OCULAR COMPLICATIONS OF LEPROSY

Complicações oculares da lepra

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ABSTRACT

Leprosy still constitutes a public health problem due to ocular complications. To expose the ocular complications of leprosy, through integrative review, contributing to practice objectivity to help changing attitudes of health professionals in relation to leprosy patients, according to the World Health Organization Vision 2020 Program. The authors conducted a critical integrative review employing inclusion criteria: the research has been published between 1930 and 2013 and be restricted to ocular complications of leprosy, been provided the inclusion of other aspects relate to the disease. Without limiting the search to English language, one employed the descriptors [leprosy], [eye], [ocular], [Hansen's disease], [*Mycobacterium leprae*] associated to [sequela], [complications] e [deformity], linked by Boolean connectors AND/OR, applied to MedLine, SCIELO, Lilacs, Scopus. EBSCO, Cochrane and Google Scholar database, using the program JabRef®, version 2.9.2. We found 387 publications, 33 of which were part of the review. Among the ocular complications, lagophthalmos, cataract, uveitis, blindness and iris changes were most frequent, with variable prevalence according to patient age, disease duration, place of study and level of detail of the eye examination. There was consensus that the prevalence of ocular complications can be reduced with the introduction of ophthalmic examination from diagnosis and after completion of multidrug therapy. Ocular complications are still worrying thus health professionals should refer these patients to ophthalmologic exam.

Keywords: Leprosy. Ophthalmology. Leprosy/complications.

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RESUMO

A lepra ainda se constitui como um problema de saúde pública devido a complicações oculares. Para descrever as complicações oculares da lepra, através de uma revisão integrativa, contribuindo para a prática da objetividade para ajudar atitudes de mudança de profissionais de saúde em relação a pacientes leprosos, de acordo com o Programa Vision 2020, da Organização Mundial de Saúde.

Os autores conduziram uma revisão integrativa crítica empregando um critério de inclusão: a pesquisa ter sido publicada entre 1930 até 2013 e foi restrita a complicações oculares da lepra, sendo fornecido a inclusão de outros aspectos relacionados a doença.

Sem limitar a pesquisar a língua inglesa, empregamos os descritores [leprosy], [eye], [ocular], [Hansen's disease], [*Mycobacterium leprae*] associado com [sequela], [complications] e [deformity], ligados pelos conectores Booleanos AND/OR, aplicados a dados do MedLine, SCIELO, Lilacs, Scopus. EBSCO, Cochrane e Google Scholar usando o programa JabRef®, versão 2.9.2. Encontramos 387 publicações, 33 dos quais foram parte desta revisão.

Dentre as complicações oculares, lagophthalmos, catarata, uveíte, cegueira e alterações na íris foram os mais frequentes, com a prevalência variável de acordo com a idade do paciente, duração da doença, local de estudo e nível de detalhes do exame ocular.

Houve um consenso que a prevalência de complicações oculares podem ser reduzidas com a introdução de um exame oftálmico a partir de um diagnóstico e depois da conclusão da poliquimioterapia. As complicações oculares ainda estão preocupando, assim profissionais de saúde devem enviar estes pacientes para um exame oftalmológico completo.

Palavras-Chave: Leprosy. Ophthalmology. Leprosy/complications.

INTRODUCTION

Leprosy is an infectious disease, granulomatous, chronic, caused by *Mycobacterium leprae*, often affects the skin, peripheral nerves, but can also affect the upper respiratory tract mucosa, muscles, bones, reticuloendothelial system, testes and anterior segment of eye [1,3].

Although leprosy control has improved significantly due to national and sub-national campaigns in most endemic countries, it is still a major public health challenge in 105 countries or territories, affecting 219,075 people in 2011[4].

Clinically, leprosy comprises a broad spectrum. At one extreme are paucibacillary cases (sometimes known as tuberculoid leprosy), characterized by relatively intact function of the cellular immunity of the host result of the low bacterial load. At the other extreme are multibacillary cases (known as lepromatous form), in which the cellular immune impairment is severe, resulting from the high bacillary load. Between the two extremes are patients known as borderline, with varying degrees of immune impairment [1].

Ocular complications in leprosy are common, with large margin of variation in prevalence and usually cause vision impairment and may evolve to blindness. Ocular manifestations may derive not only from the disease per se, but also reactions to drug therapy[4,5].

