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# Podiatric Risk Assessment in Diabetic Patients at University Hospital Center of Point G

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## Abstract

**Introduction:** Diabetes, a chronic pathology, is the source of many acute and chronic complications whose treatment requires many daily constraints that can have a serious impact on the quality of life of the patient and his family. The diabetic foot is a real public health problem which is still dominated by a very high lower limb amputation rate even in countries with high socioeconomic status. The diabetic foot classically results from the association of three entangled mechanisms which are neuropathy, arteriopathy and infection. **Objectives:** To determine the frequency of arterial disease, neuropathy, and other aggravating factors that influence the podiatry risk, and to proceed with the gradation of the podiatry risk. **Methodology:** This was a cross-sectional study concerning the period from July 1 to October 31, 2017, covering all diabetic patients received in consultation and hospitalization in the Internal Medicine Department of the G-University Hospital Center. **Results:** Our study included 50 patients (35 women for 15 men) out of 95 diabetic patients receiving a frequency of 52.6%, with a sex ratio of 0.42. The average age of

our patients was 54.38 ± 13.98 years. Overweight/obesity found in 44% of patients. The average Body Mass Index (BMI) of our patients was 27.16 kg/m$^2$. Patients with diabetes less than 5 years old represented 56% with an average duration of 5.39 ± 5.34 years. The mode of discovery of diabetes was polyuria-polydipsia syndrome in 56% of cases. Type 2 diabetes represented 74% of patients. Among the patients who had performed the HbA1C test, 80.77% were not well balanced. The antecedent of macrosomia in women accounted for 77.1%. Patients who did not know foot hygiene recommendations accounted for 82%. Among the identified podiatry risk factors, diabetic neuropathy accounted for 73.8%, and arterial disease was 32.3%. Grade 1 patients in our study accounted for 52% (gradation of foot risk). **Conclusion:** The diabetic foot is a major public health problem because of its frequency, its direct and indirect cost, and its consequences on the life of diabetic subjects.

## Keywords

Monitoring, Diabetes, Foot, Risk, Mali

## 1. Introduction

WHO predicts that by 2025, the number of diabetics will increase by 170% in developing countries against 41% in developed countries [1].

The diabetic foot is a real public health problem which is still dominated by a very high lower limb amputation rate even in countries with high socioeconomic status [2].

In the department of internal medicine of University Hospital Center of Point G in Bamako (Mali), the foot problem represented 55% of hospitalized diabetics, including 41% of amputation and 5.8% of deaths [3]. The diabetic foot typically results from the combination of three entangled mechanisms that are neuropathy, arterial disease and infection.

However, regardless of the location of the attack also on the foot or hand, ignorance, bad practice and lack of resources make it the stage of osteitis or gangrene that the care is sought by patients or their families.

Given the magnitude of this problem, we began this study on the diabetic foot in the department of internal to assess the podological risk in diabetic patients, and to determine the frequency of arterial disease and diabetic neuropathy.

## 2. Methodology

This was a cross sectional study with a prospective survey of all diabetic patients received in consultation and hospitalization during the period of 1 July 2017 to 31 October 2017 in the Internal Medicine Department of the G-University Hospital Center.

Included in our study were all diabetic patients aged 15 years and older who

had been admitted to the Department of Internal Medicine during the study period and who had accepted.

The sampling was exhaustive and the data were collected on a pre-established individual survey form addressed to patients who were admitted to a consultation or hospitalization by a trained investigator.

The questionnaire was pre-tested and validated before its uses in the study.

Each patient was inquired for the collection of epidemiological data, a clinical examination measuring anthropometric parameters; appreciating the state of staining of the integuments, the lesions and deformations of the foot, the palpation of the pedal and posterior tibial pulses, the tuning fork and the mono-filament tests.

Recent paraclinical assessments less than three months old were collected systematically, others according to the clinical symptomatology: complete lipid balance, creatinine, micro albuminuria, glycated hemoglobin (HbA1c), Doppler echography cardiac, electrocardiogram, Doppler ultrasound of the lower limbs, the funduscopy.

