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CONTRIBUTION OF UNANI MEDICINE IN MODERN OPHTHALMOLOGY-AN ASSET TO BE PROBED

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ABSTRACT

Ophthalmology is a special branch of modern medicine dealing with the eye ailments has gained special attention in the present scenario of specialization of health services. Unani Medicine is one of the ancient systems of the medicine and ophthalmology was one of specialization field in Unani Medicine during its flourishing period and ophthalmologists were called *Kahhal* i.e. *Ali Ibn Isa Kahhal, Salahuddin Ibn Yusuf Kahhal* etc. The historical development of Unani medicine and ophthalmology reached its zenith in the 10th Century under the reign of Muslim rulers. In ophthalmology this point is marked by the two excellent books i.e. *Tadhkirat-al-Kahhalin* by *Ali Ibn Isa* of Baghdad and *Al muntakhab fil ilaj amrad al ayn* by *Ammar Bin Ali Mosuli.* Unani Medical scholars made many contributions in the field of ophthalmology ranging from its anatomy, physiology, various terminologies, medicinal treatment and surgical treatment of eye diseases including innovations in surgical instruments. These contributions provided base for the emergence of modern ophthalmology in 17th Century. An attempt has been made to have a view of the work done by Scholars of Unani Medicine in the field of ophthalmology through their literary contribution which is still preserved as manuscript today, to assess its impact on the modern ophthalmology. In the field of Unani Ophthalmology few research studies have been conducted so far in India on a classical formulation i.e. *Kohal Chikni Dawa* (KCD); two in-vitro studies have concluded that the local application of 3% KCD solution possesses anti-cataract effect in alloxan-induced hyperglycemic rats and naphthalene induced

lens opacification. By taking up the evidence base research on Unani classical literature in ophthalmology, we can provide safe, economic, effective medicinal solution to the eye diseases i.e. Corneal opacity, Pterygium, Cataract, Glaucoma etc.; it will be a great contribution to the humanity.

KEYWORDS: Unani Medicine, Kahhal, Ophthalmology, Kohal Chikni Dawa (KCD).

INTRODUCTION

Ophthalmology is a special branch of medicine dealing with the anatomy, physiology and treatment of the eye diseases which has gained special attention in the present scenario of specialization of health services. Eye being a vital and important organ of the human body, always got special attention of the health care providers at any given time in the history. Unani Medicine is one of the ancient systems of the medicine and ophthalmology was one of specialization field in Unani Medicine during its flourishing period and ophthalmologists were called *Kahhal* i.e. Ali Ibn Isa Kahhal, Salahuddin Ibn Yusuf Kahhal etc. The Unani ophthalmologist and general physicians like Ibn Sina, Al Tabri, Al Razi, Al Zahrawi, Jurjani, Ibn Rushd etc. both contributed in development of the ophthalmology as a specialized field which provided a base for the emergence of modern ophthalmology. The modern ophthalmology started taking its roots in 17th Century with subsequent decline of Unani Medicine.

THE HISTORICAL DEVELOPMENT OF OPHTHALMOLOGY IN UNANI MEDICINE

The period between the 9th and the 15th century AD spotlights a golden era or flourishing period of Unani medicine, when according to the Encyclopedia Britanica, the Arabs extended their field of activity right up to Spain. Muslims rulers play the pivotal role of guardians and caretakers of scientific thoughts achieving supremacy especially in biological sciences. During this period, scholars of Unani medicine flourished in all fields of medicine including Ophthalmology. Ophthalmologist from the Arab, Iraq, Syria, Egypt, Iran, Spain and Jerusalem, of all faiths including Muslims, Christians, Zoroastrians and Jews contributed in the field of Ophthalmology. About 3 million manuscripts are scattered and preserved in several libraries of the world related to this glorious period between the 9th and 15th centuries.

During the reign of Muslim rulers, the oculists were treated as venerable members of medical profession and given a high position into royal household.[5] The Arabs had special eye hospitals in Baghdad, Cairo and Damacus.[4]

The historical development of medicine and ophthalmology reached its zenith about the year 1000 A.D. In ophthalmology this point is marked by the two excellent books i.e. *Tadhkirat-al-Kahhalin* (notebook of oculists) by Ali Ibn Isa of Baghdad and *Al muntakhab fil ilaj amrad al ayn* by Ammar Bin Ali Mosuli (1000 A.D). Then follows the slow decline of Unani Medical science until the 16th century when western science begins to awaken and to surpass in output the orient whose text books, in the meantime have been translated into Latin. Arabic terms such as *Qurratul Ayn* (Eyeball), *Multehema* (Conjunctiva), *Qarniya* (Cornea), *Anabiya* (Uvea/Iris) and *Shabkiya* (Retina) were introduced by Unani Medical scholars.[13]

Scholars of Unani Medicine also described the treatment of Pannus by peritomy (removal of broad strip of conjunctiva around cornea) and corroborating the theories relating to the disease of the deeper layers of eye, the optic nerve, the retina and the choroid affections of the lens, eye disease in children and animal parasite were also described.[4]

They also introduced a new technique of removal of cataract by suction (incision or excision of a part of the cornea and introduction of tube), sclerotomy and insertion of a part of a hollow metal needle in soft or semisoft cataract.[4] This is regarded as the greatest contribution of the ophthalmologists of Unani Medicine in practical aspect of treatment.

Ali Ibn Isa Kahhal while discussing *Damaa* (epiphora) stresses that it is due to overzealous cauterization of *Nakhoona* (Pterygium) and in chronic stage he advised its surgical removal.[10]

When conservative treatment of *Barda* (Chalazion) failed, it was incised with a round headed lancet, scrapped out with spoon and closed with a suture, which is also in practice today and called as incision and curettage. *Shaar Munqalib* (Trichiasis) was treated through extraction of the inverted hairs and *Amale Kai* (cauterization) of the roots using a heated red hot needle.[13]

Scholars of Unani Medicine also made several additions to ophthalmological remedies and improvements in methods of prescription. Single drugs like *Kafoor* (Camphor), *Mushk* (Musk) and *Anbar* (Amber) were their original contribution.[5] Unani Ophthalmologists

advised mainly compound formulation for local eye applications i.e. Kohl/Surma, Barood, Shiyaf (Corrylium/ Eye salve), Kajal, Qutoor (Eye drops), and Zimadat in the form of Pills i.e. Habbe Siyah Chashm besides systemic drugs.

