

Computerization of paper based Glaucoma strategy
And
Update of “Patient Information System” developed by Dr. Lesya Shuba

by
Mir Kabir
B00432221
mir.kabir@dal.ca

Performed at the department of Ophthalmology
Victoria General Hospital
Halifax, Nova Scotia

Internship period May 10 – August 10, 2006
And Jan 03- Mar 30 (as extension)

Date: March 1st, 2007

This internship is the requirements of the Master of Health Informatics Program,
Dalhousie University

Acknowledgement and Endorsement

The author would like to thank to Dr. Raymond LeBlanc, an eminent Senior Canadian Ophthalmologist and Glaucoma specialist for providing me the opportunity to work on “Computerization of Glaucoma Algorithm” and his consisted advices and support for this project.

The author would like to thank Dr. Lesya Shuba, an ophthalmologist of Q-2 hospital for providing me an opportunity to work with the patient database.

My profound thanks go to Prof. Raza Abidi Director, MHI program for providing me Dr. LeBlanc’s contact address and for providing me an extension to complete this project successfully.

The author acknowledged to Zeeshan Farooq, a recent graduate of CS department for helping me to learn programming language and providing me useful resources whenever required.

The author acknowledged to Shapoor Shayegani, a MHI student for helping me to learn Adobe Photoshop tool.

The author would also like to thank the people who have clarified my thinking in the process of completing this project successfully.

Executive summary

Dr. Raymond P LeBlanc is an eminent Senior Canadian Ophthalmologist, Glaucoma specialist. He is a visionary person. On my request and interest he provided me a work opportunity to computerize the paper based “Glaucoma algorithm” which ophthalmologists usually follow during their practice as a guideline during decision making process.

My role in this internship is to design the ‘computer version of the Glaucoma Algorithm’, code the program, development of the deployment version of that program, to test the program in different computer configuration, demonstration that program and to prepare a deliverable copy for the employer. Also, workflow analysis of the ophthalmology department to recommend how to use the computerized version of algorithm in that work flow.

After thoroughly reviewing the current workflow and scope of the project, the author split the project into four components. 1.Design 2.Coding 3.Feedback from employer 4.Testing 5.Prepare the final product along with user information. The paper based model was break down according to algorithm. For example: Algorithm 1, Algorithm 2a, Algorithm 2b etc. Information of each algorithm was organized according to expected user interfaces

The next step was code the model to make it executable. Though the author didn’t have any skill on any programming language, he took the challenge to code the program by himself. The author started learning Java and then switches to VB.net.

After coding the author tested this application on different computer considering the end user of “Glaucoma Algorithm” can be different person and configuration of their computers will be variable in term of resolution of the screen, monitor size and technical environment.

The author tested the application in law computer lab, engineering campus lab and the application was executed in all different computers with expected output.

Overall the main challenge the author faced in every step that lack of learning support specifically for the technical part of my work. When he got stuck with coding and with other issues, no one was there to help him. Even in learning center, no tutor could help him for VB.net. Naturally the author had to spent time to find the solution by himself.

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1. Introduction

The Canadian Glaucoma Strategy is a paper based Glaucoma management Guideline which is designed to provide a concise and practical guide to glaucoma management in Canada. It highlights current standards of practice and is intended to supplement existing guidelines.1-4 The Strategy allows physicians to use their clinical judgment to route patients through five algorithms that represent the key stages of glaucoma management.

But using this guideline during real work time is cumbersome. It was assumed that computerization of this guideline will allow the ophthalmologist and optometrist to use this guideline in the real work time in a relatively easier way and maintaining standard of their practice.

2. Background of internship

As per his interest, the author was looking for an internship opportunity in knowledge management area such as computerization of CPG, developing of CDSS and/or related issue. Having contact address (for internship) from professor Abidi, the author contact with Prof. Raymond LeBlance, an ophthalmologist of Q-2 hospital.

Professor Raymond LeBlanc (now promoted to executive Vice president, Capital health district) a visionary ophthalmologist and on author's request and interest he provided me a work opportunity to computerize the paper based "Glaucoma algorithm" which ophthalmologists usually follow during their practice as a guideline during decision making process. He was convinced to provide me this (internship) opportunity to start moving forward toward using technology in their practice and/or to see the outcome of this kind of work though Q-2 hospital doesn't have the infrastructure to use this type of decision support application.

So this type of work new to both of them (the author and employer).