Operational definition:

Glycemic balance: HbA1c: <7% = Good balance

HbA1c: >7% = poor balance

Patients' feet will be graded according to ALFEDIAM gradation.

Grade 0: No neuropathy No arterial disease, possibility of non-specific deformity;

Grade 1: Isolated insensitive foot;

Grade 2: Neuropathy + arterial disease and/or deformity of the foot;

Grade 3: History of amputation or ulceration of more than 3 months.

The data was entered and analyzed on the SPSS version 22.0 statistical software after their verification. The continuity correction and the Fisher exact test were used for the comparison of the proportions with a significance level at 5%.

## 3. Results

Our study included 50 patients (35 women for 15 men) out of 95 diabetic patients received a frequency of 52.6%.

The average age of our patients was 54.38 ± 13.98 years.

The sex ratio was 0.42 (Table 1).

In our study, 44% of patients were overweight or obese (Table 1).

Patients with diabetes less than 5 years of age accounted for 56% with an average duration of 5.39 ± 5.34 years.

The mode of discovery of diabetes polyuria syndrome represented 56% of the cases.

Type 2 diabetes accounted for 74% of patients. In our study, among the patients who had performed the HbA1c assay, 80.77% were not well balanced.

In our sample, patients who did not know foot hygiene recommendations ac-

counted for 82%.

Diabetic neuropathy accounted for 73.8% of podiatry risk factors.

Arteriopathy was found in 32.3% of patients who developed macroangiopathy.

Grade 1 patients at risk of foot accounted for 52% (Table 1).

We found a significant link between the duration of diabetes progression and sensory neuropathy (p = 0.012) (Table 2).

A significant link was found between dyslipidemia and sensory neuropathy (p = 0.026) (Table 3).

In our study, we found a significant link between glycemic imbalance and diabetic neuropathy (p = 0.034) (Table 4).

There is no significant relationship between the duration of diabetes progression and lower extremity arterial disease in diabetic patients (p = 0.488).

Table 1. Distribution according to demographic data, BMI and podiatry risk gradation according to ALFEDIAM.

| Gender | Numbers | (%) |
|---|---|---|
| Male | 15 | 30.0 |
| Female | 35 | 70.0 |
| **BIM** | | |
| <18.5 | 4 | 8.0 |
| [18.5 - 24.9] | 24 | 48.0 |
| [25 - 29.9] | 8 | 16.0 |
| [30 - 40] | 9 | 18.0 |
| >40 | 5 | 10.0 |
| **GRADE** | | |
| Grade 0 | 11 | 22.0 |
| Grade 1 | 26 | 52.0 |
| Grade 2 | 3 | 6.0 |
| Grade 3 | 10 | 20.0 |

Sex ratio = 0.42.

Table 2. Distribution according to diabetic neuropathy and the duration of evolution of diabetes.

| Duration of evolution of diabetes | Diabetic sensory neuropathy | | Total (%) |
|---|---|---|---|
| | Yes (%) | No (%) | |
| Less than 5 years | 16 (55.2) | 13 (44.8) | 29 (58.0) |
| [5 to 10 years] | 7 (70) | 3 (30) | 10 (20.0) |
| 10 years and over | 11 (100) | 0 (0) | 11 (22.0) |
| **Total** | **31 (62)** | **19 (38)** | **50 (100.0)** |

Table 3. Distribution by diabetic neuropathy and cardiovascular risk factors.

| Riskfactors | Diabetic sensory neuropathy | | Total (%) | P |
|---|---|---|---|---|
| | Yes (%) | No (%) | | |
| Dyslipidemia | 28 (73.7) | 10 (26.3) | 38 (56.0) | 0.026 |
| Hypertension | 22 (73.3) | 8 (26.7) | 30 (20.0) | 0.754 |
| Ulcer ATCD + 3 months | 9 (69.2) | 4 (30.8) | 13 (24.0) | 1.000 |
| Tobacco | 8 (72.7) | 3 (27.3) | 11 (22.0) | 1.000 |
| History of amputation | 5 (83.3) | 1 (16.7) | 6 (12.0) | 0.654 |
| Poor venous condition | 2 (66.7) | 1 (33.3) | 3 (6.0) | 1.000 |
| Alcolol | 1 (50) | 1 (50) | 2 (4.0) | 0.514 |