In addition they made the first observation of the pupillary light reflexes in the prognosis of cataract.

Another commendable contribution of Scholars of Unani Medicine is in the field of optics. The most renowned person, who had his original and progressive view on Optics, was Abu-Ali-al Hasan bin-al-Haytham (965-1035 A.D.) of Basra. He taught the visual rays do not pass from eye to object as had been conceived by ancient philosophers and physiologist but they pass from object to eye and that an infinite number of rays are emitted or reflected as the case may be from each and every point comprised within the surface of that object.[4]

In this article an attempt has been made to have a view of the work done by Scholars of Unani Medicine in the field of ophthalmology through their literacy contribution in chronological order to assess its impact on the modern ophthalmology. There is need to undertake extensive research studies in ophthalmology to validates the work done by the Unani medical scholars through their academic treasure scattered throughout the world in the form of manuscripts.

LITERAY CONTRIBUTION OF UNANI MEDICAL SCHOLARS

The followings are the details of prominent Unani Medical scholars who contributed significantly in literature on ophthalmology.

ABUZAKARIYA YUHANNA BIN MASAWIAH AL MASAWAIH (777AD – 857AD)

He was a Christian, court physician in Baghdad of modern day Iraq and teacher of Hunyan, he moved to Cairo and delivered a treatise on eye conditions to the Fatimid ruler; Al-Hakim. He was the first contributor to Unani ophthalmology and his treatise is known as "*Daghal at alayn*" (The Defectiveness of the Eye) which is the earliest treatise on ophthalmology. This landmark work discussed 48 eye conditions in detail with many cases, including the removal of cataracts with a hollow needle through suction. He is credited with one more work on ophthalmology, *"Marifat mihnat alkahhalin* (Knowledge of the Oculist Examination)".[14,29,32]

ALI IBN SAHL RABBAN ALTABARI (770-780 AD-850AD)

He was born between 770-780 AD at Tabristan in northern Iran. He was a famous Muslim physician in the service of caliphs of Baghdad, a pupil of Hunayn and one of the teachers of the great Al Razi. He compiled a book entitled "*Firdaus al Hikmat* (The paradise of wisdom) in Persian. This is a great treatise on general medicine. The book has a short description of the most common eye diseases, with a long part dealing with their treatment and many recipes for eye slaves; the ophthalmology part of this book is of clinical value. Razi quoted his book in 2nd Volume of Al Hawi.[17,29]

HUNYAN IBN ISHAQ ALABADI (809 AD -886 AD)

He was born in Al-Hira, Iraq. He composed a marvelous treatise on eye i.e. *"Kitab al-ashr maqalat fil Ayn* (Ten Treatises on the Eye)". This is earliest systemic text book on ophthalmology in which he first time provided drawing of anatomy of the eye.[1]

He described that crystalline lens is located in the exact center of the eye.[12]

He described cysts, tumors and ulcers, their causes and also laying out recommended treatments and suggestions for repairing cataracts.

Max Meyerhof the English translator of the book concluded "this is the oldest known book written in a scientific and academic way "and that "it is the first book to contain the first known drawings of the eye and its components and it is much better than the drawings of the European books written much later." It was translated twice into Latin and once into English. It has been republished by Govt. Press Cairo, Egypt in 1928.

He also compiled another book *Kitab-al masail fil ayn* (the book of the question of eye). It is in the form of two hundred and seven question and answers on anatomy and physiology of the eye, without considering treatment.

Ibne Usaiba has mention following three more books written by Hunayn.[27]
Kitab fee Tarkeebul Ayn (Book on Structure of eye)
Kitab fee Ikhtiyarat Adviyatul Ayn (Book about How to Choose Eye Medication)"
Maqala fee Taqseem Alal Ayn (Treatise about classification of eye ailments).[9,13,14,19,29,32]

THABIT IBN QURRAH AL-ḤARRANI (836AD-903 AD)

He was born and raised in Harran, Mesopotamia (Iraq) in the year 836AD; he was competent in the field of medicine. Later on he moved to Baghdad and he was appointed as the personal physician of Caliph Al- Mut'aḍid. As an ophthalmologist, he wrote a book entitled "*Albasar Wa Baseerata* (Vision and Perception)". Although it is a small book but it was quoted by most of the ophthalmologists who followed him. These included Khalifah and Al-Razi who referenced "*Albasar Wa Baseerata* "in their books *Al-Kafi* (Sufficient Knowledge in Ophthalmology) and *Al-Ḥawi fi Al-Ṭib* (Continens) respectively. The only known manuscript of *Albasar Wa Baseerata* (Vision and Perception)" is in Cairo (Egyptian archives).

His most important contribution to ophthalmology was his treatment of amblyopia or lazy eye (*Alghatash*) for which he proposed closing the normal eye with a patch to "force the visual spirit to go into the lazy eye in order to improve the vision"[17,29] which is still considered the best treatment.

ABU BAKR MUHAMMAD IBN ZAKARIYA AL-RAZI (850AD-923 AD)

He was born and raised in Ray, Iran. He was known in Medieval Europe by the title of "The Arab Galen" and Rhazes. Al-Razi's most famous book, *Al Hawi fi Al-Ṭib* (Liber Continens/Magnus opus) is comprised of 20 substantial volumes, dealing with all aspects of known diseases and their management. The second volume deals with the eye. It was praised by almost all the physicians following Al-Razi. His treatise on ophthalmology was translated into German in 1900. He also wrote other book *Kitabul Mansoori* in which some sections deals with anatomy of the eye and eye ailments. He observed how airborne germs can cause infectious diseases, including inflammation of the eye. Ibne Abi Uṣaiba mentioned following books written by him in the field of ophthalmology other than above mentioned books.[29]

1."*Risala fee fazalulayn Ala Sairul Hawas* (Treatise about the Advantage of the Eye over the other Senses

