Development of a Risk Assessment Tool for Diabetic Foot Ulcer among Diabetic Patients

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Abstract: Recently, there is no risk assessment tool for diabetic foot ulcer (DFU) in diabetes mellitus (DM) patients. It is necessary to develop risk assessment tool to early detect DFU in DM patients. This study is descriptive study which used tool development process included, 3 phases; 1) literature review to select journal revealed high statistic association using adjusted odd ratios (AOR), 2) group and categorized the risk factors associated with DFU, and 3) score the items. From literature review, there were 15 journals with AOR. Fifty factors were collected then grouped them to 15 items. Those items were: 1) age, 2) sex, 3) history or current smoker, 4) body mass index (BMI), 5) insulin use, 6) duration of DM, 7) poor diabetes control, 8) skin assessment, 9) foot deformity, 10) neuropathy sensory, 11) peripheral vascular disease, 12) history of amputation, 13) history of ulceration, 14) history of myocardial infarction, and 15) retinopathy. Then, there were 3 factors added by clinical judgment which included poor foot care, unhealthy diet, and physical inactivity. Finally, the researcher grouped, categorized and defined those items and scored each item by consultation with statistician. The total score of the risk assessment for DFU range from 3 – 23. The researcher then designed the tool format. In conclusion, the risk assessment tool for DFU in DM patients (version 1) was developed. Further, testing its psychometric properties is recommended.

Keywords: Development; diabetic foot ulcer; assessment tool

I. Introduction

Diabetes Mellitus (DM) is complex chronic disease that exhibits an increase in glucose due to insulin deficiency (Tapan, 2005; Wijaya & Putri, 2013). World Health Organization [WHO] (2013) predicts the increasing number of DM will be triple from 2000 to 2030 around the world. Data from Daniel et al. (2011) and the International Diabetes Federation [IDF] (2013) showed that 347 million people have DM and around 5.1 million people died and 548 USD billion in health spending has taken place.

The impacts among diabetic patients are high risk of micro-vascular and macro-vascular diseases (The Emerging Risk Factors Collaboration et al., 2010; Fioretto, Dodson, Ziegler, & Rosenson, 2010; Li et al., 2015). Diabetic foot ulcer (DFU) is a common problem in diabetic patients (Nehring et al., 2014). The statistic of prevalence of DFU among DM patients is approximately 5.3% - 10.5% (Reiber, 1998; Reiber, 2001; Madanchi et al., 2013) and the incidence of DFU is around 1-4% per year per among the population (Bartus & Morogolis, 2004; Khalil et al., 2014).

The effects of DFU can influence economic burden of patients, their families, health care providers and governments (Boulton et al., 2006; Ogbera et al., 2006). According to Frygeberck et al. (2006) cited in Purwanti (2013), DFU is the main cause of morbidity, long hospitalization, and increased cost to patients. The ideal management to prevent and treat DFU is feet checking regularly, give knowledge to patients and healthcare providers, appropriate footwear, determining risk of DFU and early treatment of foot problems (International Working Group on the diabetic foot, 2000; Aalaa et al., 2012).

Literature review in risk factors related to DFU among diabetic patients of 15 studied examined using adjusted odd ratio (AOR) showed 15 factors. They are: 1) age 2) sex (male) 3) body mass index (BMI) example height, weight, and waist size 4) current and/or history of smoking 5) insulin use 6) macro-vascular complication such as history of stroke and history of acute myocardial infarction (AMI) 6) duration of DM 7) poor diabetes control 8) poor glycemic control such as HbA1c 9) fissures 10) callus 11) foot deformity such as hallux rigidus, hallux valgus, hammer toe, flat foot, charcot foot 12) neuropathy sensory 13) peripheral vascular disease 14) previous foot ulcer and 15) previous amputation.

An assessment tool is important to assess risk factors related to DFU. A study of systematic review supporting the instrument or a reliably assessment is needed for international clinical guidelines to assess risk of...
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DFU among DM (Crawford et al., 2013). Based on Alavi et al. (2014) the early identification of high risk for DFU is crucial to decrease the number of morbidity and mortality and also nurses as part of an inter-professional approach which is often needed to support patients’ needs.

Recently, there is no risk assessment tool for diabetic foot ulcer (DFU) in diabetes mellitus (DM) patients. Therefore, the ADA risk classification (Boulton et al., 2008). and risk stratification tool and diabetes foot screening from New Zealand Society [NZSSD] (Garret et al., 2014). (Boulton et al., 2008). The tools have strong risk factors to predict DFU, but not cover all the risk factors for DFU which is strong prediction of DFU supported by AOR. Supported byMeta- analysis and systematic review about predicting factors related DFU it would suggest that future study should comprehensively assess factors associated with DFU such as illness, signs and diagnostic test (Crawford et al., 2007). It is necessary to develop risk assessment tool to early detect DFU in DM patients.

II. Method

This tool development process included: 1) literature review that selected journals which showed high statistic association using adjusted odd ratios, 2) group risk factors based on the similar purpose of result, and 3) categorize and score the items

III. Results

1. Literature review

Literature review has gotten by searching the journal from google scholar, google and endnote. The researcher specify the journals, there are journal of diabetes and metabolic disorder, journal diabetes metabolism, diabetes care, and journal of diabetic foot complication that specified explore about diabetes and diabetes’ complication. The keywords of sources are “risk factors, diabetic foot ulcer, diabetes mellitus”. Inclusion criteria are the journal which has full text and the statistic using AOR. The stage of literature review resulted 15 journals that have adjusted odd ratio (AOR). The researcher chose AOR because high statistic association which using two methods used to address confounding are stratification and multiple regression techniques (Szumilas, 2010). From 15 studies, the researcher had collected 50 risk factors which high associated with DFU. From 50 risk factors, some risk factors can be grouped into one item and some of risk factors were deleted because only supported by 1 study. This reason to delete only one study support has showed in Crawford, Inkster, Kleijnen, and Fahey (2007) that they delete the factors that only supported by one study.