3. Reporting person

Dr. Raymond LeBlanc

4. Employer details- Dr. Raymond LeBlanc

Dr. Raymond P LeBlanc is an eminent Senior Canadian Ophthalmologist and Glaucoma specialist. Following his tenure at McGill University and at the University of Sherbrooke, he headed the Department of Ophthalmology & Visual Sciences at Dalhousie University and was Chief of the Capital Health District Ophthalmology Department in Halifax, NS. from 1979 to 2003, and remained active in clinical care and research as part of the Eye Care Centre Glaucoma team until August 2006. In September, Dr LeBlanc was named to the position of Vice President Research and Academic Affairs for the Capital Health District Authority in Halifax

A dynamic clinician scientist who has lectured across Canada and in many parts of the world, Dr. LeBlanc has published over 60 peer-reviewed articles and several book chapters. He has championed vision research at Dalhousie through a strong collaboration with a team of dedicated PhDs and clinician-scientists in the department. He has been the recipient of continuous research grants from the Canadian Institute of Health Research, the Dalhousie Medical Research Foundation, the Camp Hill Medical Research Fund, the Queen Elizabeth II Health Sciences Centre, and the E.A. Baker Foundation for the Prevention of Blindness, among other organizations.

Dr. LeBlanc has been active in many national and international organizations, often in a founding or leadership role. His recent position as Chair of the National Coalition for Vision Health reflects his ongoing commitment to improved vision health for all Canadians. His initiative in promoting and developing an integrated vision care model for the Province of Nova Scotia has demonstrated his strong commitment to patient care. This model is currently at the vanguard of vision care reform and addresses accessibility issues in an innovative manner.

One of the highlights of Dr. LeBlanc's career has been the development [1979] of and then later [1998] the expansion and relocation of the QE II Eye Care Centre. This modern clinical care, education, and research facility offers all levels of care and serves as the primary teaching environment for the Dalhousie post-graduate training program. Teaming this clinical facility with the Retina and Optic Nerve Research Laboratory (where a team of 5 PhDs and 20 post-doctoral researchers and students carry out leading edge research), and the Vision Care Centre at the IWK Children's Health Centre, has allowed Dalhousie's

Vision Care Team to become leaders in vision research in Canada. The Department currently has two research chairs funded and 2 more are expected within the next 24 months.

Dr LeBlanc's recent investiture as a member of the Order of Canada is a testimony to his broad perspectives in dealing with Vision Health issues in Canada. "I see this nomination as validating our collective efforts to improve vision health and I received the honor on behalf of the whole group of dedicated collaborators over the years"

5. Work Performed for the internship

5.1. Description and Role

The author's role in this internship is to design the 'computer version of the Glaucoma Algorithm', code the program, development of the deployment version of that program, to test the program in different computer configuration, demonstration that program and to prepare a deliverable copy for the employer. Also, workflow analysis of the ophthalmology department to recommend how to use the computerized version of algorithm in that work flow.

In second assignment, the author was asked to "redesign current patient data entry form" and to develop an 'automated referral report' format based on the database maintain by Dr. Lesya Shuba.

5.2. Understanding current workflow- Ophthalmology department

As required for planning, the author was needed to understand the current workflow of the ophthalmology department and how and up to what extent paper based "Glaucoma Algorithm" was used. For that, there were demonstration meetings with Dr LeBlanc. He demonstrated the author in details all the steps of how patient of ophthalmology department was scheduled, registered, examined and managed and how the patient information was shared by different department (ex: laboratory). Also, how often they use paper based "Glaucoma Algorithm".

5.2.1. Current work flow

The ophthalmology department maintains a paper based patient chart to collect and maintain patient medical information. Only the images are stored in central database

system. Ophthalmologists have access to this data base using password. On the appointment day,

1. Patient is registered in reception desk. Computerized scheduling database is used for that.
2. Patient first examined by a technician in the department. He/She filled the information about past history, systemic, and ocular medication, IOP etc and records the data on a paper based form.
3. The patient is then transferred to ophthalmologist. On examination, ophthalmologist collects data on diagnosis, Gonioscopy examination, slit lamp examination, visual field examination, Optic nerve examination and records these data on that paper base form. When required, patient's previous history is retrieved manually from the chart. But images are stored in central computerized system and ophthalmologist has access to that database using password. Any investigation request or management advice is done on paper based.
4. Secretary filled the requisition/referral form on paper based. Collect information from computerized scheduling system.
5. Then investigation requisition is sent to the concerning department usually by fax or manually.
6. The investigation departments have their own scheduling system. After receiving the requisition, they contact with the patient and fixed a schedule to perform the required investigation.
7. The investigation report is documented on paper is sent manually to the referring ophthalmologist. The report is saved in the patient chart along with other documents.
8. The secretary of the ophthalmology department then contact with the patient for follow up visit.
9. On the scheduled day returning patient is again examined and follow up data is recorded manually on paper. Advices are given on paper.

