

# The study of ocular tuberculosis during the 19<sup>th</sup> and early 20<sup>th</sup> century

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## SUMMARY

During the 19<sup>th</sup> and early 20<sup>th</sup> century the achievements in the study of ocular tuberculosis were of great significance.

The development of pathological anatomy in those years helped physicians to understand the histological image and the pathophysiology of the disease and allowed the scientists to detect the specific anatomical structures of the eye, where the disease could be present. The physicians of those years tried to describe the clinical image of the disease and to give value informa-

tion, in order to facilitate the diagnosis. Despite major efforts made in the field of clinical approach to ocular tuberculosis, the treatment of the disease in those years was not very effective.

Nevertheless, the physicians of the time used every new pharmacological or not pharmacological treatment to fight the disease.

*Keywords:* ocular tuberculosis, pathology, Robert Koch, anatomy.

## INTRODUCTION

The discovery of *Mycobacterium tuberculosis* by Robert Koch (1843-1910) in 1884 was a breakthrough in the study of tuberculosis, especially for the form of pulmonary tuberculosis, which afflicted humanity from the antiquity [1, 2]. Due to this discovery the scientists could now focus on a treatment which could treat more effectively the patients. However, it took several years until Alexander Fleming (1881-1955) in 1928 discovered penicillin and introduced an accurate treatment for tuberculosis in clinical practice [3]. The *Mycobacterium tuberculosis* infection was not limited only to the lung, having in mind that pulmonary tuberculosis was very common and a lethal disease, but many other forms of this infection were also detected. Among those forms, a very distinctive one was the ocular tuberculosis where almost all the anatomical structures of the eye could be

infected. During the 19<sup>th</sup> century many studies and great effort were made in order to understand and describe this specific form of infection.

### *Ocular tuberculosis*

The birth of pathological anatomy at the first third of 19<sup>th</sup> century gave new potentials in the study of all the pathological phenomena in medicine [4]. Although from the 18<sup>th</sup> century a serious effort was made in order to examine the histological characteristics of various diseases, with the works of Giovanni Battista Morgagni (1682-1771), the introduction of more powerful, for the time being, microscopes and the systematic approaches by various physicians was necessary, in order to have clear conclusions concerning the histological disorders in the pathological phenomena [5]. On the other hand, especially for ocular tuberculosis, the invention of ophthalmoscope in 1851 by Hermann von Helmholtz (1821-1894) played an important role as well for the detection of tuberculosis [6].

Although in the previous centuries the inflammation and the ulcers on the ophthalmic tissues were observed - Antoine Maître-Jan is believed to

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describe ocular tuberculosis in 1711 - the scientific study of ocular tuberculosis began at the early 19<sup>th</sup> century [7]. The first scientific observations considered chorioidal tuberculosis were made by Johann Hermann Heinrich Ferdinand von Autenrieth (1772-1835) in 1808 [8]. Noël-Francois-Odon and Guéneau de Mussy (1813-1885) in 1837 were the first ones who pointed the infection in chorioidal after autopsy, where the specific granuloma of tuberculosis was observed [9]. Eduard Jäger von Jaxtthal (1818-1884) in 1855 was the first to describe tuberculosis in fundus after ophthalmoscopy [10]. In 1858 Wilhelm Manz (1833-1911) was the first to give a detailed description of the microscopic findings in chorioidal tuberculosis [11]. Julius Friedrich Cohnheim (1839-1844) in 1867 was also the first to combine the findings in ophthalmoscopy with the histological image in chorioidal tuberculosis [12].

Giuseppe Gradenigo's (1859-1926) observation of iris tuberculosis granuloma in 1869 was the first not only of iris tuberculosis but also of the fact that ocular tuberculosis could be primary and not only secondary as believed before, because the earlier observations were made in patients suffering mainly by pulmonary and meningitis tuberculosis, while his patient had no other tuberculosis infection in his body [13].

Giuseppe Arcoleo (19<sup>th</sup> century) noted for first time tuberculosis in cornea in 1867, Eugène Bouchut (1818-1891) in retina in 1869, Köster W. (19<sup>th</sup> century) in conjunctiva in 1873, Antonin Poncet (1849-1913) in vitreous body in 1875, Hubert Sattler (1844-1928) in optic nerve in 1878, and Köhler (19<sup>th</sup> century) in 1884 in sclera [10,14-17]. In addition, Louis Alexander (19<sup>th</sup> century) and Hans Adler (19<sup>th</sup> century) were the first, in 1875, to describe the conjunctiva tuberculosis in the form of lupus vulgaris, which is facial tuberculosis known by that name in those years [18, 19]. A year before Koch's discovery, in 1883, Julius von Michel (1843-1911) identified the tubercle in the eye [20].