Among the ocular complications are lagophthalmos, trichiasis, chronic uveitis, superficial and interstitial keratitis, corneal nerve beading, scleral and corneal nodules, acute iridocyclitis, glaucoma, cataracts and reduction of intraocular pressure (IOP). This reduction stems from the loss of autonomic function in the anterior segment of the eye, presumably by bacillary infiltration of the ciliary nerves [6].

Leprosy is a public health problem for three main reasons. At first, because of high incidence that is replaced by the rate of diagnosed cases when it cannot be determined; the second reason is because its prevalence is not adequate to reflect the epidemiological changes of the disease, since this rate depends on the type of leprosy, the patient's age and the treatment implementation. The third reason for leprosy being a challenge is in its derived disabilities, including the disease stigma and ocular complications, both preventable and curable, as the most important[7].

The care of patients with leprosy should follow the recommendations including eye examination for every patient to the diagnosis, when ceasing drug therapy and in the presence of ocular complications. However, the leprosy patients rarely seek eye care services, which increases the risk of visual impairment by ocular diagnostic delay[1]. Additionally, the WHO[4] has warned that, in practice, these recommendations are not followed because it is not an active search of cases and the disease is not yet prioritized, resulting to be considered neglected; hence the importance of disclosing ocular complications of leprosy, as a way to preserve the vision of these patients[8,9].

The aim of this review is to describe and analyze the frequency, types and degrees of eye complications caused by leprosy, contributing to practice objectivity in understanding the

disease that can assist in changing attitudes of health professionals towards patients with leprosy, as with the Vision 2020 Program from the World Health Organization.

METHODOLOGY

We carried out a descriptive integrative review, which constitutes a type of systematic review aimed at the synthesis of knowledge and incorporation of evidence into clinical practice. The integrative review, compared with systematic reviews (with or without meta-analysis) is more comprehensive because it allows experimental or quasi-experimental studies, reviews, meta-analysis, dissertations, academic theses, and case studies are included, as well as case-control studies and cohorts for a better understanding of the state of art, giving greater scope in order to contextualize advantages and desvantagens [10].

The guiding question of this review was: what is the frequency of each of the ocular complications of leprosy and how to reduce it? To answer this question, were defined as inclusion criteria the research has been published between 1930 and 2013 and restricted to ocular complications of leprosy, being permitted to include other aspects relating to the disease. Without limiting the search to English language were used the descriptors [leprosy], [eye], [eye], [Hansen's disease], [*Mycobacterium leprae*] associated with [sequel], [complications] and [deformity] combined by the Boolean connectors AND/OR

MEDLINE, SciELO, LILACS, Scopus EBSCO, Cochrane and Google Scholar databases were searched with the JabRef ® references search program version 2.9.2.

RESULTS AND DISCUSSION

A total of 387 publications were located, which were subjected to independent analysis of two judges by reading the titles and abstracts. At this stage 168 publications were excluded by title and 186 by the abstracts, resulting in 33 publications that have integrated this revision, as shown in the flowchart (Figure 1) and in Table 1.

Among the 33 studies, 10 [1,4,7,11-17] were epidemiological reports or reviews, two studies were case-control[6,18], 17 were cross-sectional design[3,5,19-30,34-36], two were cohort studies[31-32] and two were case studies [2,33].

Regarding the sites of field research, regardless of the design, seven were performed in the Americas[2,18,20,24,34-36], four Brazilian studies [24,34-36, 13] involving patients from Asian

countries [3,5-6,21-23,25-30,32], with a predominance of India [3,5,22-23,27-29,32-33] two in African countries [19,30] and a multicenter study of patients from Asian and African continents [31].

All studies held in common the classification of patients according to leprosy characteristics, bacillary form, type of injury, disease duration and treatment time, which were always considered prognostic factors for the development and worsening of ocular complications. These variables were also highlighted in reports of relative [5,7,14,22,24,26] or cumulative [21] frequency, incidence [32] or prevalence [2-4,6,9,23,25,27-29,33-36].

Table 2 shows the prevalence, incidence or frequency of ocular complications reported in 17 of 20 studies with field research, which could be classified into two groups according to the treatment time. The first group included patients during treatment [5-6,19-22,25-26,29-31], while the second group included patients after treatment completion [3,21,23-24,28,32,34-36].

Among the ocular complications, we found that unilateral or bilateral blindness was reported in 13 (81.2%) studies, adopting the criteria defined by the WHO in the International Classification of Diseases, version 10.in In frequency, the references in lagophthalmos (12; 75.0%), cataract attributable to leprosy (11; 68.8%), changes in corneal aesthesia (10; 62.5%) and in fewer research other complications were reported, as shown in Table 2.

