

## Research Article

# A study on the impact of smoking and alcoholism as determinant factors in the prognosis and outcome of diabetic foot ulcer disease

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## ABSTRACT

**Background:** This is an observational study to determine the relation between the life style factors like smoking and chronic alcoholism with the severity of the diabetic foot ulcer disease; its implications and prognosis and outcome with particular reference to the incidence of amputation and the duration of the hospital stay. This study was done in 89 patients who were admitted in the surgical wards of two large private medical colleges in India: KPC Medical College and Hospital, Kolkata, West Bengal and Bhaskar Medical College and Hospital, Yenkepally Village, Ranga Reddy District, Telengana. In our study, we explored the relationship between two determinant factors - smoking and chronic alcoholism with the increased incidence of amputation and prolonged hospital stay in a diabetic cohort. It has been found from this study that the severity of diabetic foot ulcer disease is more in patients who were addicted to either smoking, alcohol or both.

**Methods:** The study was done on 89 patients who were admitted in the surgical wards of the following teaching hospitals in India - KPC Medical College and Hospital which deals mostly with middle income group of urban population (Rs.7594 to 15188) and Bhaskar Medical College and Hospital which deals mostly with low income group of semi-urban population (Rs.4556 to 11361) as per Kuppuswamy's socio-economic status scale (updating for 2012). The youngest patient was from semi-urban area aged 26 years and the oldest patient was from urban area aged 83 years. The outcome and prognosis of the diabetic foot ulcer disease were assessed with the incidence of amputation and duration of hospital stay in relation to the two determinant factors of smoking and alcoholism.

**Results:** The diabetic patients who were smokers and/or chronic alcoholic underwent more amputations with concomitant longer hospital stay than the patients who had no addiction to these substances. The prognosis was worse in the subgroup of patients who were both smoker and chronic alcoholic.

**Conclusions:** The study observed that the prognosis and outcome of a diabetic foot ulcer disease changes significantly in patients who are addicted to smoking and alcoholism with higher incidence of amputation and longer hospital stay.

**Keywords:** Diabetic foot ulcer disease, Wagner classification of diabetic foot ulcer disease, Smoking and diabetic foot ulcer, Alcoholism and diabetic foot ulcer, Amputation and diabetic foot ulcer disease, Hospital stay and diabetic foot ulcer disease

## INTRODUCTION

It has been established beyond doubt that smoking leads to type 2 diabetes mellitus.<sup>1-4</sup> In fact, smokers are 30-40% more likely to develop type 2 diabetes than nonsmokers

and more importantly people with diabetes who smoke are more likely to face difficulty in controlling their disease.<sup>5</sup> Smokers with diabetes have higher risks for serious complications,<sup>6</sup> including poor blood flow in the extremities, peripheral arterial disease and peripheral

neuropathy that can lead to infections, ulcers, and possible amputation. It also delays wound healing after diabetic foot surgery. The complications in bone healing are well documented in the smoking populations. Lower extremity amputations are often an unfortunate outcome for someone who develops a foot ulcer. Despite public health efforts, the incidence of amputations in the diabetic population continues to increase. The 5-year mortality rate in diabetics who underwent lower extremity amputation, has been reported to be as high as 50%.<sup>5</sup> It is well known that tobacco use increases the risk of amputation. Liedberg and Persson demonstrated that out of 188 lower limb amputees in Sweden only 23 were non-diabetics, others were smokers who had diabetes.<sup>7</sup> There are several ways in which cigarette smoking inhibits tissue healing. Tissue perfusion and oxygenation are decreased by harmful by-products of cigarette smoke such as carbon monoxide and hydrogen cyanide that inhibit the normal metabolism of healing.<sup>8</sup> Further, tissue perfusion may be decreased as nicotine stimulates epinephrine and norepinephrine release. Nicotine may also affect osteoblast directly and this prevents bone healing.<sup>9</sup> Research has indicated that chronic alcohol consumption in well-nourished diabetic patients results in increased blood sugar levels.<sup>10</sup> The mechanisms underlying the increasing hyperglycemia in chronically drinking diabetics are still unknown. As the most common form of diabetes, type 2 diabetes mellitus, is associated with both insufficient insulin secretion and insulin resistance, it appears likely that the alcohol-induced increase in blood sugar levels results from adverse effects on one or both of those variables. The diabetics with chronic alcohol intake may show worse compliance with their dietary and pharmacological treatment regimens, which also may result in uncontrolled blood sugar levels and subsequent development of diabetic foot ulcer disease. Diabetes and alcohol consumption are the two most common underlying causes of peripheral neuropathy.<sup>11</sup> Regular consumption of even moderate amounts of alcohol (i.e., two to four drinks per day), clearly interferes with diabetic blood sugar control and increases the risk of peripheral neuropathy and subsequent development of diabetic foot ulcer disease with bad prognosis which may lead to increased incidence of amputation.<sup>12</sup>