2. "*Kitab fee Kaifiyatul Absar* (A Book about the Mechanism of Vision)"

3. "*Risala fee Haiyatulayn* (Treatise about the morphology of the eye)"

4. *"Risala fee Ilajulayn bil Hadeed* (Treatise about the Surgical Management of the Eye Diseases)

5. "*Kitab fee Adviyatulayn wa Ilajateha* (A Book about the Eye Drugs and its Treatments)"

6. "*Maqala Illa-taee Min Ajleha Tazeeq unnawazir feennoor Wa Tattesa fee Zulamata* (Treatise about why the pupil constricts in light and dilates in darkness).[28]

The main contributions of Al Razi in the field of ophthalmology are as under;

1. He rejected Galen's Theory of vision that "a ray exits from the eye to touch the object or objects in front of it and then return to the eye where the vision takes place."Al-Razi put forward his own explanation of vision that rays are emitted by the object and enter the eye in his Monograph "*Tabiyatul Absar* (Nature of Vision)".
2. He was the first one to state retina reacts to light.
3. He was the first one to describe the reflex action of the pupil. He explained that this reaction was due to the presence of small muscles that react to the intensity of light.
4. He explained causes for Glaucoma i.e. excessive salt consumption.
5. He described the cauterization of lachrymal fistulas, truly innovative work in the field of ophthalmology. (*Kitab al-Mansuri).*
6. He recommended the treatment of pubic lice and lice of the eye lashes by applying mercury ointment.
7. He explained that the cataract lies in the hole of the iris between it and the crystalline lens.
8. He stated that in case of a disease of the optic nerve, there will be a visual disturbance derived from the brain, accompanied by headaches and tinnitus. The pupil of this side will be dilated and the pupil of the other eye will be constricted.
9. Razi documented the removal of cataracts with a glass tube.
10. He advised that the pupil has to be carefully evaluated before attempting to couch the cataract.[14,17,19,29,32]

YUḤANNA IBN ṢARABYUN (D.935AD)

He was born in Damascus, Syria and was a prominent practicing physician there. He compiled a book "*Alkunash Alkabir* (Practica)" which was written in Syriac and was later translated into Arabic by an anonymous author and it was quoted repeatedly and extensively even by Al-Razi. The eleven chapters of this book that deals with ophthalmology are excellent and comprehensive. Gerard De Cremona translated the book into Latin and then Andreas Alpago did the same.[17,29,32]

ABU AL HASAN AḤMAD IBN MOḤAMMAD AL-ṬABARI (D.976AD)

He was from Tabristan, Iran. He authored a book "*Mu'alijat al-Buqratiyya* (Hippocratic treatment)" completed it in 850A.D, which contains 10 dissertations, 4th one deals with ophthalmology. The following are some of his original contributions in the field of ophthalmology:

1. He described in detail the ability of the patient to see his own ocular circulation after rubbing the eyes and pressing on them.
2. Remaining in dark places for long periods of time, like prison, could lead to total blindness.
3. He was the first to state that "The cataract is a thick humidity that affects the crystalline lens and makes it opaque.*"* In this way he was 800 years ahead of Hermann Borhaff (1668-1738CE) who is wrongly accredited for the same. Although Al-Razi and others insinuated something similar vaguely, the exact anatomical location was not disclosed until Al-Ṭabari mentioned it in his works.
4. He explained the signs and symptoms of ocular migraine.
5. He uniquely stated; "There is a true congenital type of squint which is not curable because it represented an organic disease, which originates in the womb and is hereditary"
He advocated a treatment for congenital squint; by wrapping the baby's head with a black thick cloth with two openings in front of the eyes to realign and straighten them.
6. He is the first to relate eye diseases to contact with animals and described the entrance of gnat-like flies in the eye.
7. Al-Ṭabari may have been the first to describe snow blindness as "extensive exposure of the eye to reflected sunlight."
8. He attempted to describe the "black water" which is now known as glaucoma and stated, "No treatment can be successful.
9. He described the solar eclipse and attributed it to the passing of the moon between the sun and the earth. He also warned not to look at the eclipsed sun with naked eyes to avoid permanent blindness.
10. He pioneered the description of biconvex lenses, calling it the burning pebble.[17,29,32]

ABU ABDULLAH MOHAMMAD BIN AHMAD ALMAQDASI TAMIMI (D.980 AD)

He was a famous physician from Jerusalem, who practiced in his hometown around 980 AD. He compiled a book known as "*Fee Mahiyat al ramad wa anwaihi wa aqsamihi wa ilajihi* (Treatise about the Essence of Ophthalmia, its types, Causes and Treatment)*"* in last quarter of 10th century. In his book he discussed followings;
He described the pathology of Ophthamia; its types, causes and treatment.

He proposed that retina is at least partially responsible for sight, explaining that light falls on retina in the way as light falls on the wall of dark room through pin hole.

The image forming on retina conveyed to brain through optic nerve.

He explained the shape of the eye, sense of sight, what is light? nature of light, how we see things? why two eyes are given to man instead of one?.
He solved many optical problems by combining geometry with optics.

He not only made lenses but also amply used them in his discoveries. He disapproves many theories of his predecessors on the basis of scientific experimentation.[17,32]

ABU MANṢUR AL-ḤASAN IBN NUḤ AL-QUMRI (D.990 AD)

He lived in Khorasan, Iran and died shortly after 990 AD. He was teacher of Ibn Sina. He wrote a book entitled as *Kitab al-Ghina wa-al Muna* which is preserved in NLH, USA. He explained various causes of weak eye sight i.e.; such a person had constipation, looked at a bright object, read books with small letters, consumed too much salt in food, or had too much sugar for a prolonged period (Now known as hypertensive/ diabetic retinopathy as a complication of Hypertension and Diabetes mellitus) etc.[29,32]

ALI IBN ABBAS AL-MAJUSI (930-994AD)