This review is justified given the need to highlight the most important aspects of the ocular complications in leprosy, which have not been sufficiently disseminated among non-ophthalmologist professionals or non-epidemiologists working in basic health units [5,7,12, 27,29.]

There is consensus among several authors at different times, that the high prevalence of severe ocular complications in leprosy, including blindness, is due in large part to the retardation of ocular diagnosis [1,4,5,12,15,23,34]. Despite the WHO guidelines [4,7] emphasize this point, only four articles [12,27,29,34] suggested that ophthalmologists should train health professionals for ocular inspection of eye problems screening in all patients diagnosed with leprosy, regardless of time of treatment or illness, since part of ophthalmologic complications manifest later, even after patients having been considered "cured"[12,34].

The same recommendation is made in the Manual of Ocular Complications Pipelines for the Ministry of Saúde [34], written under the guidance of Oréfice, Brazilian ophthalmologist internationally regarded as expert on ocular complications of leprosy.

> Among the simple basic actions of eye care at the community level, made by trained health agents, [...] the simplified eye examination should be performed in all patients with leprosy at

diagnosis, at the time of discharge and when showing any ocular signs or symptoms.

The importance of ocular complications of leprosy based on prevalence has been questioned, because it is influenced by several factors. Among these are environmental conditions (climate and geographic region), patient characteristics (ethnicity and social status), disease variables (type and duration of disease and treatment, type and number of leprosy reactions) as well as conditions for patient assistance (institutionalization, community care, level of complexity of the health service, availability of eye care and professionals expertise for the management of leprosy) [1,3-4,11-12,31,35-36].

This argument is relevant to the extent that the disease mostly affects people inhabiting developing regions where resources for health care are limited or even nonexistent. Hence, prevalence studies have been restricted to locations that have ophthalmologists experienced in the diagnosis of ocular complications of leprosy, thus leaving many of these patients out of the statistics, which would explain such disparate rates as listed in Table 2.

Another explanation for different rates as well as for omission of the prevalence of some of the ocular complications of leprosy consists of some authors exclusively prioritize complications that cause blindness or can be more easily identified by non-ophthalmologist health professionals [4,26,28-30]. From this prioritization may have derived more frequent report of cataract, lagophthalmos and corneal sensitivity changes, as well as the omission of prevalence of madarosis and trichiasis [27].

In reducing the prevalence of leprosy, it has been questioned the non-inclusion in the statistics of patients that completed multidrug therapy, which should be considered as relevant with respect to ocular complications. Evidence has shown that about 20% of multibacillary patients in five years after finishing the polychemotherapy will present potentially severe ocular complications[1]. The fact emphasizes the importance of ophthalmological care to these patients over at least five years for prevention of blindness [4,7,34].

Leprosy has been considered a public health problem since 1989 [1,6], but the reasons for classifying it as so have changed over time, due to better knowledge of the disease and the improvement of ophthalmic research equipment, as also for causing disabilities.

Initially, studies were mainly aimed at determining the prevalence of skin lesions, especially by the stigma attached to leprosy. To the extent that disease prevalence decreased due to the availability of treatment, the interest by the disease has also decreased, but according Thompson[13] in ophthalmology, there was a changing of leprosy in identifying that there is no

disease that causes most eye damage than it. However, the interest of ophthalmologists is far from being spread among other health professionals, to devote greater effort on examining these patients [4,7,14,15,17,34].

Ocular complications of leprosy have been the subject of several studies. In Brazil, the first studies were performed by the group of ophthalmologists led by Oréfice, who has had to demonstrate the presence of *M. leprae* in the conjunctiva of patients in the course of polychemotherapy [35], as well as identifying that 31.5% of patients had ocular complications, whose frequency was higher in older patients and with longer disease duration[36]. It was also reported that the most serious injuries were rare, a fact attributed to multidrug therapy [36].

The finding of *M. leprae* in iris was reported by Messmer et al [2]. The authors considered that the presence of bacteria could trigger cell-mediated reaction (by macrophages, T lymphocytes and epithelioid cells) and autoimmune phenomena, which would respond by iridocyclitis resulting in blindness by leprosy, even after proof of absence of mycobacteria in the skin. Bacteria in the iris would cause the formation of miliary lepromas or "pearls", pathognomonic of the invasion, but rarely described before the acute inflammation manifests, even if they are present in the early stages of the disease.