The main interest in the study of ocular tuberculosis during the 19<sup>th</sup> century was the detection whether ocular tuberculosis was primary or secondary. This distinction played a crucial role at the time, because in case of secondary, the physician should find the primary place of the infection on the body and the patient should be examined thoroughly and treated with great care. Apart

from problems in vision, special clinical characteristics were assigned according to each structure of the infected eye [21].

Conjunctival tuberculosis was considered either primary or secondary. In primary type it was believed that the *Mycobacterium tuberculosis* had entered conjunctiva through wounds of the conjunctiva or after an operation. Two forms were distinct: the acute and the chronic. The acute form could be misdiagnosed as acute trachoma or Parinaud's conjunctivitis, as in this form numerous small nodules, which grow and coalesce, appeared. In the chronic form the appearance of an irregular shallow ulcer on the palpebral or ocular conjunctiva is characteristic. Therefore, it can be misinterpreted as chalazion or epithelioma. The chronic form is known as the lupus vulgaris disease [22].

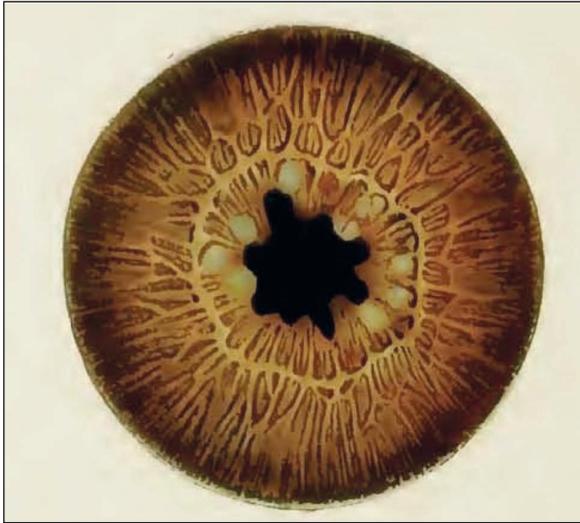
Corneal tuberculosis was rarely believed to be primary and affecting both eyes. Three clinical images of this infection were described. The interstitial keratitis, the sclerosing keratitis, and the appearance of grayish opacities situated deep in the corneal tissues and lead to superficial ulceration of the cornea [23].

The tuberculosis of sclera was extremely rare as a primary infection, while more frequent was the extension of the infection by uveal tract, Tenon's capsule, optic nerve and cornea. Episcleritis or scleritis were the main symptoms [24].

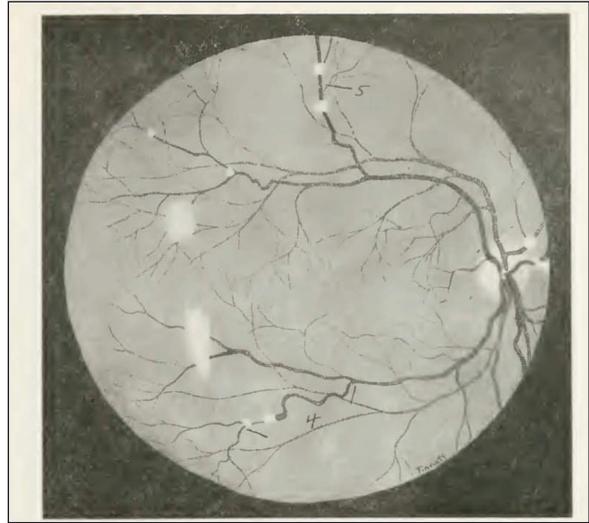
Tuberculosis of iris (Figure 1) was considered as a children's or young boy's disease, because it was very rarely diagnosed in people older than twenty years. This could be primary or secondary. It had two forms. The first one miliary tubercles of the iris had the form of small gray elevations which had a thickened hyperemic base. The second one appeared as conglomerate tubercle, where a large mass of tubercular tissue developed from one or from numerous foci. Both forms could be misdiagnosed as syphilitic iritis [25].

Chorioidal tuberculosis was considered a disease either of the chorioidal stroma or the chorioid. It was believed to be secondary. In this condition the miliary tubercles were detected at the posterior part of the fundus and were not visible until they occasionally disturbed the retinal pigment layer [26].

Tuberculosis of the retina was believed also to be secondary (Figure 2). The detachments of the retina or the chorioid were among the characteristic



**Figure 1** - Iris tuberculosis in wax model. Copy of a real case in early 20<sup>th</sup> century. (Greef R. Atlas of external diseases of the eye. New York: Rebman Co. 1914).