Table 4. Distribution according to diabetic neuropathy and HbA1c level.

| Last HbA1c | Diabetic sensory neuropathy | | Total (%) |
|---|---|---|---|
| | Yes (%) | No (%) | |
| <7% | 1 (5.8) | 4 (94.2) | 5 (10.0) |
| >7% | 16 (94.12) | 5 (5.88) | 21 (24.0) |
| Total | 17 (65.4) | 9 (34.6) | 26 (100.0) |

Exact Fisher test = 2.404; p = 0.034. The minimum theoretical strength is 1731.

## 4. Discussion

Limitations of our study: during the study we encountered some difficulties among which:

* Economic reasons: not all paraclinical assessments have been performed by all patients;
* The weak sample of our study.

Our study included 50 patients (15 men for 35 women) with a sex ratio of 0.42. This result is comparable to those of Drago [4] who found a sex ratio of 0.36; however it is different from that of Rose [5] who found a sex ratio of 2.47.

The average age of our patients was 54.38 ± 13.98 years. This result is comparable to that of Drago [4] and Rose [5] who respectively found an average age of 53.03 ± 11.75 years and 66.90 years.

Forty-four percent (44%) of the patients were overweight/obese. This result is lower than that of Drago [4] who found 58.2%. The average BMI of our patients was 27.16 kg/m$^2$. This result is lower than that of Rose [5] and Matthieu [6] who found respectively an average of 30.11 kg/m$^2$ and 30.03 kg/m$^2$. Our results are consistent with data from the literature that showed a link between diabetes (especially type 2 diabetes) and overweight/obesity [7].

Patients whose diabetes had evolved for less than 5 years represented 56% with an average duration of 5.39 ± 5.34 years. Our result is comparable to that of Drago [4] who found 65.5%.However it is lower than that of Matthew [6] who found an average duration of 16 ± 10.2 years. This difference could be explained by the late treatment and management of diabetes in Bamako [7].

In our study, among the patients who had performed the HbA1c assay, 80.77% were not well balanced. This result is higher than those obtained by Drago [4] and Rose [5] who found respectively 58.12% and 64%. This difference could be explained by the non-observance of certain patients, the financial reasons or the denial of the disease.

In our sample, patients who did not know foot hygiene recommendations were 82%. This result is different from that of Drago [4], who found that 34.1% of patients did not have a good knowledge of foot hygiene recommendations. This difference could be explained by the fact that the diabetic education sessions in the internal medicine unit of the University Hospital Center of Point G mainly take into account only hospitalized patients.

Among podiatric risk factors, diabetic neuropathy accounted for 73.8%. This result is comparable to those obtained by Rose [5] and Drago [4] who found respectively 63% and 67.7%.

Amongthe patients who have developed macroangiopathy, 32.3% presented with arteriopathy.

This result is comparable to that found by Hamdi *et al.* 21.4% [8].

Grade 1 patients in our study accounted for 52%. This result differs from those found by Drago [4] and Matthieu [6] who regained a predominance of grade 0, *i.e.* 70.30% and 44% respectively of the sample. This difference could be explained by the fact that the diabetic education sessions set up by the service take into account practically only inpatients.

A significant link was found between dyslipidemia and sensory neuropathy ($p = 0.026$). Drago [4] in his study had found a comparable result ($p = 0.03$).

We found a significant link between the duration of diabetes progression and sensory neuropathy ($p = 0.012$). This result is comparable to that of Drago [4] ($p = 0.005$).