Waddell and Saunderson [19], investigating 678 patients, among 2715 with leprosy, identified that multibacillary patients had a higher risk of developing lagophthalmos compared to those paucibacillary (OR = 1.4%, 95% CI 0.6 to 3.2%). Even if one considers the lack of significance of this difference, the importance of this study was the demonstration that lagophthalmus represented increased risk of eye damage, even after treatment completion, unlike what was assumed at the time. To the authors fitted the merit, recognized later in the consensus meeting of the World Health Organization, of drawing attention to the need to monitor leprosy patients after multidrug therapy completion, because prevalence rates showed geographical change.

This statement was confirmed by Singhi et al. [5] when identifying that prevalence of ocular complications in India ranged from 6.3% to 74.2%, depending on the region in which it was determined. Also, this variation was attributed to the environmental conditions and the health care facility. Likewise, Courtright et al.[31], in a longitudinal study including patients from three countries (India, Philippines and Ethiopia), concluded there being geographical variations in the prevalence of ocular complications, even in countries where leprosy control could be considered of quality.

It means that the control of ocular complications of leprosy must be constantly investigated in each country, so that we can conclude the existence of controlling these complications, even because, although patients who complete treatment are considered cured of leprosy by being bacteriologically negative, impairments manifested before treatment will be still present (24) may be evolve due to neural damage, which does not revert with the treatment[22].

The study by Daniel et al.[22] confirmed this assertion. When investigating patients with relapsed leprosy, the authors found that lagophthalmos was significantly associated with disease duration, degree of deformation II, punctate keratitis and cataracts. Additionally, the authors found that patients with lepromatous and lepromatous borderline forms to the initial diagnosis had a higher risk of reduced visual acuity, iris atrophy, keratic precipitates and the formation of beads on the corneal nerves compared to the other ways; thus requiring more accurate and more frequent ophthalmologic care. The authors consider their study as a pioneer, but in this review was noted that Walton, Ball and Joffrion [20] reported such injuries in 1991.

In a study involving 193 patients previously treated with dapsone or clofazimine, Walton, Ball and Joffrion [20] identified that 10% showed primary glaucoma and 5.7% secondary glaucoma to uveitis, in all cases diagnosed after one year of treatment. The authors concluded that chronic inflammation of leprosy remains and evolves to secondary glaucoma, even after monotherapy treatment [20].

Study on 501 patients considered as cured identified that 11 years elapsed from the end of treatment, 15% developed lagophthalmos, keratitis or posterior synechiae, previously absent injuries, resulting in the recommendation of prioritizing the systematic monitoring of patients with lagophthalmos, even with natural eyelid closure, trichiasis, pupillary diameter smaller than 2 mm and posterior synechiae, as a way of preventing the development of lagophthalmos in forced eyelid closure, keratitis and cataract [21].

Study in Nepal [23], including 58 patients, confirmed the persistence of ocular lesions after completion of multidrug therapy. Multibacillary patients, when compared to those paucibacillary, had twice the frequency of uveitis, cataracts and corneal lesions attributed to trichiasis. They also found that the uveitis was cause of blindness in 88% of patients, corroborating wide variations in prevalence of eye complications according to spatial distribution.

A characteristic of leprosy is the possibility of the occurrence of reactions - periods of acute inflammation in the course of a chronic disease that can affect nerves. Those with various skin lesions and neural enlargement are at high risk. Multibacillary patients (MB), the most serious form of the disease, especially those who already have neural impairment in the diagnosis, should be monitored more frequently for signs of new neural damage requiring treatment, because most of them (65%) can develop it. However, in patients with MB leprosy reactions can occur for many years after the treatment has been completed [1,13,17].

The eye may be involved in type 2 reaction with iritis. Clinical manifestations such as pain, redness, narrowing and pupil irregularity and photophobia usually occur during the first three years after starting the multidrug therapy (MDT), but they may also be present before this early in more advanced MB cases. As the body needs a long time to eliminate the dead bacilli, patients may present episodes of type 2 reaction, even after two years of successful completion of MDT, as evidenced by Daniel et al.[32].