He was from Ahwaz in Iran. He composed a book "*Kamil al-San'aa al-Tibbiya* (Complete Art of Medicine)". The book was translated into Latin by Constantine the African in the 11th century and it was known as *Liber Regius* (*Kitab al-Malaki*/The Royal Book). The book was translated into French in 1903 and into German in 1904. The book was translated into Urdu by Hakim Ghulam Husain Kanturi in 1889 and published from Lucknow.[2]

In the 13th chapter of the book he described 130 eye diseases in anatomical sequence, 143 simple drugs and names of beneficial herbs for the eye diseases. There is description of eye diseases i.e. ophthalmia, swelling, hardness in conjunctiva, itch, protuberance in the eyes, Pannus, blood spot, ulcers, pustules. He also prescribed treatment of chemosis, thrush, tinea, corneal cancer and scrofula. In this book he presented the idea of capillary system and Pterygium. He had knowledge of optic nerve, retina and choroidal disease. He advised special foods for patients of eye diseases. He stated that the people having diabetes and kidney diseases can develop eyes diseases.[17,29,32]

AMMAR BIN ALI MOSULI (D.1000 A.D)

He was born in Mosul Iraq and then he migrated to Egypt; about 1000 A.D, he travelled widely as an ophthalmologist. He composed a book on eye diseases "*Al muntakhab fil ilaj*

amrad al ayn (selection in the treatment in the eye diseases)". This is an excellent textbook on eye with many original remarks and observation. It deals first with the anatomy and physiology of eye, then preparation of prescriptions. He described 48 eye ailments of the different parts of the eye e.g. Lid, cornea, conjunctiva and pupil. The description of diseases and treatment are very clear. He described 6 types of cataract operations and described the details of cataract operations performed by him. He also wrote a book on ophthalmology "*Marifat mihnat-al-kahhalin* (knowledge of the Oculists examination)" which is in the form of question and answers. He was one of the most famous and certainly the most original of Arab Oculists.

His contributions in the field of ophthalmology are summarized as follows;

1. Ammar was the inventor of the cataract operation by suction, using a fine hollow needle (Injection needle) inserted through the limbus (where the cornea joins the conjunctiva).[1]
2. He recommended, for the first time in history, to scratch there to create a blood clot in order to prevent the cataract from re-ascending.
3. He was the first to warn surgeons of dislocating the cataract into the anterior chamber, as doing so will touch the corneal endothelium, causing irreversible corneal edema, which is now called corneal decompensation.
4. He was a pioneer in the advocacy of fragmenting and aspirating the cataract.
5. He was the first to use the word "*Saqba-e Anabia* (pupil)" to refer to what was previously called the "hole of the iris."
6. He used the term "airy cataract" to describe a superiorly dislocated cataract that is stuck at the upper edge of the pupil.

Above all, he invented and skillfully used the hollow couching needle; the operation of removal of cataract by suction through hollow needle which was introduced in Europe in 18th century.[9]

Ammar described the characteristics of a good surgeon as being one who is able, experienced, sharp sighted and steady-handed."[7,8,13,17,32]

AḤMAD IBN'ABDUL-RAḤMAN IBN MANDWAYHAL-IṢFAHANI (D. 1019AD)

He was from Isfahan, Iran and wrote two books on ophthalmology "*Risala fee Tarkeeb Tabqatbul Ayn* (Treatise about the construction of the eye's coats)"and "*Risala fee Ilaj Intesharul Ayn* (Treatise about the treatment of Mydriasis)". Samarrai, however, wrote a

more detailed biography of Al-Iṣfahani and mentioned two books concerning eyes mentioned by Uṣaiba and stated that Al-Iṣfahani was the first to write about paediatric ophthalmology in his book, "Treaties about Illness in Children".[17]

ABUL QASIM KHALAF IBN ABBAS AL-ZAHRAWI (936AD-1036AD)

He was a famous physician and surgeon of Cordova, Spain and practiced there throughout his life. He compiled an extensive encyclopedia of medicine "*Kitab al-Tasrif Lamin-al ejaz al Anal Taleef* (The Explanation for He Who is Unable to Write Books)" in 30th treatises. Gerard De Cremona translated it into Latin; and J. Jenning published a combined Arabic and Latin translation of this book from Oxford in1778. L. Leclerc translated the book into French at Paris in 1861 and lastly 30th Treatise of the book was translated into English by Spinks and Lewis in 1973.[17] The book was translated in Urdu by Nasim Ahmad Kakori and was published from Kanpur, India in 1947.[21]

The last treatise deals with surgery, he divides the treatise in three part; first part deals with Cauterization, second part deals with operation and third part deals with bone settings.

In the second part, he divided eye diseases into 12 divisions, including those of the eyelids such as scabies, adhesion and cohesion. He described diseases of conjunctiva i.e. ophthalmia, blood clot in the white of the eye, diseases of cornea i.e. ulcers causing severe pain, headache and flowing of tears and two kinds of chemosis. He was the first one to give diagrams of surgical instruments. He performed cataract operations and in Maqala 30 he described the details of 25 eye operations.[17,23,29,32]

ABU ALI AL HUSAIN IBN SINA (980-1037)

He was born in Bukhara which is the city in modern days Uzbekistan. Ibn Sina compiled a vast medical encyclopedia "*Al qanoon"fit tibb* (Canon of medicine)". Al Qanoon remained the principle text book of medicine for over 500 years." Arabic edition of Al Qanoon was printed in Rome in 1593 and later in Bulaq, Egypt in1877. Gerard of Cremona translated it into Latin and Andreas Alpago of Belluno published another Latin translation in 1547.[17,32] The book was translated in Urdu by Ghulam Husain Kantoori and published by Munshi Nawal Kishore Press, Lucknow in 1889AD. He wrote extensive and complete treaties on ophthalmology. Chapter on eye diseases was a reference to just about every ophthalmologist to follow him.