In our sample, we did not find a significant link between the age of diabetic patients and sensory neuropathy. This result is different from that of Drago [4] who found a significant link ($p = 0001$). This difference could be explained by the small size of our sample.

We found a significant link between glycemic imbalance and diabetic neuropathy ($p = 0.0173$). Our result is comparable to that of Drago [4] ($p = 0.002$).

We found a significant link between the duration of diabetes progression and arterial disease of the lower limbs in diabetic patients ($p = 0.0219$). Our result is comparable to that of Drago [4] ($p = 0.002$).

There is no significant relationship between the duration of diabetes progression and lower extremity arterial disease in diabetic patients ($p = 0.488$). Our result is different from that of Drago [4] ($p = 0.002$).

## 5. Conclusion

Diabetic neuropathy and arterial disease are the predominant podiatric risk factors in the Department of Internal Medicine at the University Hospital Center of

Point G. The increasing incidence of diabetes worldwide continues to lead to a parallel rise in disabling and potentially fatal complications. Those that touch the foot are among the most feared and should be more monitor for better prevention of podiatry risk.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

## References

[1] King, H., Aubert, R.E. and Herman, W.H. (1998) Global Burden of Diabetes. 1992-2025: Prevalence, Numerical Estimation and Projection. *Diabetes Care*, **21**, 1414-1431. https://doi.org/10.2337/diacare.21.9.1414

[2] Mayfield, J.A., Reiber, G.E., Sanders, L.J., Janisse, D. and Pogach, L.M. (1998) Preventive Foot Care in People with Diabetes. *Diabetes Care*, **21**, 2161-2177. https://doi.org/10.2337/diacare.21.12.2161

[3] Sidibé, A.T., Minta, D.K., Dembelé, M., Diarra, A.S. and Traoré H.A. (2006) Pied diabétique en médecine interne de l'hôpital du Point "G". *La Revue de Médecine Interne*, **8**, 14-17.

[4] Aphou, D. (2011) Identification du risque podologique chez les patients diabétiques du centre de santé de référence de la commune I du district de Bamako. Thèse, Faculté de Médecine et d'Odontostomatologie, Bamako, p. 75.

[5] Yoan, R. (2014) Pied diabétique et vulnérabilité sociale. Thèse, Faculté de médecine Henri Warembourg, Lille, p. 5.

[6] Matthieu, J. (2014) Evaluation de l'apport d'un réseau dans la prévention du pied diabétique: bilan de l'action "pied diabétique" menée par le réseau diabcoeur en 2004. Thèse, Université de LORRAINE, Faculté de médecine, Nancy, p. 11.

[7] Touré, A.A. (1997) Traitement chirurgical des complications infectieuses des os et des parties molles chez les diabétiques et de l'artériopathie diabétique—Le diabète EPU. Société Médicale du Mali, 1-10.

[8] Hamdi, S., Mahjoub, F., Fennira, E., Gammoudi, A., Sallem, K. and Sébai, I. (2016) Dépistage des diabétiques à risque d'ulcère du pied. *Communications Affichées*, **42**, a60. http://www.emconsulte.com https://doi.org/10.1016/S1262-3636(16)30223-3

## Annexes

Investigation sheet

No. of the survey sheet: .....................

I) Identification

Q1: Date of consultation: ...... / ......... / .........

Q2: Name and surname: ................................................................

Q3: Sex: / ......... / 1 = Masculine; 2 = Female

Q4: Age (years): / ......... /

Q5: Ethnicity: /........./ 1 = Bambara; 2 = Sarakole, 3 = Soniké, 4 = Dogon, 5 = Peulh, 6 = Sonrai, 7 = Bozo, 8 = Others

If (8), specify .........................

Q6: Nationality: / ...... / 1 = Malian; 2 = Non-Malian

Q7: Profession / ......... /

1. Housewife; 2. Worker; 3. Official; 4. Studen; 5. High frame; 6. Unemployed; 7.Other

If other (7), Specify: ........................................