5.2.2. Using paper based algorithm during current workflow

In the current work flow paper based “Glaucoma Algorithm” can be kept as handy, but it was observed that ophthalmologist don’t use this tool regularly. The reasons are, relatively difficult to use that tool at the point of care. User friendliness might be another reason.

5.3. Planning

After thoroughly reviewing the current workflow and scope of the project, the author split the project into four components.

1. Design
2. Coding
3. Feedback from employer
4. Testing
5. Prepare the final product

5.4. Implementation of planning

5.4.1 Design

Considering the information seeking behavior of doctors and maintaining the original paper based algorithm, this tool was designed to keep it simple and users’ friendly. Microsoft power point was used to design all the interfaces of this tool. The tool was break down according to algorithm. For example: Algorithm 1, Algorithm 2a, Algorithm 2b etc. Information of each algorithm was organized according to expected user interfaces. Link was created to go one page to another. Graphics are used as per requirements.

When initial designed was done the proposed model was reviewed by Dr. LeBlanc. His advices and comments were put into the model. Then the revised version was again reviewed by Dr. LeBlanc. After checking thoroughly a model was finalized.

5.4.1.1 Challenges and solution

The only challenge the author face during designing face was to keep track of interfaces. When design was completed, the tool became almost 20 interface pages. Some of them are

almost similar but should come with specific link. Keeping track of which one come after which was little bit tedious.

To overcome this challenge the author spent more time and used a paper bases ID no for each interface page.

5.4.2. Coding

The next step was code the model to make it executable. As far the author's knowledge, in professional field coding is done by another group who are professional coder of any program. In his case, though the author didn't have much skill on any programming language, the author took the challenge to code the program by himself. The rationales were 1) the author found that only designing is not sufficient work for internship requirement 2) His client seemed not interested to deal with other person for this work. That is, hiring another person for rest of the work. 3) The author was convinced to learn one programming language so that he can go in-depth of developing clinical applications. Based on his knowledge, the author chooses Java as programming language to code that model. So he started to learn Java language. After spending two months to learn Java, he became to know that VB.Net should be his choice of programming language to code that particular type of application. Then the author switched to VB.net and spent time to learn that programming language. With VB.net the author was working smoothly except the graphical part for which he finally used Adobe Photoshop.

5.4.2.1. Challenges and solution

The author faced tough challenges in coding phase. Having no computer background it was not easy for him to code, debug and execute a program. Initially, debugging was the problem but when he became familiar with VB.net he could overcome that. The next challenge was coding the graphical part of that tool. Coding the graphics by VB.net is a sub area under VB.net language. This sub area is not only huge, complex to learn but also extremely tedious (my experience).

It was extremely difficult for him to figure out how to code the graphics even after spending more than two weeks only for that. On that situation one undergraduate student him to do graphical part by using Adobe Photoshop and then imports those graphics in the main program.

So the author started learning how to use Adobe Photoshop. Once he got familiar with Photoshop tool, he did the graphical part of “Algorithm tool” with that and overcome that challenge.

Feedback from employer: After developing the tool, it was reviewed by Dr. LeBlanc. He put some more advices after observing the output. Putting his advices necessary changes were done and final version of the application was developed.

5.4.3. Testing

Considering the end user of “Glaucoma Algorithm” can be different person and configuration of their computers will be variable in term of resolution of the screen, monitor size and technical environment, the author decided to test the program in other computers.

5.4.3.1. Challenges and solution

The author started testing in MHI lab computers and other hallway computers. The first challenge the author faced that the program was not executed in those computers though it was executed in his personal computer. Initially he could not figure out where is the problem. After a long research the author figure out the solution and that in order to run the program in any computer, the program should be installed as a deployment project (file) not as executable file. So he converted the executable file into a deployment file and tried again. This time problem arose with installment permission. Since department lab does not permit to install any application the author could not test the application. On searching the facility to test the application the author became to know that Killam library provides permission to install any application temporarily. The author tested the application in that lab. It worked there. But resolution problem arose. That is, some portion of the interface was cut off. Again after searching for a while the author became to know how to solve resolution issue in any application.

