Quantification & scaling of risk factors of diabetes mellitus and isolation of microorganisms from diabetic foot ulcer: a cross sectional study

Rinky Sharma

Roll No. 0119/12

Registration No. 739

Session: 2019-2020

A thesis submitted in the partial fulfillment of the requirements for the degree of Masters in Public Health

One Health Institute

Chattogram Veterinary and Animal Sciences University, Chattogram-4225, Bangladesh

January 2021

Authorization

I hereby declare that I am the sole author of the thesis. I also authorize the Chattogram Veterinary and Animal Sciences University (CVASU) to lend this thesis to other institutions or individuals for the purpose of scholarly research. I further authorize the CVASU to reproduce the thesis by photocopying or by other means, in total or in part, at the request of other institutions or individuals for the purpose of scholarly research.

I, the undersigned, and author of this work, declare that the electronic copy of this thesis provided to the CVASU Library, is an accurate copy of the print thesis submitted, within the limits of the technology available.

…….

Rinky Sharma

Quantification & scaling of risk factors of diabetes mellitus and isolation of microorganisms from diabetic foot ulcer: a cross sectional study

Rinky Sharma

Roll No. 0119/12

Registration No. 739

Session: 2019-2020

This is to certify that we have examined the above Master's thesis and have found that is complete and satisfactory in all respects, and that all revisions required by the thesis examination committee have been made.

Prof. Dr.Abdul Ahad
(Supervisor)

Dr. Mohammad Asif Khan
(Co-supervisor)

Prof. Dr. Sharmin Chowdhury

Chairman of the Examination Committee and

Director, One Health Institute

One Health Institute

Chattogram Veterinary and Animal Sciences University
Khulshi, Chattogram-4225, Bangladesh

January 2021

Acknowledgement

All praise to Almighty who controls everything according to His will. I am deeply indebted and highly grateful to my respected teacher and supervisor **Prof. Dr. Abdul Ahad**, Dean and Convenor of the Dean Council, Faculty of Veterinary Medicine, Chattogram Veterinary and Animal Sciences University, Chattogram for his constructive criticism and encouragement in every stage of my work like a mentor for excellence. I am also expressing special respect and gratitude to my respected teacher **Prof. Dr. Sharmin Chowdhury**, Director, One Health Institute for her valuable suggestion to complete the thesis work in time with a remarkable quality.

My sincere obeisance to my mother Sumita Sharma and my father Subal Sharma to guide me in a proper way of my life. My special gratitude to Dr. Mohammad Asif Khan, Deputy Civil Surgeon, Chattogram for his cordial guidance, inspiration to peruse carrier in Public Health and for his mentoring to develop networking with public health communities. Furthermore I am also grateful to him due to his valuable opinion to complete the thesis in time.

I am truly thankful to, Deputy Director, Chattogram Diabetic General Hospital, Chattogram; Dr. Shireen Afroz, Consultant, Department of Endocrinology, Chattogram Diabetic General Hospital, Chattogram; Orthopaedic surgeons and other staffs were working in laboratory of Chattogram Diabetic General Hospital, Chattogram for their kind co-operation, sharing their experience and suggestion during the research work. I would like to thank all the Participants participated in this study, in spite of their distress, for their cooperation that made this work possible. I would like to express my gratefulness to all my MPH fellows specially Dr. Jahan Ara for their extended support. I also would like to express my gratefulness to all faculties of One Health Institute, Chattogram Veterinary and Animal Sciences University for their kind efforts.

Last but not the least, I express my sincere admiration to my younger sister Dipta, my elder sister Pinky, elder brother Athanu and friends who have kept me always in line with their continuous company and moral support, also had to suffer a lot during the study period due to my unavailability in their lives.

…….