Among the studies included in this review, it was found that 8 (24.2%) reported changes in intraocular pressure in leprosy patients, but only 2 (6.1%) reported increased IOP. Daniel et al. [22] in 2002 described a case of increased IOP, using biomicroscopy by slit lamp and measurement of intraocular pressure by Goldmann applanation tonometer, corresponding to a percentage of 1.7%. However, Thomas et al.[3] in 2003 described 9 (2.3%) cases among 386 multibacillary patients treated and attributed the higher frequency of increased intraocular pressure by employing equipment that allows more detailed examination. The authors[22] found that the use of gonioscopy, automated perimetry and stereoscopic examination of the optic disc, in addition to the tests used by Daniel et al. [22], allowed identification of cases that would be underdiagnosed.

Knowledge of the ocular complications of leprosy has evolved, allowed early institution of preventive measures, but much remains to be investigated. In the opinion of Mahendradas et al.[33], there is a need for introducing the most modern arsenal of ophthalmic research in the routine exams of leprosy patients. The authors used optical coherence tomography and proved that nodular lesions well demarcated, smooth surface, with internal hyporeflexia in the iris, corresponding to areas of granuloma, decrease in size with chemotherapy treatment, demonstrating that this noninvasive technique may represent the future of investigation of eye injuries.

Ocular complications, even after more than 100 years since the first description of leprosy, remains a public health problem that has been relegated to the background, especially

in the monitoring of patients considered cured, given the negative bacilli in the skin after polychemotherapy. The detailed ophthalmological examination has allowed identifying that blindness by leprosy is preventable, when obeyed the condition of monitoring patients.

Among the most common ocular complications are included lagophthalmos, uveitis, iritis, cataract, glaucoma, and more rarely, increased intraocular pressure. The importance of such complications lies in the risk of blindness or visual loss, compromising the quality of life of patients.

FINAL CONSIDERATIONS

This review identified that the description of ocular complications evolved from the involvement of the annexes to the detailing of intraocular injuries due to the use of technologically enhanced equipment. Similarly, it is expected that the use of the more modern diagnostic arsenal may contribute to greater awareness of eye disease, greatly reducing blindness from leprosy.

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SUPPLEMENTARY MATERIAL

TABLES

Table 1 - Characteristics of articles included in the integrative review

Author(s)	Year	Type of study	N.	objective	Results of interest for review
Lewallen et al.[6]	1989	Case-control	510	Postural changes in intraocular pressure	Reduction of intraocular pressure associated with keratitis and avascular iris, probably by autonomic changes of the anterior segment of the eye
Lewallen et al.[18]	1990	Case-control	509	Postural changes of intraocular pressure, and evaluation of the pupil size as a measure of ocular autonomic dysfunction	Autonomic dysfunction explains the reduction in pupil diameter, but does not the reduction of the intraocular pressure of patients compared to controls
Walton, Ball, Joffrion[20]	1991	cross-sectional	193	Prevalence and characteristics of glaucoma	Informs the prevalence of glaucoma in patients treated pointing the need for evaluating iridocyclitis and intraocular pressure, even after treatment completion
Waddell, Saunderson[19]	1995	cross-sectional	2715	Prevalence, range and severity of ocular involvement	Informs the prevalence of ocular complications in patients treated by assigning the low prevalence to the early ophthalmologic examination and follow-up during treatment, but reiterates need for training of professionals

Author(s)	Year	Type of study	N.	objective	Results of interest for review
					for this to occur
Messmer, Raizman, Foster[2]	1998	Case Study	1	Description of a case of leprosy diagnosis from ocular involvement	Description of the diagnosis of bilateral uveitis, glaucoma and keratitis refractory to conventional therapy, attributed to leprosy diagnosed from ocular examination
Lewallen et al.[21]	2000	cross-sectional	501	Progression of ocular complications in "cured" patients	Informs the cumulative incidence in patients treated by identifying the progression of ocular complications even after microbiological cure as a result of neural injury
Lewallen, Courtright[1]	2001	critical review	-	Review of the prevalence and causes of ocular complications in Africa	Informs the prevalence of ocular complications in treated cases, stating there being little information about blindness by leprosy. The frequency of lagophthalmus ranged from 2% to 5% and vision smaller than 6/60 was 2.2%
Courtright et al.[31]	2002	Cohort of eight years	691	Description of ocular complications in India, Ethiopia and the Philippines	Informs the prevalence of complications in patients treated