Objectives of this study is to correlate and compare the severity, prognosis and outcome of the diabetic foot ulcer disease in patients who are addicted to smoking and/or chronic alcoholism with the other patients in the study who were not addicted to these substances and assess and observe the impact of smoking and chronic alcoholism in the development of more severe type of diabetic foot ulcer disease which ultimately resulted in higher incidence of amputation and longer hospital stay.

## METHODS

Both Type I and Type II diabetic patients were taken into consideration who presented with clinically infected foot

ulcers. The patients who were treated with Oral Hypoglycaemic Agents, the pregnant ladies, the patients below the age of 18 years and the patients who were admitted in the Critical Care Units were excluded from the study. The due consent was taken after thorough explanation about the study methods in their own language. The necessary data were collected from the patients with particular importance to the history of addiction to smoking and alcoholism which were recorded. Information on current smoking history, including number of pack years, was collected. Patients were divided into two groups in regards to their smoking history. Patients were defined as smokers if they had more than 5 pack years of smoking history. Non-smokers were defined as patients who had never smoked or had a smoking history of less than 5 years and were not currently smoking at the time of admission. Patients are designated as chronic alcoholics if they had one or more bouts of drinking every day for at least 10 years. The patients who were addicted to both smoking and chronic alcoholism are put in a different subgroup and the outcome and prognosis of these patients were compared with the other subgroup of patients who were either only smokers or only alcoholics.

## RESULTS

In our study, we explored to find whether diabetics who were smokers or chronic alcoholics had more amputations and longer hospital stay than non-smokers and also whether diabetic foot ulcer patients who were both smokers and chronic alcoholics had worst outcome than the rest of the patients. A total number of 79 patients were taken as a diabetic cohort - 53 patients from KPC Medical College and Hospital, Kolkata, India and 26 patients from Bhaskar Medical College and Hospital, Ranga Reddy District, Telengana, India. In this study, out of 79 patients, 53 (67.09%) of the patients were addicted to either smoking, alcohol or both and 26 (32.91%) had no addiction.

The total number of smokers and chronic alcoholics were 42 (53.14%) and 32 (40.51%) respectively. The number of patients who were both smokers and alcoholics were 21 (26.58%) (Figure 1). From the data, it has been found that 50% of the smokers are also alcoholic and 65.63% of the alcoholic patients were also addicted to smoking. The incidence of amputation is higher in patients who were admitted in Bhaskar Medical College and Hospital as they presented with more severe grades of diabetic foot ulcer disease. 53.85% of patients (14 out of total 26 patients from Bhaskar Medical College and Hospital) had undergone amputation in comparison to 28.30% of patients (15 out of total 53 patients from KPC Medical College and Hospital). The total number of patients who had undergone amputation in both medical college hospitals was 29 (36.71%). Out of 29 amputees, 16 patients 55.17% were smokers and 12 patients 41.38% were alcoholics, 8 patients 27.59% had no addiction, 11 patients 37.93% were addicted to both smoking and