Finally the author tested the application in law computer lab, engineering campus lab and the application was executed in all different computers with expected output.

Overall the main challenge the author faced in every step that lack of learning support specifically for the technical part of my work. When he got stuck with coding and with

other issues, no one was there to help him. Even in learning center, no tutor could help him for VB.net. Naturally the author had to spent time to find the solution by himself.

5.4.4. Prepare user information

An information leaflet on “how to use this tool’ was developed which explains installation information and related issues step by step using graphics.

5.4.5. The final product

After successfully tested, the deployment project was burned in a CD along with set up .msi file and user information file. This is the deliverable product of this project.

Update of “Patient Information System” developed by Dr. Lesya Shuba

Background

As Prof. Raymond LeBlanc has been promoted as Executive vice president of Capital district health, he does not work as Ophthalmologist in the department. So to continue the author’s internship work, Prof. LeBlanc introduced the author with Dr. Lesya Shuba, another ophthalmologist of Q-2 hospital. In the group meeting Prof. LeBlanc, Dr Shuba, Chris Philip (system administrator) and the author discussed about the feasibility and scope and opportunity to establish electronic medical record in ophthalmology department. But due to lack of funding the group did not take any initiative rather decided to upgrade the patient information system which Dr. Shuba has been maintaining by herself.

About Dr. Lesya Shuba (Employer)

Dr. Lesya M. Shuba is a young ophthalmologist with special interest in glaucoma, who recently joined the Department of Ophthalmology and Visual Sciences, Dalhousie

University as an Assistant Professor. She completed her PhD, Medical School and ophthalmology residency at Dalhousie University and then went on to do a fellowship in glaucoma with Dr Alward at the University of Iowa, USA. During her training she was awarded a number of scholarships and grants. Her current research interests are in pseudoexfoliation glaucoma, modulation of wound healing during glaucoma filtration surgery and correlation between structure and function in glaucoma. Dr. Shuba has published over 25 research articles, several book chapters, and presented research abstract at different national and international conferences. Currently she is a member of a number of national and international medical societies.

Since starting her clinical practice, in September 2006, Dr. Shuba took initiative to implement information technology in her clinical work. She has developed a patient database system for collection and archiving of patients clinical information.

Current workflow of the department and Dr. Shuba's patient information system

The author already mentioned (page-7) that in the current work flow of the ophthalmology department patient data is collected and maintained in paper based chart. All other activities (ex: Investigation request, Investigation result) are also in paper based. On this background Dr. Shuba, another visionary ophthalmologist created a 'patient information system' by her own initiation. 'FileMaker database management system' software was used to develop that 'patient information system'. All the clinical information of her patient is maintained in that database.

Job description

Dr. Shuba asked the author to upgrade that 'patient information system' by developing an automated referral letter form. Earlier she manually entered patient information in the referral letter. She also asked the author to modify of 'Visit form'. This visit form is used to enter patient information into the database.

Work experience

Though the author has experience to work with database (HINF 6220 course and previous work experience) but FileMaker was not familiar to the author so his first task was to learn ‘how to use FileMaker’ to create relational database. Naturally it took few days to learn FileMaker (working knowledge) for him. Once the author has working knowledge about FileMaker, he spent some more days to understand the existing database.

Planning phase

Once the author became familiar with existing database, he performed a requirement analysis by discussing with his employer. Based on those requirements he grouped all the proposed components (fields) of the referral letter into different subheadings. Then he arranged all the proposed components on a paper based layout.

For modification of the visit form the author planned to keep the original but to remove all the graphics and to create new graphics.

Implementation and feedback

In this phase the author implemented that paper based referral letter layout by using FileMaker. For the visit form the author created the required graphics and appropriately added to that form. He also modified some of the components (fields) of visit form by adding lists to them.

Challenges

The first challenge the author experience in this project is to understand the current databases. Another important challenge was lack of resources. When the author got stuck with any issue, no resources were available to him. The author resolved all the problems by searching online.