Author(s)	Year	Type of study	N.	objective	Results of interest for review
Singhi, Kaccawa, **Table 2 - Characteristics of articles included in the integrative review** Ghiya[5]	2002	Descriptive cross-sectional	518	Frequency of ocular impairment	Prevalence of blindness (2.8%), reduced visual acuity (5.2%) and risk of blindness (11%), which requires ophthalmologic follow-up until five years after end of treatment
Daniel et al.[22]	2003	cross-sectional	60	Percentage of ocular injuries in patients with newly diagnosed multibacillary recurrence	Informs the relative frequency of involvement of one or both eyes in 50.5% of treated patients, pointing to the need for ophthalmological examination
Thomas, Thomas, Muliyil[3]	2003	Population, cross-sectional	446	The prevalence of glaucoma in patients who completed treatment	Informs prevalence of glaucoma in multibacillary patients treated equal to 3.6%, the same as the general population for primary glaucoma

Author(s)	Year	Type of study	N.	objective	Results of interest for review
Nepal, Sherestha[23]	2004	cross-sectional	58	Frequency of ocular complications after treatment	Stricter eye examinations of patients after treatment, especially women
Hogewer, Keuner[12]	2005	critical review	-	Description of the causes of blindness and prevention	To fulfill the Vision Program 20/20 from WHO, it is necessary to train physicians for diagnosis, although presumptive and referral to an ophthalmologist
Souza et al.[24]	2005	cross-sectional	58	Frequency of ocular abnormalities in cured patients	Informs the absolute frequency of ocular complications in patients treated, claiming to be high for changes in the ocular bulb after treatment completion, pointing to the need for continuous eye care
Javvadhi et al.[25]	2005	cross-sectional	93	Change in intraocular pressure and risk factors	Reduction of intraocular pressure of patients compared to controls, especially when untreated and can be used as standard treatment efficacy
Thompson[13]	2006	editorial	-	Presentation of problems related to not prevention	Need for dissemination of leprosy for the general population and for clinicians in particular, aiming at prevention
Thompson et	2006	cross-sectional	1137	Patterns of ocular morbidity and blindness	Informs the prevalence of morbidity (20.75) and blindness (2.9%) in treated patients and treatment, claiming to be

Author(s)	Year	Type of study	N.	objective	Results of interest for review
al.[27]					variable in different areas of the same region. The eye examination is essential in the monitoring of patients
WHO[7]	2006	report	-	Eighth Meeting of the WHO Committee on Leprosy Control	Informs the prevalence and proportion of new cases, they will remain being diagnosed despite efforts to eradicate the disease, which requires special care to prevent eye disorders
Daniel et al.[32]	2006	Cohort of eight years	278	Incidence of ocular complications after two years of multidrug therapy	Informs the incidence of ocular complications in treated patients pointing the need for ophthalmologic monitoring for two years of multibacillary patients undergoing multidrug therapy
Lewallen, Courtright[1]	2007	critical review	-	Details of ocular complications	Alerts to the danger of considering leprosy under control, because the ocular complications are serious and must be diagnosed early
Ministério da Saúde[14]	2008	epidemiological report	-	Description of the epidemiological situation of leprosy in Brazil	Description of the temporal trend from 1994 to 2007, the incidence and the coefficient of new cases diagnosed in Brazil
Trivedi,	2008	Short review	-	Description and causes of ocular complications	Associates the description of the ocular complications to the signs and likely causes

Author(s)	Year	Type of study	N.	objective	Results of interest for review
Venkatesh[16]					
Cohen[17]	2009	review	-	Review of ocular complications	Ophthalmologists need to become more perceptive and interested in the diagnosis and treatment of complications
Parikhet al.[28]	2009	cross-sectional	386	Description of ocular manifestations after treatment	Informs the prevalence of treated cases Ocular complications should be tracked in multibacillary patients, even after treatment completion
Reddy, Raju[29]	2009	cross-sectional	1004	Prevalence of ocular lesions evaluated by trained health professionals	Informs the prevalence of ocular complications in treated patients and under treatment, which equates to 60.3%, whose determination was possible due to the training of health professionals for the initial diagnosis and referral to the ophthalmologist
Javvadhi, Das, Agrawal[26]	2009	cross-sectional	186	Patterns and determinants of ocular complications	Informs the percentage frequency of ocular complications in treated and untreated patients, identifying corneal complications more frequent in patients with higher bacterial load, longer duration of disease, as well as reduced corneal sensitivity
Eballé et al.[30]	2009	cross-sectional	346	Prevalence and causes of blindness and low vision	Informs the prevalence of ocular involvement in treated cases, identifying 35% of patients with undiagnosed ocular impairment and the need for systematic ophthalmologic