1. He said that the lens is the receptive organ of sight.

2. He was the first person who described 6 extrinsic ocular muscle controlling eye movements.
3. He also first time described contraction and dilatation of pupil and its diagnostic importance.
4. He also discussed about the functions of lachrymal duct.
5. He mentioned eye as one of external senses.[1,17,19,21,24,30,32]

ALI-IBN ISA KAHHAL (1039 AD)

He was famous practicing Christian Oculists of Baghdad. He wrote a book on ophthalmology "*Tadkirat-al-kahhalin* (notebook of the Oculists).[6] He is known to European translators as Jesu Hali and his book as Memorandum/*Tractatus de Oculis.* This book was first translated into Persian and then into Latin and printed in Venice in 1497 AD. It was translated with commentary into German by Hirschberg and Lippert in 1904 and into English by Casey Wood in 1936 and published by Northwestern University Chicago.[31] Ibn Isa's book was the most widely referred textbook by later ophthalmologists.[13,14,32] The most recent edition of the book was published in 1964 in Hyderabad India. The Manuscript of the book is available at Raza Library, Rampur.[8,10,21]

The first part of the book deals with the anatomy and physiology of the eye; the second with the diseases externally visible; the third with hidden diseases, dietetics and general medicine from the oculist standpoint. He described 130 eye diseases with their anatomical location, thorough descriptions of the signs & symptoms and phases of some of the diseases and medical and possibly surgical-management with extensive details. He characterized 143 simple medications in alphabetical order and 80 additional prescriptions of compound medication.

1. Ibn Isa illustrated the optic chiasm and brain.
2. He was the first to discover the symptoms of Vogt-Koyanagi-Harada syndrome (VKH) - ocular inflammation associated with a distinct whitening of the hair, eyebrows and eyelashes.[20]
3. Ibn Isa was also the first to classify epiphora as being a result of overzealous cauterization of Pterygium.
4. He also suggested treatments for epiphora based on the stage of the disease - in the early stages to be treated with astringent materials i.e. ammonia salt, burned copper, or lid paste and for chronic stages, he advised hook dissection with a feathered quill.[17,29,32]

5. Ibn Isa is also thought to be the first to describe temporal arteritis, although Sir Jonathan Hutchinson (1828-1913) is erroneously credited with this.[3]

ABU-ALI-AL HASAN IBN-AL-HAYTHAM (965-1039 A.D)

He was born in Basra; Iraq. He authored a book on eye after extensive experiments and named it as *Kitab-al-Manazir* (Optics). In the first chapter of the book he described the Vision and anatomy of eye, he further divided anatomy of eye into descriptive and functional anatomy of eye and in second chapter he described theory of reflection of light and in third chapter he described theory of refraction of light.

His main contributions to help the modern optics and ophthalmology are given below.

1. He described the whole area of the eye behind the iris constitutes the *uveal sphere.*
2. He also described the eye as being made up of two intersecting globes.
3. He makes his most original anatomical contribution by describing the functional anatomy of the eye as an optical system, or optical instrument.
4. He provided information about Conjunctiva, Cornea, Aqueous humor, Iris, Pupil, Lens, Corpus vitrium, Optic nerve and Retina. He acquired best knowledge of the structure of the eye and provided self drawn picture of the eye.
5. He also devised technical terms for Ophthalmology i.e. *Saqba Anabia* (Pupil), *Al Qarnia* (Cornea), *Al A'asab Albasariya* (Optic Nerve), *Al Baiziya* (Albugenous Humor), *Al Zujajiya* (Crystalline Humor), *Al Jaleediya* (Vitreous Humor).
6. He stated that the visual rays do not pass from eye to object as had been conceived by ancient philosophers and physiologist but they pass from object to eye and that an infinite number of rays are emitted or reflected as the case may be from each and every point comprised within the surface of that object.
7. He was the first to explain that vision was made possible because of refraction of light rays.
8. He showed the system of eye as diaoptrics and relation between different parts of eye. He described the process of image formation incorrectly that the lens was the receptive organ of sight, but correctly hinted at the retina also being involved in the process.
9. He invented new field of optics now known as physiological optics.
10. He conceptualized the essential principles of pinhole projection from his experiments with the pinhole camera, compared it with eye ball and then stated that rays from objects falls on retina in the way as light falls on the wall of dark room through pin hole. The inverted rays

after falling on retina go to brain through optic nerve and viewed the pupil as being similar to an aperture.

11. He first time described the optical hallucinations.

12. He described five different types of mirrors i.e. plain, circular, concave, convex and conical.

Thuringopolonus Vitello translated *Al-Manazir* into Latin in the 13th century and called it *Opticae Al-Hazeni*. Risener published the scattered Latin translations in1572 with the name of *Opticae Thesaurus Al-Hazeni, Libri VII*.[10,13,14,17,32]

ALI IBN IBRAHIM IBN BAKHTISHU (D.1067AD)

He was born and raised in *Kafarṭab* which is a small town in northern Syria. He travelled to Egypt and practiced ophthalmology there. He died in Cairo around 1067AD. He compiled a treatise on eye "*Tarkib al ayn wa ashkalha wa madawat ilajha* (Structure of the eye, its shape and the treatment of its diseases)" in 10th century. He described the anatomy of eye; the eye and its seven coats, three humidities, nine muscles and four nerves with adnexa (eyelids, lacrimal sac etc.). He was the first person to state that "The eye is an instrument of vision and not a seeing organ by itself. The book lacks any illustrations or drawings. The treatise today exists in two complete copies in the libraries of Leningrad and National Archives in Cairo.[17,32]

ABU RUH MOHAMMAD IBN MANSUR IBN'ABDULLAH IBN MANSUR AL-YAMANI (D. 1087AD)

He was a Muslim ophthalmologist from Iran and is popularly known as Zarrin- Dast (The Golden Hand). He wrote a book on ophthalmology "*Noorul Uyoon* (The Light of the Eyes)". The book consists of ten chapters. He deals with anatomy and physiology of the eye and eye diseases. One chapter is devoted to eye diseases i.e. cataract, trachoma, scleral and corneal diseases and problems of the eyelids. Another chapter deals with diseases that lie hidden (the signs are exhibited in the eye and vision but the cause may be elsewhere) i.e. third nerve paralysis, blood disorders, toxicity etc. The book mentions curable and incurable diseases with methods of treatment. The seventh chapter is about surgery of the eye and he described some 30-eye operations including 3 types of cataract operation. There is a section on drugs employed by the oculists. Zarrin-Dast did not give any credit to the books or authors he

quoted frequently. Hirschberg stated that the 30 eye operations he mentioned in his book are almost identical to those mentioned in the "Memorandum" by Ali Ibn 'Isa.