7. Conclusion

Though the author took some more time to complete my internship, but the author learned to how to code, debug and how to make a deployment project for using that project (application) in any computer system. The author think knowing coding up to certain extent will facilitate to go in depth of any application and will also facilitate to design any application more perfectly. As his interest is to be in developmental process of different application in the medical area this experience will an asset for him. His work with Dr. Shuba upgrading the existing database and making automation of some of the functionalities of the database will facilitate that goal (developing medical applications).

8. Appendix and Reference: Please see below.

Appendix: Images of computer version of “Glaucoma Algorithm”

Glaucoma Strategy

GLAUCOMA ALGORITHM

Glaucoma Strategy: A reference tool

- ALGORITHM 1: DIAGNOSIS
- ALGORITHM 2a: STAGING GLAUCOMA SUSPECT
- ALGORITHM 2b: STAGING OPEN ANGLE GLAUCOMA
- ALGORITHM 3: TREATMENT
- ALGORITHM 4: FOLLOW UP

The Canadian Glaucoma strategy was designed to provide a concise and practical guide to Glaucoma Management In Canada. It highlights current standards of practice and is intended to supplement existing guidelines.

The strategy allows physicians to use their clinical judgment to route patients through five algorithms that represent the key stages of Glaucoma management.

Algorithm 1: Diagnosis

GLAUCOMA CONCERN

Glaucoma Risk Assessment and Full Eye Examination

ALGORITHM 1: DIAGNOSIS

- Objective
- How it works?

Algorithm 1: Diagnosis (Cont...)

Risk Assessment

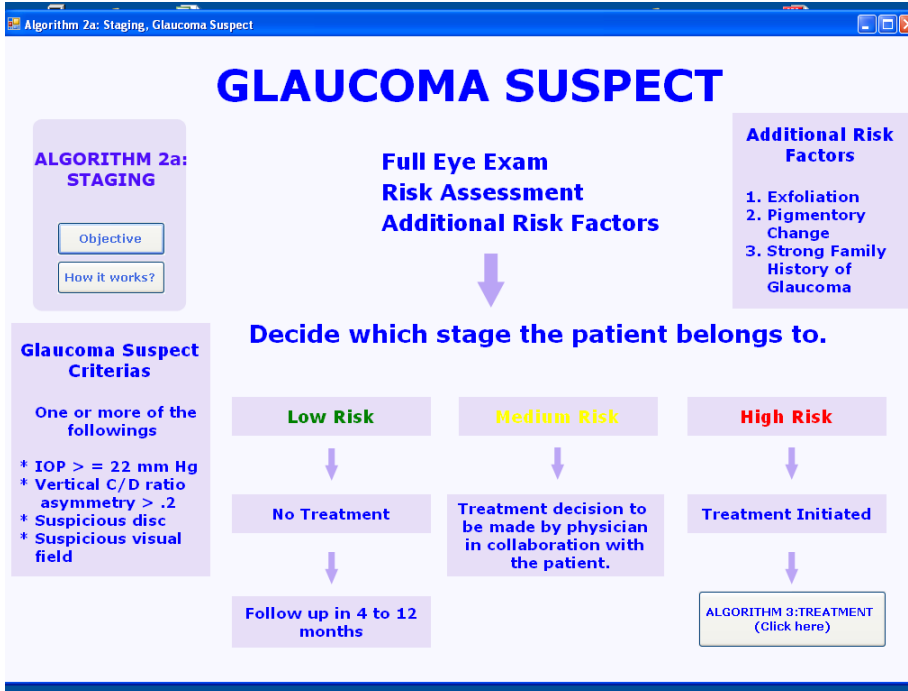
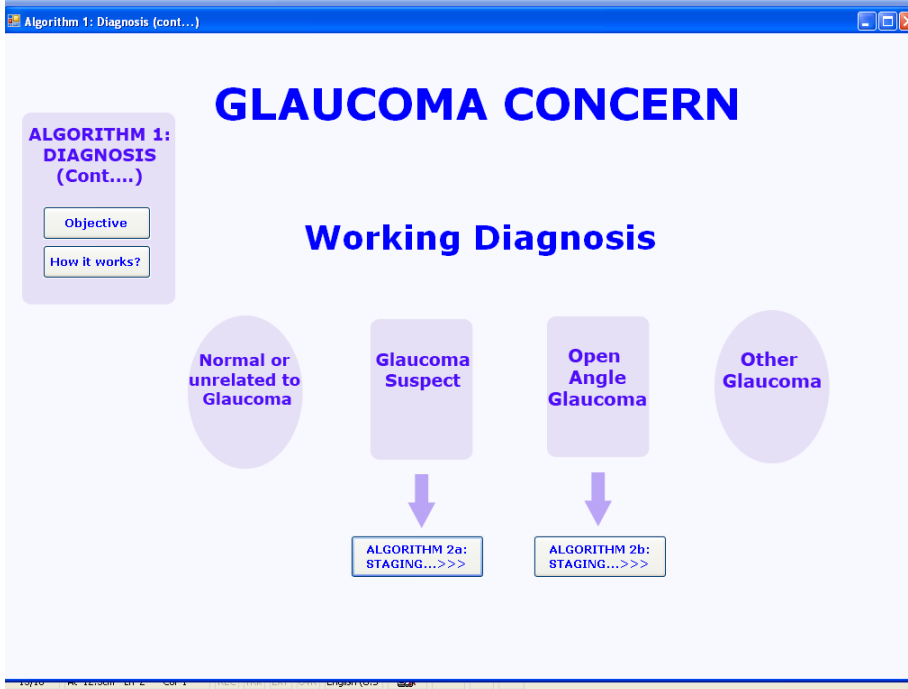
↓