**Figure 2** - Tuberculosis of retinal vessels. View through ophthalmoscope. Early 20<sup>th</sup> century. (Wood CA (Ed.). American Encyclopedia and Dictionary of Ophthalmology. Chicago: Cleveland press. 1913-21).

symptoms of these two types of tuberculosis. Retinal tuberculosis occurs most often as a vasculitis or a peri-vasculitis of the retinal vessels which appear as white infiltrates surrounding and attacking the vessels [23].

Tuberculosis of optic nerve was believed to be present only after a trauma or surgery. Optic neuritis was the primary symptom, while tubercle tumors could arise in every portion of the optic nerve [27].

#### *Ocular tuberculosis diagnostic tests*

The clinical image of ocular tuberculosis and the lesions found during ophthalmoscopy were the main means for diagnosis of ocular tuberculosis before Koch's discovery. The earlier diagnosis of tuberculosis in another organ helped many physicians to reach this diagnosis. After the discovery of *Mycobacterium tuberculosis*, four tests were introduced in clinical practice in order to diagnose ocular tuberculosis, when the patient did not have another obvious form of tuberculosis and the symptoms in the eye showed mycobacterial infection, namely: the Calmette's ophthalmotuberculin reaction, the von Pirquet's reaction, the Moro test and the Koch subcutaneous tuberculin test. Calmette's ophthalmotuberculin reaction was the only test applied directly to the eye, be-

cause a drop of 1% tuberculin in aqua solution was instilled in the eye and the physician waited for its irritation during the next 24 hours. Von Pirquet's reaction and Moro test had to do with the application of tuberculin on the skin either on the inner surface of the arm, or on the chest (or the abdomen). All these methods were not considered secure and had low value for the diagnosis. The more preferable one was the Koch's subcutaneous tuberculin test where 0.1 mg of tuberculin was injected subcutaneously [28].

#### *Treatment of ocular tuberculosis*

After Koch's discovery of tuberculin, apart from being a mean to diagnose the disease, tuberculin was also used as the main treatment in ocular tuberculosis, firstly used by this physician in 1890. Two forms were used: the old and the new tuberculin. The old tuberculin consisted of broth culture of the tubercle bacillus of the human type boiled and concentrated, from which the bacilli had been removed by filtering. New tuberculin was a suspension of pulverized tubercle bacilli in water with an addition of an equal volume of glycerin. New tuberculin was also produced by bovine bacilli. Tuberculin was mostly injected. At that time it was believed that tuberculin could be used for the immunization of the population,

therefore it was used also as a vaccine, but with great controversy, and finally this idea was abandoned. Before Koch's discovery, a popular treatment for ocular tuberculosis was the use of mercury as collyrium [28].

The discovery of X-Rays by Wilhelm Conrad Röntgen (1845-1923) in 1895 was a breakthrough not only in radiology but for the entire medicine, because these rays were used for the treatment of many diseases, including ocular tuberculosis. The main treatment by X-rays was 10 sessions with duration of 10 minutes. This treatment was mainly tried against lupus vulgaris, but it was also used for conjunctival and iris tuberculosis [29].

A different treatment but with good results was applied against intraocular tuberculosis. This treatment, introduced by Köster, intended to cure intraocular tuberculosis by injecting sterile air into the anterior chamber, a portion of the aqueous humor. It was considered as effective in the superficial forms of keratitis, scleritis, kerato-conjunctivitis of phlyctenular origin, central and marginal ulcer of the cornea, with or without hypopyon. During this treatment the needle tip of a sterile hypodermic syringe filled with air drawn through an alcohol flame was entered beneath the conjunctiva leaving the sterile air [28].

Surgery had also a major role in the treatment of ocular tuberculosis, when the pharmaceutical and others treatments had failed. Enucleation of the eye was necessary in cases of retinal, corioidal tuberculosis or in cases of optic nerve tuberculosis. In cases of iris tuberculosis, iridectomy was a solution. Cautery was used in external lesions mainly on the lids and in lupus vulgaris [30].

## ■ CONCLUSION

The history of ocular tuberculosis during the 19<sup>th</sup> and the early 20<sup>th</sup> century can be divided in four periods: before and after the introduction of the study of pathological anatomy and before and after Koch's discovery of *Mycobacterium tuberculosis*. The study of pathological anatomy gave the opportunity to understand the histological lesions provoked in this disease and specific pathological characteristics were attributed to the disease. Therefore, the histological image could distinct the disease from other ocular pathologies, which could provoke confusion when only the clinical

characteristics were examined. On the other hand, Koch's discovery gave the opportunity for specific pharmacological treatment with tuberculin to have the primordial role that time. Ocular tuberculosis was a serious pathological condition attracting the interest of physicians, and as a result almost all the text books of ophthalmology include special chapters for this disease.

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