The book is written in the form of Questions and answers and was discovered in the Bodleian Library. Hirschberg translated it into German in 1905 which was published from Leipzig.[10,17,32]

ADNAN AYNZARABI (D.1135 AD)

He studied medicine in Baghdad and practiced it there; later on migrated to Cairo, Egypt where he was appointed as Court Physician to Fatmid Ruler Al Zafir (1149-1154). He compiled a treatise on medicine known as "*Al Kafi fee Sin' at al Tibb* (What is Sufficient for Art of Medicine)". In this book he described Scabies on the interior of eye lids, its types and symptoms i.e. hardness of lids, difficulty in opening and closing of lids on wakening in morning. He also described chemosis of lids and causes of contraction and dilatation of the pupil. He also described ill effects of seeing snow on eye sight i.e. weak eye sight/snow whiteness on seeing snowy scene.[32]

IBNE QASSOUM IBNE ASLAM AL-GHAFIQI (Died 1165AD)

An Arab scholar and oculists born in Cordova Spain, his famous work on eye is *Kitab almurshid fil kahhal* (The occultist guide of ophthalmology). It is divided into six sections of which fifth (partially) & sixth (whole) deals in treatment by eye diseases with medicine and hygiene of eye. The author extensively discusses the anatomy and physiology of the eye and stresses the effect of the patient's psychological condition on his eyes.

It deals first with the anatomy of the eye, then with the disease of the eyelids, cornea, the conjunctiva and the pupil. It also gives details of the diseases of the head and brain. The description of diseases and treatment are very clear. He also described cataract operation performed by him. Al-Ghafiqi listed over 500 single drugs known in his region and 59 Compounded prescriptions that he personally used to treat his patients. He illustrated 13 surgical instruments which he created, as an ophthalmologist. In his chapter *"Amraz Arrohul Basir* (Diseases of the Visual Spirit)", he drew several figures to explain the refractive error of the eye. Al-Ghafiqi listed 23 Arabian physicians and their books including Ammar's treatise as references for his work.[6, 8,10,14,17,29]

ABUL-WALID MUḤAMMAD IBN AḤMAD IBN RUSHD (1126-1198 AD)

He was from Cordowa, Spain. In his book *Kitabul Kulliyat* (*Colliget)*, Ibne Rushd was the first to attribute photoreceptor properties to the retina and he was also the first to suggest that the principle organ of sight might be the arachnoid membrane (*aranea*) which in turn led to the discovery that the retina is the principle organ of sight in 16th century.[17,27,32]

ABDULLAH IBN QASIM AL-ḤARIRI AL-ISHBILI AL-BAGHDADI (D. 1248 AD)

He was from Baghdad and wrote a book on ophthalmology known as *"Nihayatul Afkar Wa Nuzhatul Absar* (The End of Thoughts and the Joy of Vision)". The book was discovered, edited by Hazem Al-Bakri and Mustafa Sharif Al-Aani and was published in Baghdad by the Ministry of Cultural Affairs and Information, GO Iraq, in 1979.[17]

FATH AL-DIN AL-QAYSI (D.1259 AD)

He was from Damascus, Syria and later migrated to Cairo where he was appointed as court Physician to the Caliph. Al-Qaysi was one of a three-generation family of court physicians in Cairo and was himself "Chief of Physician" to two Ayyubid rulers in Egypt; died in 1259 AD. He wrote a book on eye diseases entitled as *Natijat al-fikar fi ilaj amrad al-basar* (The Result of Thinking about the Cure of Eye Diseases).

The treatise consists of 17 chapters; definition of the eye and its uses, anatomy, how sight occurs, the temperaments and colors, diseases of conjunctiva, layer and the cornea, the iris, the humours, the retina, the choroids, disease symptoms and treatments, the hollow nerve. The diseases of the extraocular muscles, eyelids and canthus, weak eyesight, health of the eye, uvea, 124 eye conditions, lens, virtuous body, lacrimal glands, choroid, sclerotic, optic nerve and eye management.

Followings are his main contribution in the field of ophthalmology.
He described some topics apparently for the first time i.e. diseases of the ocular muscles, eye lid, canthus, weak eye sight etc.

Al-Qaysi attempted to describe the glaucoma and diseases of the aqueous humor. The book contains his observations and unique experiences in the field of ophthalmology.

The book was translated into German and was produced in Frankfurt by Hands Dieter Bischoff in 1988. A copy of *Natija fikr fee Elaj amraz al-Basr* dated 16th November 1501, is present in National Library of Medicine, Maryland.[8,9,14,17,32]

KHALIFAH IBN ABI AL-MAHASIN AL-HALABI (D.1260AD)

He was from Halab, Syria. He composed a comprehensive ocular manual, "*Al-Kafi fi al-kuḥal* (The Sufficient Knowledge in Ophthalmology)" a book of 564 pages in which he describes of various surgical instruments including 36 instruments for eye surgery and gives their drawings. He gave a diagram of brain, its membrane, optic nerve and eye. He observed that right eye is controlled by left side and left eye controlled by right side of brain. The book contain a very elegant and detailed illustration of the eyes, the optic chiasm, the cerebral ventricles, the pericranium and meninges i.e. the duramater, the piamater, the olfactory nerves and the petrosal bone. The book contains quotations from 73 books, written by 41 physicians and referenced all authors and books.

Followings are his main contribution in the field of ophthalmology;

1. He first time represented optic chiasm showing total cross over optic nerve while discussing the visual pathway between eye and brain in 1266.
2. He for the first time clearly illustrated the zonules as *Ribatul Moallaq* in a medical book.
3. He first time showed two parallel lines extend from the back of the lens to the sclera and optic nerve in a diagram, almost nearing the description of Cloquet's Canal as *Qinat alkaloka*.[8]
4. He described 12 kinds of cataract operations.
5. Khalifah was the first known surgeon in history of medical science who used a magnet for the removal of a broken piece of the couching needle from the eye.