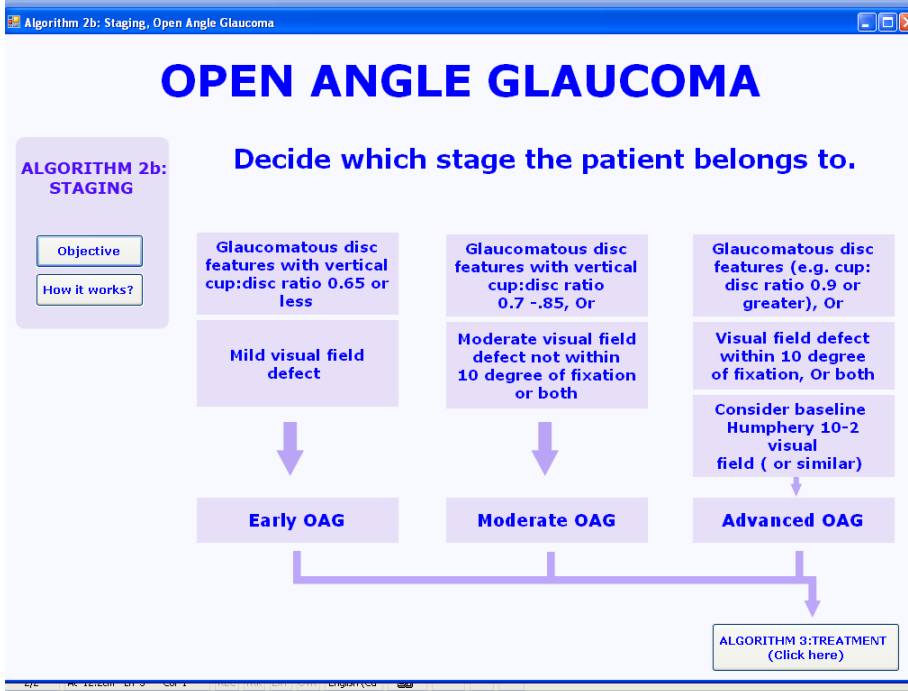
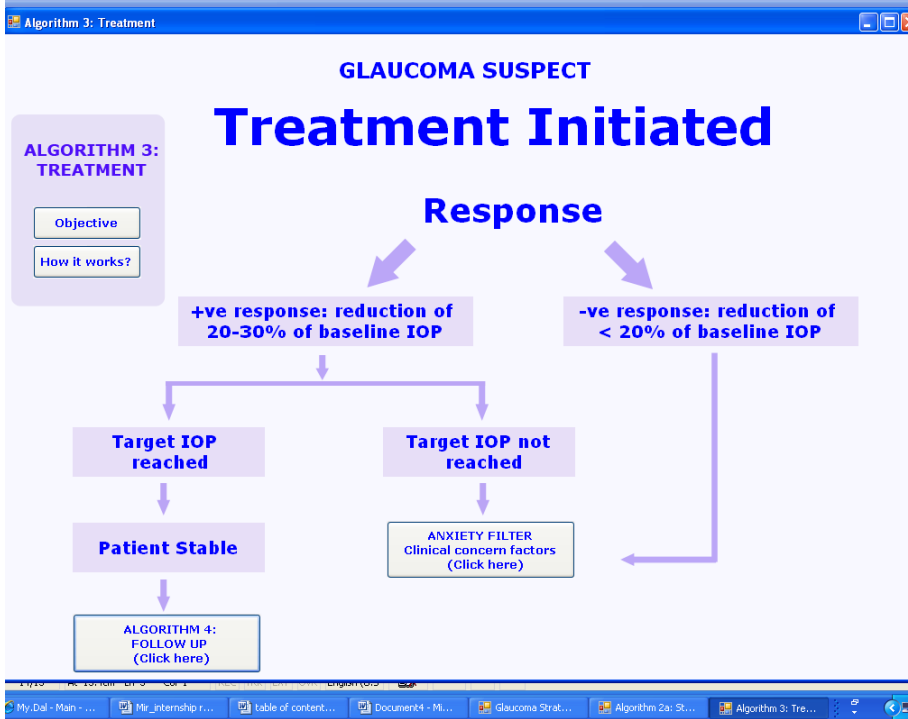
- Family history
- Ocular history
- Age
- Race
- High myopia