alcohol. These findings show that both smoking and alcoholism are strong determinant factors in the development of severe grades of diabetic foot ulcers which ultimately leads to amputation. In our study, we found that smoking was a significant determinant factor for diabetic foot ulcer disease. In agreement with our results, Moss et al.<sup>13</sup> and Nabil Abd El Fatah Al Kafrawy et al.<sup>14</sup> found that smoking was predictive of foot ulceration and amputation. Diabetic foot ulcerations are more common in younger patients who smoked than in non-smokers. Nevertheless, smoking is a strong risk factor for peripheral vascular disease and development of diabetic foot ulcer disease.<sup>15</sup> This observation was also supported by other studies.<sup>16,17</sup> In our study, the number of diabetic smokers who underwent amputation was compared to their non-smoking counterparts in regard to incidence and age at the time of amputation and the results showed a significantly greater number of amputations in diabetic smokers than the non-smokers and is consistent with the findings in the study done by Alamogordo et al.<sup>18</sup> In this study, we also found that the patients who were smokers and/or alcoholics had longer hospital stay due to presence of mostly Grade III and IV diabetic foot ulcers. We divided the hospital stay in two groups: patients who had up to 14 days of hospital stay and patients who stayed in hospitals for more than 14 days. 44 patients (55.70 %) had hospital stay of up to 14 days whereas 35 patients (44.30%) stayed more than 14 days. Out of 44 patients who had hospital stay up to 14 days, 19 patients (43.18%) had no addiction, 19 patients (43.18%) were smokers and 17 patients (38.64%) were addicted to alcohol and 10 patients (22.73%) were addicted to both smoking and alcohol. Of the rest 35 patients who had stay of more than 14 days, 22 patients were smokers (62.86% and 16 patients (45.71 %) were alcoholics, 12 patients (34.29%) were addicted to both smoking and alcohol and only 8 patients (22.86%) had no addiction. These findings show smoking is a strong determinant factor for prolonged hospital stay as 62.86% of the patients who had hospital stay of more than 14 days were smokers. Similarly, alcohol is another strong determinant factor for long hospital stay as 45.71% patients were alcoholics who had hospital stay of more than 14 days (Figure 2). The lower extremity amputation in a patient of diabetic foot ulcer disease may be exacerbated by or related to the smoking habits and history of chronic alcohol intake by the patient. Out of 21 patients who were addicted to both smoking and alcoholism, 11 patients undergone amputation (52.38%) and 12 patients had hospital stay of more than 14 days (57.14%). The comparative data for who were only smokers (13 patients) are as follows: 5 patients (38.46%) had undergone amputation and 11 patients (84.62%) had hospital stay of more than 14 days. Out of the 11 patients who were only alcoholic, 5 patients each (45.45%) had either undergone amputation or had hospital stay of more than 14 days. The comparative data for the 26 patients who were neither smoker nor alcoholic, 8 patients 30.77 % had undergone amputation and 7 patients 26.92% had hospital stay of more than 14 days. The above findings

show that the incidence of amputation is highest in the subgroup of patients who were both addicted to smoking and alcoholism 52.38% though prolonged hospital stay is highest in the patients who were smokers only 84.62% (Figure 3). In this study, the worst outcome was noted in the patients who were addicted to both smoking and chronic alcoholism as more than 50% of these patients had undergone amputation and had longer hospital stay of more than 14 days.

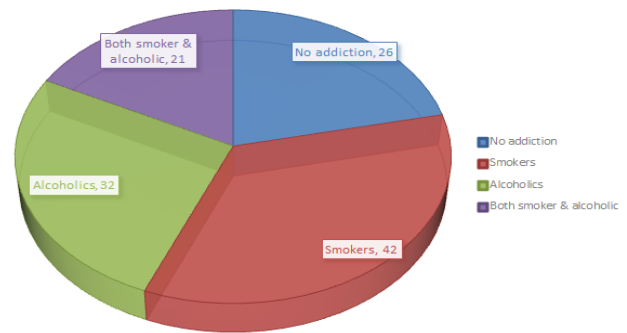


Figure 1: Incidence of diabetic foot ulcer disease.