Q8: Residence: / ........../ 1 = Bamako, 2 = Outside Bamako, 3 = Outside Mali

Q9: Level of education: / ......... /

1: Primary; 2: Secondary; 3: Higher; 4: Illiterate; 5: Others

If Other (5) Specify: ........................................

II) The parameters

Q10: Anthropometric values measured on the day of the survey by the investigator

Weight: ............ Kg; Hip circumference: .................. cm

Size: ......... cm; Waist: ............ cm; RTH: ..................

IMC: / ......... /

Q11: Are you hypertensive? / ......... / 1. Yes; 2. No

If yes, last measurement done by TA investigator (mm hg): / ......... /

If yes treated by antihypertensive: / ......... /1. Yes; 2. No

If yes medicine (s) ..........................................

III) Data on the disease (diabetes)

Q12: Duration of diabetes discovery (in years): / ......... /

Q13: Discovery mode: / ......... / 1 = Fortuit; 2 = Polyuropolydyps in syndrome; 3 = Complications; 4 = Other

If other (4) Specify .........................................................

Q14: Type of diabetes: / ......... /

1 = Type I 2 = Type II; 3 = Secondary; 4 = Gestational

Q15: Personal history: Macrosomia for women: / ......... /

1. Yes; 2. No; 3. Do not remember

Q16: Family history of diabetes: / ......... / 1. Yes; 2. No

Q17: How long have you been treated by a doctor? /........./years)

Q18: Drug treatment of diabetes / ......... / 1.Yes; 2. No

Q19: IF yes how long? /........./ years

Q20: What kind of treatment? / ......... /

1 = Insulin; 2 = Oral antidiabetic drugs; 3 = both; 4 = Single diet

Q21: Last HbA1c level: / ......... /%

Q22: As part of the care of the feet there are rules to follow meticulously:

- Quote 3 Things to do:

1 ...............................................

2 ...............................................

3 ...............................................

- Quote 3 Things to avoid:

1 ...............................................

2 ...............................................

3 ...............................................

- Name 3 Situations where you will need to see a doctor:

1 ...............................................

2 ...............................................

3 ...............................................

Q25: Do you practice the self examination of the feet? / ......... / 1. Yes; 2. No

If so, how often ? / ......... /

1. Every day; 2. 3 times/week; 3. 1 time/week

4. 1 time/month 5. Less than 1 time/month

Q26: Do you know the recommendations for foot hygiene?

/ ......... / 1. Yes; 2. No

If so why ?............................................. ..............

Q27: Cardiovascular and other risk factors:

• Tobacco • Alcohol • Dyslipidemia

• History of amputation of a limb or part of the limb

• Antecedent ulcer lasting more than 3 months

Venous condition: / ......... / 1. Good; 2. Bad

If (2) specify ..................................

Q28: Summary of Complications

- Macro angiopathy

• Hypertension • Coronary artery disease • Stroke/Ait

• Arteritis • AOMI

- Microangiopathy

• Diabetic nephropathy • Diabetic retinopathy

• Cataract • Glaucoma

Peripheralneuropathy

Pain / ......... / 1. Yes; 2. No

Tube test Hot and cold / ......... / 1. Positive; 2. Negative

- Tuning test / ......... / 1. Positive; 2. Negative

- Monofilament test: / ......... / 1. Positive; 2. Negative

(On each orange zone of the foot note by a (−) if hypoesthesia or anesthesia of the zone and by a (+) if normal sensitivity)

- Sensorimotor
  - Flat foot • Hammer toe
  - Joint stiffness • Foot of Charcot
- Autonomic neuropathy
  - Sweating Disorder • Dagger Disorder
  - Hyperkeratosis • Skin atrophy • Local heat
- Lesions of the foot (the day of the survey)
  - Ulceration • Gangrene • Athlete's foot
  - Wound • Crack • Crevice
  - Durillon • Cracks

Q29: Gradation of the foot: / ......... /

1. Grade 0; 2. Grade 1; 3. Grade 2; 4. Grade 3