

## CORRELATION BETWEEN GLUCATED HEMOGLOBIN (HbA1C) LEVEL AND THE INCIDENCE OF DIABETIC FOOT

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### Background

Diabetes due to the increasing prevalence, frequent complications and higher cost, present in our country and in all over the world a major medical and social problem. It is one among of the major causes of morbidity and mortality. Diabetes complications such as end-stage of renal disease, diabetes gangrene, leg amputations, cardiovascular disease and adverse outcomes of pregnant women with diabetes significantly exacerbate lifeline of our populations and present a heavy financial burden. The costs of Diabetes reimbursable drugs in Albania are about \$ 7 million per year which constitute 12% of the total expenditure of Health Insurance Institute. However the existing Evidence from several studies indicates that the complications of diabetes can be prevented if metabolic parameters of blood glucose maintained continuously in optimal levels.

### Rationale

From numerous studies it has been proven that there is a correlation between the level of HbA1C and the risk of diabetic complications of micro and macroangiopathy. In this context, we evaluated the interest to study the correlation between the percentage of HbA1C and the incidence of diabetic foot which is one of the most dramatic, and more financially costly diabetes complication but as well relatively easy to avoid.

Glycated hemoglobin was identified 40 years ago as a summary indicator of glycaemic balance within a period of 2-3 months, which is the same periode of biological half-life of red blood cells. The HbA1C in our country has been measured since 1980, initially as HbA1 and later as HbA1C which is the most relevant fraction reflecting the glycaemic balance. According to the recommendations, of American Diabetes Association a sustainable level of HbA1C lower than 6.5% is indicative of a very good balance of diabetes, and a predicative factor for prevention of Diabetes long-term complications. This implies that maintaining such levels of HbA1C would be a crucial factor for preventing the occurrence of diabetic foot complications.

Therefore aiming to ensure a better diabetes balance and hopefully to reduce the incidence of diabetic

foot complications we undertook this study along with service of endocrinology in Gjirokastra hospital.

### The objectives of the Study

- 1) To determine the prevalence of diabetic foot complications in patients of the district of Gjirokastra
- 2) To measure the HbA1C level in our diabetes patients group.
- 3) To evaluate the relationship between levels of HbA1C and the presence or not of the diabetic foot.
- 4) To propose recommendations aimed to improve the glycaemic balance in patients with diabetes, and preventing the diabetic foot complications.

### Materials of Study

1. The study included 508 patients with diabetes in the district of Gjirokastra and Tepelena during their periodic visits.
2. In the survey has been analyzed the data on HbA1C levels and the Clinical data related to diabetic foot complications by taking into consideration the clinical diagnostic criteria of neurological, vascular peripheral complications, legs infectious and data related to the age of the patient, type of diabetes etc.
3. Data of HbA1C levels in total of all diabetic patients and separately the HbA1C levels in two diabetic patients groups: with and without diabetic foot symptoms.
4. Tests of HbA1C in the study reflect the situation of glycemic control only in one trimester for each patient (They are performed in private laboratories, and currently not reimbursed).

### Method of the Study

1. The patients were examined clinically by a doctor endocrinologist.
2. The presence or not of diabetic foot symptoms (neural, vascular and infectious) is based on clinical examinations (inspection and filament test).
3. HbA1C Test was carried out by means of the following method:

Venous blood was used with K3EDTA and uses techniques inhibitory agglutinin offered by the firm Bayer DCA 2000 + camera device offers the possibility of electronic caliber and relevant Kitty offers the possibility of determining the value of the total Hb as well as determination of HbA1C fraction.

HbA1c % HbA1c = -----X 100% Total Hb  
Our normal HbA1C values ranging from 4 to 6%. Patients with Hemoglobinopathy have been excluded from the study.

4. Evaluation of correlation between HbA1C level and the quality of glicaeamic balance is based on the table used by the French League of diabetes patients as below (Tab1):.

**Table nr.1. Corresponding to the level of Glycated hemoglobin with average of glicemi level, and the balance of diabetes**

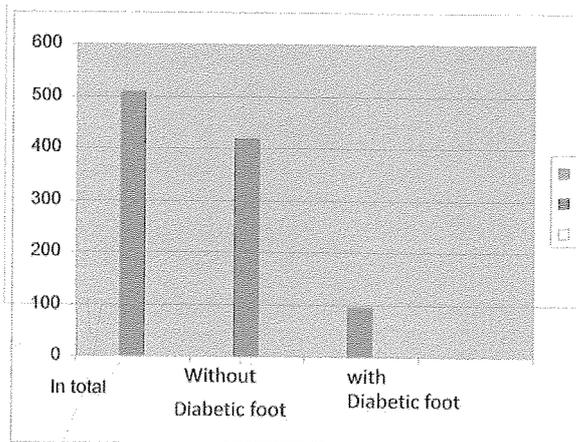
| Balance   | Average of glicemi for last three months | HbA <sub>1</sub> C |
|-----------|--|--------------------|
| Too bad   | 380 mg dl                                | 14%                |
|           | 340 mg dl                                | 13%                |
|           | 310 mg dl                                | 12%                |
| Bad       | 280 mg dl                                | 11%                |
|           | 240 mg dl                                | 10%                |
|           | 210 mg dl                                | 9%                 |
|           | 180 mg dl                                | 8%                 |
| Good      | 140 mg dl                                | 7%                 |
| Very good | 110 mg dl                                | 6%                 |
|           | 80 mg dl                                 | 5%                 |

The study was carried out during 2011 year.