Author(s)	Year	Type of study	N.	objective	Results of interest for review
					examination
Ministério da Saúde[15]	2011	National Health Plan	-	Description of goals for leprosy	Informs the crude mortality rate and prevalence of diagnosed cases - determining as reduction goal from 1,75:100.000 to 0,98:100.000 inhabitants until 2015
WHO[4]	2012	epidemiological report	105 países	Study on the prevalence and detection rate of cases	Informs the prevalence of treated cases equal to 0,34:10,000 inhabitants and the case detection rate equal to 4,06:100.000 inhabitants
Mahendradas et al.[33]	2013	Case Study	1	Findings by optical coherence tomography in granuloma	The examination of the anterior eye segment by optical coherence tomography should be included in the evaluation
Brasil[34]	2003	manual for procedures	-	Conducts for prevention of blindness	Definition of blindness preventive measures, primary, secondary and tertiary
Campos et al.[35]	1996	prospective	120	Investigation of the presence of *M. leprae* by conjunctival biopsy	Identification of bacilli in the conjunctiva, even in patients in the course of multidrug therapy
Monteiro et al.[36]	1998	cross-sectional	997	Investigation of changes in ocular bulb	Increased bulbar changes according to age of the patient and duration of illness, serious injuries are rare due to previous treatment. Report of "pearls" in the fundus exam

Table 3 – Prevalence or frequency of ocular complications of leprosy according to articles included in the integrative review

Author (s)	Year	N. of patients	IOP	Changes of corneal	Changes	cataract	blindness	scleritis	Glaucoma	iridocyclitis	lagophthalmos[1]	madarosis	trichiasis	corneal ulcer	uveitis
Lewallen et al.[6]	1989	510	12.0	-	-	-	-	-	-	-	-	-	-	-	-
Lewallen et al.[18]	1989	509	42.5	-	-	-	-	-	-	-	-	-	-	-	-
Walton, Ball, Joffrion[20]	1991	193	-	-	35.0[2]	16.0	4.9[2]	-	10.0	-	-	-	-	-	-
Waddell, Saunderson[19]	1995	2715	-	-	-	11.6	0.6	-	-	33.0[3]	3.7	-	-	-	-
Lewallen	2000	270	-	20.1	44.3	34.5	11.6	-	-	-	15.8	-	9.6	2.4	-