Full Eye Exam

↓

- Vision
- Refraction
- Anterior Segment
- CCT
- IOP
- Posterior Segment
- Gonioscopy
- Optic nerve head exam and documentation





Automated referral letter: for Dr. Shuba's patient information system.

FileMaker Pro - [Copy of NSECCB with data - LShuba]

DALHOUSIE UNIVERSITY
Department of Ophthalmology & Visual Sciences

Leiya Shuba, MD, PhD, FRCSC, FRCOphth

Eye Care Center • 1271 Tower Rd., Halifax NS B3H 2Y9 • Phone (902) 473-3410 • Fax (902) 473-2839

Date: 2007/2/26

Dear Dr. C

Thank you very much for referring the following patient, and your very helpful letter.

First Name: Mr Last Name: Kabir Date of birth: 12/30/67
Referral reason: Not Noted

Date of assessment: 01/03/07

History

Medical / Surgical Hx: Not found
Family History of Glaucoma: Present
Past ocular history:

Glaucoma Diagnosis: Chronic Angle Closure Glaucoma Glaucoma suspect (bica)
Other Ocular Diagnosis: Not mentioned
Ocular procedures OD: ALT 180 deg CPC ECCE, ACIOL
Ocular procedures OS: ECCE, ACIOL Ahmed valve none
Ocular Medications: Alphagan P OU bid
Systemic medications: Not found
Allergies/Intolerance: Not found

Examination

	OD	OS
Pupil		
Best corrected visual acuity		
Goldmann field/visual evoked myography		
Central corneal thickness	7	9
Slit lamp examination	Normal Buphertic	
Gonioscopy	Normal	
Optic nerve	Open Grade IV with	Open Grade IV with
Visual field		normal
HRT		
OCT		

start | My Dal - Main ... | The Daily Star ... | cover letters | Internship report | Dr. Shuba's da ... | Microsoft O ... | FileMaker Pro ... | 8:00 AM

Visit Form

FileMaker Pro - [Copy of NSECCB with data - LShuba]

Glaucoma Service

Database Number: 001
Last Modified: 02/28/07
Last Name: Kabir
First Name: Mr
Date of Birth: 12/30/67

Date: 01/03/07

SUBJECTIVE

SYSTEMIC MEDICATIONS: reviewed - no change

OCULAR MEDICATIONS: reviewed - no change
Alphagan P OU bid

V_A CC OD _____ ph _____ T_A OD _____ at _____ P PERL yes no
SC OS _____ ph _____ OS _____ RRAP yes no
LRRAP yes no

Dilated O₃ at _____ LLC
 K
 IP
 AC
 L

GONIOSCOPY

Speath Gr _____ Pigment Gr _____

Open Grade IV with minimal buphertic Open Grade IV with buphertic

Optic nerve OD Optic nerve OS

HVF/GVF

	OD	OS
Slit lamp examination	Normal Buphertic	
Visual field	Normal	normal HVF
HRT	superior thinning	superior thinning
OCT		
GDX		

Resident/Fellow Note: _____ Staff Note: _____

start | My Dal - Main ... | (4 unread) Ya ... | cover letters | Internship report | Dr. Shuba's da ... | Microsoft O ... | FileMaker Pro ... | 8:14 AM

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