**Results**

1. The average HbA1C in all patients with diabetes (508) in the study resulted 8.46% which present a non satisfied metabolic control. This indicates the need for reevaluation of the treatment regime toward improvement in all our patients with diabetes.
2. Without presence of diabetic foot, complications were resulted 415 patients or 81.7 % of total number of patients in the study. They resulted with an average of HbA1C level 8.1%.
3. With presence of complications of diabetic foot were found 93 patients or 18.3% of all cases. In this sub group the average levels of HbA1C was above 10%.

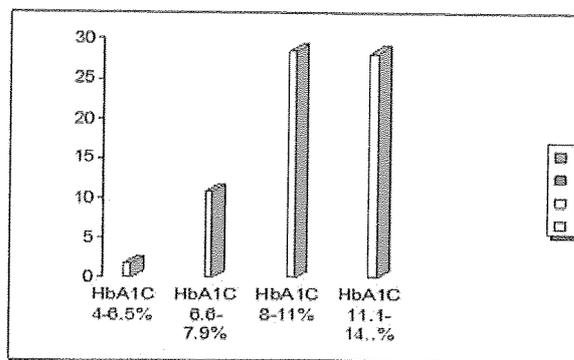
In graphic below are presented the number of total patients, number of patients without diabetic foot, and the number of patients with diabetic foot, resulted from our study (Graph.1):



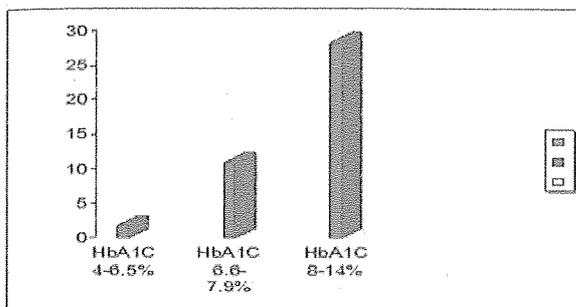
4. In the subgroup of patient with diabetic foot complications the diver's levels of HbA1C has been found a direct relationship with the incidence of diabetic foot complications. The higher level of HbA1C corresponds to higher incidence of diabetes foot as below:

- With HbA1c level 4 - 6.5% were found 117 patients in which only 2 patients were found with diabetic foot complications or **1.7%**.
- With HbA1C 6.6-7.9% was 111 patients where it was found 12 patients with diabetic foot complications or **10.8%**.
- With HbA1C 8-11% were 186 cases, 53 patients were found with diabetic foot complications or **28.49%**.
- With HbA1C 11.1-14% was 94 patients in which were found 26 patient with diabetic foot complication or **27.65%**.

Presented in graphical, results looks as follows (Graph.2):



5. The subgroup of patients with HbA1C level above 8% results had a sharp increase of diabetic foot incidence (Graph.3).



### Conclusions:

1. The incidence of diabetic foot in the district of Gjirokastra is at high levels.
  2. The average level of HbA1C in a significant number of patients is high.
  3. There is a direct relation between high levels of HbA1C and incidence of diabetic foot indicating an ineffective control of the disease.
  4. The HbA1C level higher than 8% of patients with diabetes seems to be a risk indicator for development of diabetic foot complications.
  5. Maintaining constantly at long term the HbA1C levels below 6.5% seem to be positive ensuring indicator for prevention of diabetic foot complications.
  6. The systematic HbA1C measuring every 2-3 months in diabetic patients, helps doctors and patients to prevent or previously diagnose the risk of occurrence of diabetic foot complications.
5. A closer cooperation between patients with diabetes, Family Doctors, Endocrinologist, Medical laboratory staff may help to a better diagnosing, avoiding or minimizing the prevalence of diabetic foot.
  6. Family physicians or General Practitioners should be trained in the prevention and diagnosis of diabetic foot since at the early stages.
  7. Patients with diabetes should be educated and empowered in every visit on special care to avoid incidence of diabetic foot and to treat it at the early stage possible.
  8. In order to help the early detection of peripheral diabetic neuropathies (which is the major cause of diabetes amputations) the skin tests and biothesiometer must be used currently in the clinical practice of diabetes care.
  9. The reimbursement of HbA1C test by Health Insurance Institute (HII) will favor its systematic measurement and a better quality of diabetes care.

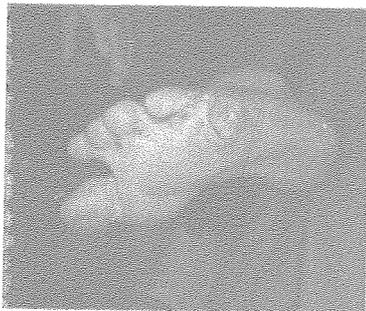
### Recommendations

1. The HbA1C test is necessary to assess the balance of diabetes and as a preliminary

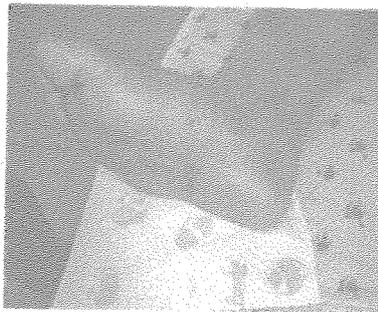
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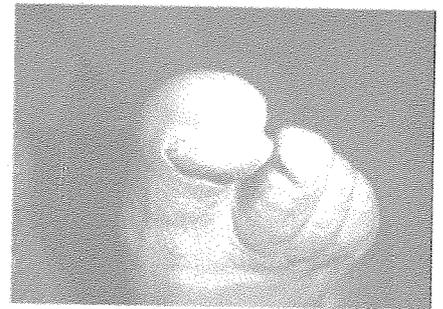
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Mali Perforans (H.B)



Bula



Onychomycosis

#### Infected infected injuries, neuropathy

