		13.72 ± 7.73		0.007*
1-Past foot ulceration					
No	262	94.2	15	68.2	<0.001*
Yes	16	5.8	7	31.8	
2-Laser photocoagulation					
No	270	97.1	19	86.4	
Yes	8	2.9	3	13.6	0.044*
3-Smoking					
No	253	91.0	19	86.4	
Yes	25	9.0	3	13.6	0.444
4-Presence of diabetes complication					
No	208	74.8	11	50.0	0.012*
Yes	70	25.2	11	50.0	
5-Foot care					
Satisfactory	4	1.4	2	9.1	0.064
Unsatisfactory	274	98.6	20	90.9	
6-BMI					
Normal	6	2.2	1	4.5	
Mild mal nutrition	2	0.7	0	0.0	
Over weight	78	25.5	0	0.0	
Obese class I	101	36.3	7	31.8	
Severely Obese class II	66	23.7	3	13.6	0.538
Extreme obese class III	32	11.5	4	18.2	

FEp: p value for Fisher Exact test p: p value for Chi-square test

^{t} p:p value for Student t-test

*: Statistically significant at $p \leq 0.05$

Table 3 (Cont): (Model 1) Univariable logistic regression for all potential risk factors of diabetic foot ulceration.

Risk factors	Predictive foot ulceration				Test of sig.
	No		Yes		
	No	%	No	%	
7-Abnormal total neuropathy symptoms score (NSS)					
No	218	78.4	13	59.1	0.038*
Yes	60	21.6	9	40.6	
8-Abnormal neuropathy disability score (NDS)					
No	254	91.4	15	68.2	0.004*
Yes	24	8.6	7	31.8	
9-Monofilament test					
No	253	91.0	14	63.6	0.001*
Yes	25	9.0	8	36.4	
10-Total neuropathic patients					
No	207	74.5	11	50.0	0.013*
Yes	71	25.5	11	50.0	
11-Autonomic neuropathy					
No	261	93.9	17	77.3	0.015*
Yes	17	6.1	5	22.7	
12-Vascular assessment					
Normal	169	60.8	11	50.0	0.320
Abnormal	109	39.2	11	50.0	
13-Ankle dorsiflexion					
No	250	89.9	21	95.5	0.707
Yes	28	10.1	1	4.5	
14-Ankle plantar flexion					
No	253	91.0	19	86.4	0.444
Yes	25	9.0	3	13.6	
15-Patient have foot deformity					
No	250	89.9	19	86.4	0.485
Yes	28	10.1	3	13.6	
16-Cracking heels					
No	218	78.4	18	81.8	1.000
Yes	60	21.6	4	18.2	
17-Random blood glucose					
Normal	122	43.9	7	31.8	0.271
Abnormal	156	56.1	15	68.2	
18-Calluses on ball					
No	250	89.9	17	77.3	0.079
Yes	28	10.1	5	22.7	
19-Tinea pedis					
No	215	77.3	15	68.2	0.328
Yes	63	22.7	7	31.8	

FEp: p value for Fisher Exact test
*: Statistically significant at $p \leq 0.0$
p: p value for Chi-square test
^{t}p:p value for Student t-test

Table (4): (Model 2) Multivariate logistic regression analysis for the significant risk factors of diabetic foot ulceration.

	B	**Sig.**	**OR**	**95% CI (lower–upper)**
Age	0.003	0.930	1.003	0.943 – 1.067
Diabetes duration	0.053	0.119	1.055	0.986 – 1.128
Past foot ulceration	1.836	0.012*	6.274	1.486 – 26.489
Laser photocoagulation	1.109	0.270	3.030	0.422 – 21.739
Diabetes Complication	-0.474	0.464	0.623	0.175 – 2.210
Patient had peripheral neuropath	0.954	0.388	2.597	0.297 – 22.704
Predictive foot ulceration	0.133	0.885	1.142	0.189 - 6.913
Monofilament	1.792	0.048*	6.003	1.002 – 38.802
Total neuropathic patients	-1.607	0.419	0.344	0.026 – 4.575
Autonomic neuropathy	1.739	0.009*	5.694	1.541 – 21.036