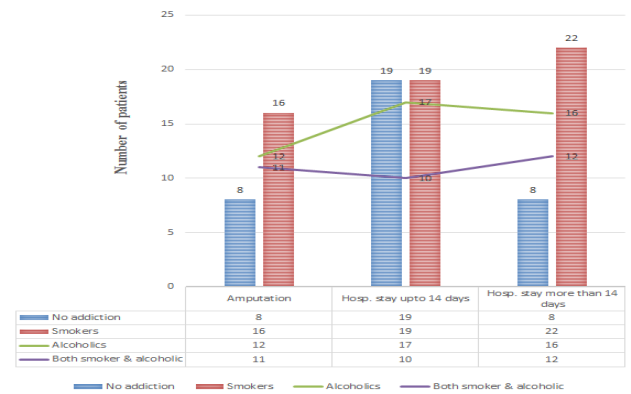


Figure 2: Comparative study between addicted and non-addicted patients in relation to amputation and hospital stay.

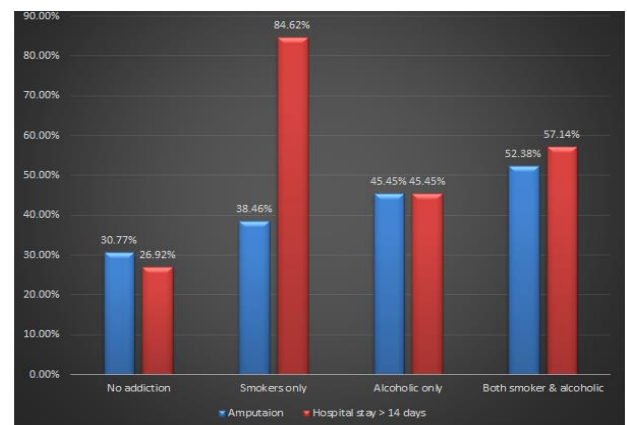


Figure 3: Relative outcome of the diabetic foot ulcer disease in relation to addiction habits.

## DISCUSSION

Lower extremity amputation continues to be an unfortunate complication in patients with diabetes. In addition to functional limitations that amputees experience, there is also a significant psychological impact.<sup>19</sup> Depression has been shown to increase the number of macro and micro vascular complications in diabetics.<sup>20</sup> Recently, comorbid depression in diabetics has been shown to increase mortality, excluding cardiovascular complications caused by depression.<sup>21</sup> One finding from our data shows that diabetic patients who smoke are more likely to undergo amputation than the non-smokers. This information is important to note and to relay to patients who continue to smoke while having diabetes.<sup>22</sup> This study was performed to examine the correlations between smoking and/or chronic alcoholism with amputation and longer hospital stay. Our information on patients, smoking habits and alcohol intake was based on their responses. The overall conclusion is that diabetic patients who smoke are more likely to undergo a lower extremity amputation when compared to diabetic non-smokers. This effect is compounded by the concomitant intake of alcohol with worst outcome. Educating patients on the increased risk of amputations with continued smoking and alcoholism may play a role in cessation of the addiction habits. The first step to prevention is patient education. Approximately 85% of lower limb extremity amputations are preceded by non-healing foot ulcers.<sup>23</sup> A high percentage of these problems are preventable by recognizing the major risk factors that lead to diabetic foot ulcer disease and implementing essential measures to prevent these wounds from occurring.<sup>24</sup> The health care providers are crucial in recognizing and discussing the risk factors, initiating preventative measures, and promptly referring the patients to the surgeons for proper wound and surgical management for their patients at risk.<sup>24</sup> Lastly, it is concluded that addiction to smoking and alcohol poses a great threat to the patients with diabetic foot ulcer disease which may be the determinant factors in the ultimate outcome of the disease.

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