He was so confident of his superior surgical expertise that he performed cataract operation on a person who had only one eye.

Copy of this book is available in the National Library of Medicine, Maryland. The book has been published by Islamic Educational, Scientific and Cultural Organization in 1990.[8,10,14,17,32]

NASIR AL DIN AL TUSI (1201-1274 AD)

He was born in the city of Tus in Khorasan province of Iran. He was an architect, mathematician, philosopher, physician, scientist, theologian and Marjae Taqleed. He compiled two books on eye i.e. *Al Mubahith fee anakas al Isha, at wa Inayataf, Tahrirul Manazir and Ta'liqa bar qunun-e-Ibn Sina* and his correspondences with Qutb al-Din Shirazi and Katiban Qazwini.[32]

IBN AL QAF ALKARKI (D.1286 AD)

He was from Kark which a city of modern day Jordan. He wrote a book "*Kitabul Umda fee Sina ul Jaraha* (On the Art of Surgery). In this book at Maqala 2, division 15 and Maqala 3, division 3, he described anatomy of eye. There is nothing new except repetition of his predecessors. The book was published by Dairatul Ma'arif Hyderabad in 1937.[17,21]

ABUL HASAN ALLAUDDIN ALI IBN ABIL HAZM IBN-AL-NAFIS (1210- 1288 AD)

He was from Qarshia near Damascus in Syria. He is popularly known as Ibn Nafis or Qarshi. His work on eye is "*Al-Muhadhab fi al-Kuhl al-Mujarrab"* (The Refined Book on Ophthalmology) is a comprehensive but not very original record of the whole knowledge of the Arabs in ophthalmology; it was used by several later authors.[7]

Ibn Nafis was first to describe following facts in the field of ophthalmology,

1. He classified the eye and gives it 25 different names based on the size, color and shape.
2. He described the visual cone with a drawing to illustrate it.
3. He explained with great accuracy, the differential diagnosis between the corneal laceration and the corneal abrasion.
4. He related the hypopion to iridocyclitis and recommends the aspiration of the hypopion from the eye.
5. He warns that chronic hypotony due to wound leaks may result in phthisis bulbi, or shrinking of the eye.
6. He described the corneal flattening due to intraocular hypotension, as seen with severe dehydration.
7. He described the Aniseikonia in patients with a dilated pupil of only one eye.
8. He described the monocular diplopia due to lenticular subluxation.
9. Cataract: He described the incipient cataract induced myopia.

He insisted the importance of light perception in the eye before performing the cataract surgery to ensure the success of the procedure.

He described the bullous corneal edema secondary to trauma to the corneal endothelium during cataract surgery.

He advocated fragmenting, expressing, and irrigating the cataract and avoiding the loss of the aqueous humor.

He refused to perform bilateral cataract surgery in the same sitting fearing the possibility of contamination.

9. **Glaucoma:** He described the cataract secondary to glaucoma, *glaucomfleken*.

He advised purging and vomiting to treat elevated intraocular pressure attack.

He described papillary dilation and the inability to constrict during the acute glaucoma attack. He advised lowering the intraocular pressure by extracting the aqueous humor to facilitate the repositioning of the prolapsed iris surgically.

10. He described the consensual papillary reaction to differentiate between pre and post chiasmal optic nerve injury.

11. He warns that irritating cancerous lesions can spread the cancer locally or systematically.

12. He described five different types of strabismus, namely: congenital, acquired, spastic, paralytic and strabismus fixus.

He clearly and firmly stated that congenital strabismus should be treated as early as possible.

13. He described and explains the after-image phenomenon.[8,13,14,17,21,24,29]

A manuscript entitled *"Kitab al-Muhadhab fî Tibb al-'Ayn* (A Book of Corrections in the Medicine of the Eye) attributed to Ibn Nafis is present in Vatican library. It contains a description of the eyes of animals and a discussion on the varieties and colors of the human eye.

SALAHUDDIN IBN YUSUF ALKAHHAL (1296AD)

He was from Hammah, Syria and a famous eye specialist of his time. He wrote a book on eye diseases in 1296 AD known as "*Noorul Uyoon wa Jamey al Funoon* (The Light of the Eyes and the Collector of the Arts)" and he discussed new work on the optical theory of vision in this book. He gave biographies of all ophthalmologists up to his time. It is divided into 10 chapters; description of eye, its anatomy and diagrams, theory of vision, eye disorders, its cause and cures, cleaning of eye and benefits of eye lashes, affection of canthi, affection of conjunctiva, affection of cornea, affection of uvea & cataract, Intangible affection, simple drugs of eye disorders. He quoted 94 physicians and scientists, copied 31 books, beginning with Galen and Euclides and ending with Al-Hasan Ibn Al-Haytham's *Kitab-Al-Manazir*. Followings are the unique features of his book.

1. He summarizes most of written work on eye prior to his time.

2. References from most original authors.
3. The book is well organized as he divided it into chapters and subchapters.
4. It is the first book to include a colored picture of a cross section of the eye.
5. The book contains uniquely featured seven diagrams to explain the theory of vision and two diagrams to explain the strabismus.
6. It contains a drawing of 18 surgical instruments scattered throughout the chapter on surgery.
7. The author depends heavily on 'Ali Ibn' Isa's Book *Memorandum* and on the second volume of Al-Razi's book *Al-Hawi*

The manuscript is available at The National Library of Paris, The Gotha Library, Germany, Alexandria Library Egypt, Hamediyah Library Istanbul, Turkey.[8,10,17,32]

QUTUBUDDIN SHIRAZI (1236—1311AD)

He was from Shiraz, Iran and a student of Nasir aldin Al Tusi. He was 13th-century Persian polymath and poet who made contributions to astronomy, mathematics, medicine, physics, music theory, Sufism and philosophy. He was appointed as eye specialist at Shiraz Hospital where he stayed for 12 years. He wrote three books on medicine; *Nuzhat al-ḥukama wa rawżat al-aṭibba* a book on medicine, a comprehensive commentary in five volumes on the Kulliyat of the Canon of Avicenna written in Arabic, *Risala fi'l-baraṣ*- a medical treatise on leprosy in Arabic and *Risala fi bayan al-ḥajat ila'l-ṭibb wa adab al-aṭibbaʾ wa waṣaya*-hum.