طـرق الـكشـف لـلـتـعرف عـلـي إمـكـانـيـة حـدوث تـقرح الـقـدم الـسـكـري بـيـن الأشـخـاص الأكـــثر عـــرضـــة لـهـا

أ.د / ثـنـاء مـحـمد عـــلاء الـديـن- أ. د/ هـدي وديـع الجاولـي- أ.د / مـــهـــا عـــــادل سالم
أ.د / حـمـدي احمد سـلـيـم - م م السيدة جمال على بغدادى
أسـتـاذ الـتـمـريض الباطني والجراحي- قسم تـمـريض الـبـالغين- كـلـية الـتمريض- جـامـعـة الأسكندريـة-
أسـتـاذ الفارماكولوجي كـلـية الطب -جـامـعـة قناة السويس- أسـتـاذ التمريض الباطني والجراحي قسم تمريض البالغين- كـلـية الـتمريض – جـامـعـة الأسكندريـة- أسـتـاذ أمراض الـبـاطـنـة -كـلـيـة الـطـب- جـامـعـة قـنـاة الـسـويـس-مدرس مساعد تمريض الباطنى والجراحى – كلية التمريض – جامعة بورسعيد

الخلاصة

تعتبر مشكلة تقرح القدم السكري من المشكلات الصحية الخطيرة حيث أنها ترتبط بقدر كبير من الألم الجسدي وعدم مقدرة المريض على ممارسة حياته الطبيعية كما أنها تمثل مشكلة اقتصادية للمريض وتعتبر أيضا من الحالات المهددة لحياته وذلك عند حدوث مضاعفات كالعدوى و تأخر التئام الجرح مما يودى إلى بتر القدم لذلك تهدف الدراسة إلى الكشف عن عوامل الخطر لتقرح القدم السكري بين الأشخاص الأكثر عرضة لها . دراسة استكشافية في مدينة بورسعيد تضمنت 300 مريضا بالسكر تم فحصهم ومتابعتهم مرتين بعد ثلاثة وستة أشهر . الأدوات التي استخدمت في جمع البيانات تضمنت الاتى . استمارة معلومات مرضى السكر، استمارة فحص القدمين لمرضى السكر ، استمارة تقييم تقرح القدم السكري ، فحص المريض تضمن وجود اعتلال الأعصاب الطرفية ، اعتلال الأعصاب اللاإرادية ، خلل في الإحساس بالأطراف ،قصور الدورة الدموية الطرفية ، تشوهات القدمين ، مشاكل الجلد والأظافر.تم تصنيف المرضى وذلك حسب درجة وجود عوامل الخطر المسببة لتقرح القدم السكري .باستخدام (التصنيف العالمي للعوامل الخطر المسببة لتقرح القدم السكري وقد أظهرت الدراسة النتائج الآتية. أكثر العوامل تأثيرا لحدوث تقرح القدم السكري هو التاريخ المرضى السابق و اعتلال الأعصاب الطرفية واعتلال الأعصاب اللاإرادية بالإضافة الى الفئة العمرية (9.20 ± 53.14) و طول مدة الإصابة بمرض السكر و الإصابة بمضاعفات السكر المزمنة وكان هذا التأثير ذو دلالة إحصائية ، تقرح القدم السكري حدث في 7.3% من العينة بعد ثلاث و ستة أشهر من المتابعة ، خيط المونوفيليمنت يعتبر الأكثر حساسية في تحديد فقد الإحساس في القدمين لدى المرضى، قصور الدورة الدموية وجد في 40% من المرضى ، اعتلال الأعصاب شخص في 27.3% ، تشوهات القدمين 10.3% - من أهم توصيات الدراسة . يجب أن يجرى فحص القدمين سنويا ويشتمل على تقييم كلا من الإحساس في القدمين والدورة الدموية كما أن برامج تعليم كيفية فحص القدمين المتخصص يجب أن يتوافر لكل أفراد الفريق الصحي القائمين على تقديم الرعاية الصحية لمرضى السكر.

الكلمات الدالة :- تقرح القدم السكرى – عوامل الخطر – طرق الكشف