Dr. Rinky Sharma

Table for Contents

Authorization **ii**

Acknowledgement **iv**

List of Tables **vi**

List of figures **vii**

Abstract **viii**

Chapter-1: Introduction **1-3**

1.1. Introduction **1-2**

1.2. Objectives **3**

Chapter-2: Review of Literature **4-17**

2.1. Gender based prevalence of diabetic foot **4**

2.2. Diabetes mellitus as a public health concern **4**

2.2.1. Epidemiology of diabetes mellitus **4**

2.2.2. Burden of Diabetes mellitus in community **5**

2.2.3. Burden of Diabetes mellitus in a global scale **6**

2.2.3.1. Burden of Diabetes mellitus in gulf **6**

2.2.3.2. Burden of Diabetes mellitus in Asia **7**

2.2.3.3. Burden of Diabetes mellitus in Latin America **8**

2.3. Foot ulcers as a complication of diabetes mellitus: Bangladesh Perspective **8**

2.3.1. Prevalence of foot ulcers in Bangladesh **8**

2.3.2. Gender based difference in ulcerative complications **9**

2.3.3. Sequels of ulcerative complications **10**

2.4. Organisms associated with diabetic foot ulcers **11**

2.4.1. Overview on ulcer causing organisms **11**

2.4.2. Methods of collecting samples from ulcer wounds **11**

2.5. Sensitivity of ulcer causing organisms **12**

2.5.1. Overview on concepts related to sensitivity testing **12**

2.5.2. Concerns related to sensitivity testing **13**

2.5.3. Colonization of organisms 13
Chapater-3: Materials and Methods 15-22
3.1. Study design 15
3.2. Study period 15
3.3. Place of the study 15
3.4. Reference Population 16
3.5. Source population 16
3.6. Sample size 16
3.7. Selection criteria 16
3.8. Sampling technique 16
3.9. Research Instrument 16
3.10. Data collection tool 17
3.11. Data Processing and analysis 17
3.12. Ethical considerations 17
3.13. Study procedure 18
3.14. Bacterial Isolation 19
3.14.1 .Sample collection procedure 19
3.14.2. Microscopic study by staining method 20
3.14.3. Bacteriological Investigation 21
3.15.Study flow 21
3.16. Study Variables 22
3.16.1. General variables 22
3.16.2. Specific variables 22
Chapter- 4: Results 28-44
Chapter-5: Discussion 45-53
Chapter-6: Conclusions 54-55
6.1. Conclusions 54
6.2. Limitations of the study 54
Chapter-7: Recommendations and Future perspectives 56
References 57-60

Chapter – 8: Appendices **61-67**
Appendix A: Schedule of works **61**
Appendix B: Informed Consent form (English Version) **62**
Appendix B: Informed Consent form (Bengali Version) **63**
Appendix C: Questionnaire **64-67**
Brief biography **68**

List of Tables

Table 1.1 Grading of ulcers in different age groups **25**
Table 1.2 Grading of ulcers in male and female participants **26**
Table 1.3 Grading of ulcers among patients involve with different occupations background with various socioeconomic status **27**
Table 1.4 Relation between educational status with grading of ulcer **29**
Table 1.5 Type of treatment was followed in diabetic patients **32**
Table 1.6 Physical activity associated with grading of ulcer **33**
Table 1.7 Harmful personal habits in grading of ulcer **34**
Table 1.8 Association between Knowledge and practice with Grading of ulcer **35**
Table 1.9 Frequency distribution of DSS score (n=106) **36**
Table 1.10 Descriptive values of risk factors among the respondents (n=106) **37**

List of Figures

Figure 1.1 Different grades of diabetic foot ulcers **19**

Figure 1.2 Distribution of grading of ulcers **24**

Figure 1.3 Habitants of the participants **28**

Figure 1.4 Growth of organisms in ulcers **30**

Figure 1.5 Growth of different organisms in ulcers **31**

Figure 1.6 Level of diabetes sensitivity of the respondents (n=106) **37**

Figure 1.7 Co-morbidities among patients **38**

Figure 1.8 Complications found in patients **38**

Figure 1.9 Antibiotic sensitivity of *Pseudomonas* observed in ulcer samples **39**

Figure 1.10 Antibiotic sensitivity of *Klebsiella* observed in ulcer samples **40**

Figure 1.11 Antibiotic sensitivity of *E. Coli* observed in ulcer samples **41**

Figure 1.12 Antibiotic sensitivity of *Coliform* observed in ulcer samples **42**

Figure 1.13 Antibiotic sensitivity of *Enterococcus* observed in ulcer samples **43**

Figure 1.14 Antibiotic sensitivity of *Staphylococcus* observed in ulcer samples **44**

Abstract

Diabetes mellitus (DM) is a chronic noncommunicable disease (CNCD) and a leading global health problem. In the last few decades, especially in the developing world, diabetes is the fourth leading cause of deaths. The prevalence of diabetes in Bangladesh is increasing rapidly, as well as complications of chronic diabetes. Diabetic foot is one of the most serious complications associated with diabetes and affects quality of life among patients in all ages and races. The study is aimed at identifying the risk factors & complications of DM and isolate microorganisms from diabetic foot ulcer. In addition, we tried to see the antibiotic sensitivity of the microorganisms along with identifying the antibiotic resistant genes. This is a cross sectional study and was performed among patients of Chattogram Diabetic General Hospital, Chattogram and responses from 106 cases on general and specific variables were documented. Data was collected with predesigned questionnaire along with random blood glucose measurement using glucometer. Sample was taken from diabetic foot ulcer. Microbial culture and CS test was conducted. Out of 106 patients, most were having an age more than 59 years (40; 37.70%) followed by the age group having 55-59 years of age (18; 17.00%) while the lowest number of patients were from the relatively younger age having an age less than 35 years (2; 1.90%). A total of six microorganisms were found in culture. *Staphylococcus* was the most prevalent organism causing the foot ulcers in diabetic patients (28; 26.40%) followed by *coliform*s (16; 15.10%), *Klebsiella* (12; 11.30%), *Enterococcus* (10; 9.40%), *Pseudomonas* and *E. Coli* (8; 7.50%). We have found that gram positive bacteria both *Staphylococcus* and *Enterococcus* 100% sensitive to only Tigecycline among 18 antibiotics alternatively *Enterococcus* showed 100 % resistant to Cefuroxime, Erythromycin and Oxacillin. Among gram negative bacteria, *E. coli* showed 100% sensitive to Colistin, Cefepime, Imipenem, Levofloxacin, Tigecycline in addition *Klebsiella* showed 100% sensitive to Colistin only.

To better understand the risk of the diabetes mellitus and proper management of diabetic foot ulcer the data will be helpful in prescribing appropriate antibiotics, reducing hospital stay, preventing major surgical interventions and thereby saving resources.