In his book on Astronomy and Geography *Nihayatal aflak fi Darayat al aflak* (The Limit of Accomplishment concerning Knowledge of the Heavens), he observed that rainbow was the result of the passage of light through transparent medium (the rain drop). Ray of light is refracted twice and reflected once to cause observable colors of primary bow. He wrote a book on eye ailments and cures in which he described vision theory, optic chiasm, and optic nerve.[5,17]

KAMAL AL-DIN AL-FARISI (1265–1318AD)

He was the pupil of great astronomer and mathematician Qutubuddin Shirazi. A Persian mathematician who repeated and expanded upon the work of Ibn al-Haytham and compiled a book "*Kitab Tanqih al-Manazir* (The Revision of the Optics)". He observed the path of rays of light in the interior of a glass sphere; in order to examine the refraction of sunlight in rain

drops. This led him to an explanation of the genesis of primary and secondary rainbows and he stated that the colors of the rainbow are phenomena of the decomposition of light. He also compiled another book *Al-Basa'ir fi 'ilm al-manazir* (Insights into the Sciences of Optics), a text book for students of optics, presenting the conclusion of the *Tanqih* without the proofs or experiments. He completed the writing of this book in 1309 A.D.[5,17,18]

SADAQA IBN IBRAHIM SHADHILI (D.14TH CENTURY)

He wrote a book on eye diseases "*Kitab al-Umda al-kahliyya fee amaraz al-Basariyya* (The book of ophthalmologist for diseases of eye)" which was a textbook in medical colleges of Egypt. The treatise consisted of five sections each divided into subsections (*fasls*). He stated there is a strong connection between human brain and eyes. He observed that color of eyes is different in each generation. He described four stages of trachoma (Egyptian ophthalmia). He also mentioned cancer of eye lid. Out of four available copies of the book; one manuscript is preserved at National Library of Medicine, USA[5,32] and two Manuscripts are at Royal Library Munich and Leningrad.[17]

IBN AL-AKFANI, ABI'ABDULLAH MOḤAMMAD IBN IBRAHIM IBN SA'ED AL-ANṢ ARI AL-SINJARI (D. 1348 AD)

He lived and practiced medicine in Cairo, where he was the head physician of Al-Manṣuri Hospital. He wrote a book on Ophthalmology "*Kashafurraen fee Ahwalul Ayn* (Uncovering Disorders of the Eye)", this was extensively reviewed by Hirschberg. Ibn Al-Akfani was probably the first to mention following in his book.

1. He described anthrax accurately and named it "Persian fire or Persian fever (*Nare Farsi*)", as severe pustules affect the eyelid.
2. He described a knot (*Uqda*) among the eyelid lesions.
3. He stated that the Pterygium consists of two layers, the epithelium and the endothelium.
4. He stated that giant papilla, or chemosis (*Alwardeenaj*) one of the retinal diseases, which is an erroneous assumption, as it is an eye lid lesion.
5. He described the ocular migraine, as a separate entity, the clinical description and symptoms of which are valid till today.
6. He classified the optic nerve diseases and lesions to prechiasmal (within the chiasm) and postchiasmal (posterior to the chiasm), which is still valid classification.

7. He described day blindness. It is clear, however, that what he was actually describing was congenital blindness caused either by a congenital bilateral optic atrophy or by congenital corneal opacity.[17,32]

DAUD IBNE UMAR AL ANTAKI (D.1599AD)

He was from Antakya in Turkey and a blind person at birth. He learned Greek and Arabic languages, medicine and became an Ophthalmologist. He wrote a treatise known as *Tadhkirat ulil-albab wa jami lil- al-ajab alajab* (Note book on the intelligent on the great marvels) in which he provide explanation of eye diseases and their treatment.[17]

IBRAHIM ALI IBNE TALIB IBNE ALI ALHANAFI (17th Century)

He composed an ophthalmological manual "*Istibsar fee ilaj amrad al absar* (Reflection on treatment of eye diseases)"sometime before 1698. The treatise is divided into four chapter; first deals with anatomy and physiology of eye, the second on external and visible eye diseases, third on hidden eye diseases and fourth on compound ocular remedies. The Manuscript is available in National Library of Medicine, Washington DC.[32]

ABDUL QADIR AL KHULASI AL DAMASHQI (18th Century)

He was from Damascus Syria and composed a book on eye "*Kitab khulasa Al Tashrih* (Epitome of Anatomy)" in which he described functions of each body parts including eye and its treatment.[32]

AHMAD HASAN ALRASHIDI (19th Century)

One of the outstanding ophthalmologist and scholar of Medical School and Hospital "Qasr Al Ayni, Cairo, Egypt", wrote a book on eye "*Kitab Dhiya Al Nayirrin fee elaj al aynayn* (On treatment of eye diseases) printed from Cairo in 1840.[2,32]

CONCLUSION

In the context of the above it may be concluded that Unani Medical scholars contributed a lot in the field of ophthalmology from anatomy and physiology of eye to optics, eye diseases and their treatment through medicine as well as surgery which proved as a base for the progress of western or modern ophthalmology. In the present scenario, Muslim world have an ignorant view of their rich academic culture but India have to play a leading role in revival of the dynamic science which have a vast academic and health care infrastructure of Unani Medicine. In the field of Unani Ophthalmology few research studies have been conducted so

far in India on *Kohal Chikni Dawa* (KCD) a classic formulation for eye ailments for which eye specialist were called *Kahhal*. In an in-vitro study it was concluded that the local application of 3% KCD solution possesses anti-cataract effect in alloxan-induced hyperglycemic rats.[25] In another in vitro study it was found that Local application of KCD (twice daily) caused significant reduction in the lens opacification after 2 to 4 weeks of naphthalene administration.[26] It proved that Unani Medicine have an assets in the field of ophthalmology which has not been explored yet and it requires deep probe to find economic, effective treatment for eye diseases where modern medicine have no answer.

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