2. Group and categorize the risk factors

The total risk factors after deleting and grouping were 15 risk factors. They were: 1) age, 2) sex, 3) history or current smoker, 4) body mass index, 5) insulin use, 6) duration of DM, 7) poor diabetes control, 8) skin assessment, 9) foot deformity, 10) neuropathy sensory, 11) peripheral vascular disease, 12) history of amputation, 13) history of ulceration, 14) history of myocardial infarction and 15) retinopathy. Then, there were 3 risk factors added by clinical judgment which included 1) foot care, 2) unhealthy dietary and 3) physical inactivity.

3. Categorize, define and score the items

The researcher categorized the items into 4 components where were demographic data, foot assessment, behavioral assessment, and complication disease. Finally, the component and items were scored by consultation with statistician. The total score of risk assessment tool for DFU ranges from 3 – 23 (tool version 1), the tool can be seen in table 1. Low score means low risk while high score means high risk.

2. Group and categorize the risk factors
3. Score the items

Table 1 Risk assessment tool for DFU (tool version I)

<table>
<thead>
<tr>
<th>RISK ASSESSMENT TOOL FOR DFU</th>
<th>Scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Demographic Data</td>
<td></td>
</tr>
<tr>
<td>Research code</td>
<td></td>
</tr>
<tr>
<td>Age: _____ Years old</td>
<td>&lt; 50 [ 1 ] ≥ 50 [ 2 ]</td>
</tr>
<tr>
<td>Duration of DM : _____ Years</td>
<td>&lt; 10 Years [ 1 ] ≥10 Years [ 2 ]</td>
</tr>
<tr>
<td>History of amputation : No [ 0 ] Yes [ 1 ] , Specify:</td>
<td></td>
</tr>
<tr>
<td>B. Foot Assessment</td>
<td></td>
</tr>
</tbody>
</table>

DOI: 10.9790/1959-0806021114 www.iosrjournals.org
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1. Neuropathy sensory
   Normal [0]  Abnormal [1]

2. Peripheral Vascular Disease
   a. Absent pulse of dorsalis pedis; Yes [ ] No [ ]
   b. Absent pulse of posterior tibial; Yes [ ] No [ ]

3. Skin assessment, Inspection
   a. Callus Yes ( ) No ( )
   b. Fissures Yes ( ) No ( )

4. Foot deformity, Inspection:
   a. Hammer toe
      Yes ( ) No ( )
   b. Claw toe
      Yes ( ) No ( )
   c. Hallux valgus
      Yes ( ) No ( )
   d. Hallux rigidus
      Yes ( ) No ( )
   e. Pes planus
      Yes ( ) No ( )
   f. Charcot
      Yes ( ) No ( )
   g. Limited joint mobility
      Yes ( ) No ( )

5. Other
   Normal [0]  Abnormal [1]

C. Behavior assessment

1. History of smoking
   Current and/or history of smoking
   No [0]  Yes [1]

2. Insulin use:
   Normal [0]  Low
   High [2]

3. BMI
   BMI = Weight (Kg) / (Height M * Height M)
   None [0]  Only 1 [1]  >1 [2]

D. Complication Disease

1. Retinopathy
   None [0]

2. Stroke
   Only 1 [1]

3. Acute Miocardial infarction
   >1 [2]

TOTAL SCORE (3 – 23)

IV. Discussion

The risk assessment tool has to be simple and clear because the tool will be used to predict risk level of DM patients for DFU. Based on Alavi et al., (2014), the early identification of risk for DFU is crucial to decrease the number of morbidity and mortality. Nurse as part of an inter-professional team need to detect risk for DFU and prevent DFU in patients. If the tool is simple and clear, it will be easy to apply. Risk assessment tool for DFU among DM patients has to be objective and discriminative which helps to differentiate risk among DM patients.

The researcher grouped risk factors in to items, from 50 risk factors become 15 risk factors based on the characteristic of the risk factors’ result. If the result of risk factors were same, the researcher made it into 1 item. The researcher grouped the risk factors bade on the purpose of the results of the risk factors in which grouping is an act or process of placing in groups or a set or arrangement of things in a group (Dictionary.com, 2016). For examples: Hammer toe, flat foot, charchot foot, hallux rigius, hallus valgus were grouped become foot deformities. Monofilament insensitifity, loss of protective sensation, peripheral neuropathy present were grouped become neuropathy sensory. ABI, peripheral vascular disease, absent pulse were grouped become peripheral vascular disease. Then, the researcher categorized the risk factors or items of instrument based on characteristic of the items which divided into 4 dimensions. There are 1) demographic data, 2) foot assessment, 3) behavioral assessment, and 4) DM complication diseases. Categorize means put into category which category is defined as group in a complete system (Oxford, 2008). Some items were deleted because only have 1 study which supported the item. Based on Crawford et al. (2007) showed that only accepted two or more reports which present estimated of effectiveness in their systematic review.
V. Conclusion

The risk assessment tool for DFU in DM patients (tool version I) was developed. The tool includes 15 items and the total range from 3-23. Further, testing its psychometric properties is recommended.

References


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