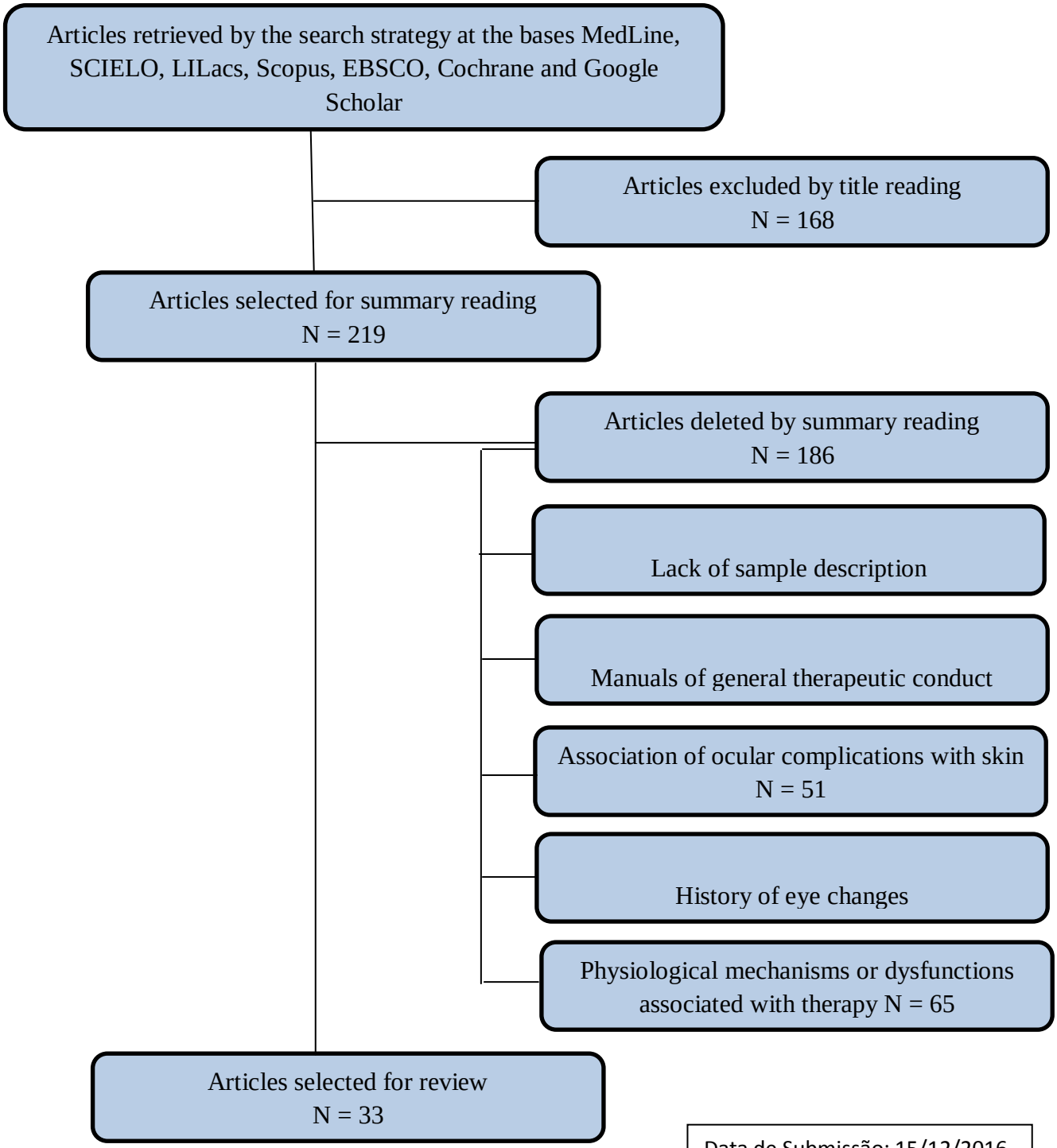
Author (s)	Year	N. of patients	IOP	Changes of corneal	Changes	cataract	blindness	scleritis	Glaucoma	iridocyclitis	lagophthalmos[1]	madarosis	trichiasis	corneal ulcer	uveitis
et al.[21]															
Courtright et al.[31]	2002	691	-	-	-	-	2.8	-	-	-	3.3	-	1.0	0.9	-
Singhi et al.[5]	2002	518	-	20.9	8.9	5.6	11.0	-	-	-	10.2	28.1	1.0	-	-
Daniel et al.[22]	2003	60	1.7[4]	73.0	3.3	25.0	-	-	-	-	10.0	-	1.7	11.7	-
Thomas, Thomas, Muliyil[3]	2003	446	1.3[4]	-	-	-	2.6	-	3.6	-	-	-	-	-	7.8
Nepal, Sherestha	2004	58	-	6.8	-	18.1	9.0	-	3.4	-	5.2	12.1	1.7	31.03	12.1

Author (s)	Year	N. of patients	IOP	Changes of corneal	Changes	cataract	blindness	scleritis	Glaucoma	iridocyclitis	lagophthalmos[1]	madarosis	trichiasis	corneal ulcer	uveitis
[23]															
Souza et al.[24]	2005	58	20.8	42.6	20.8	24.9	6.0	-	8.7	-	14.8	70.4	13.0	6.9	-
Javvadhi et al.[25]	2005	93	100.0[5]	16.1	6.4	-	-	0.1	-	-	-	3.2	-	-	10.7
Daniel et al.[32]	2006	278	-	-	3.0[6]	6.6[6]	1.0[6]	0.18[6]	-	-	0.24[6]	-	-	5.35[6]	3.78[6]
Parikh et al.[28]	2009	386	2.8	20.2	-	51.0	11.4	-	4.9	-	4.2	43.8	5.4	-	6.7
Reddy, Raju[29]	2009	1004	-	36.1	-	16.9	16.8	1.5		14.7	17.3	44.1	-	5.9	14.7

Author (s)	Year	N. of patients	IOP	Changes of corneal	Changes	cataract	blindness	scleritis	Glaucoma	iridocyclitis	lagophthalmos[1]	madarosis	trichiasis	corneal ulcer	uveitis
Javvadhi, Das, Agrawal[26]	2009	186	5.9	14.5	-	-	4.3	-	-	-	17.7	4.3	1.1	4.7	8.6
Eballé et al.[30]	2009	346	-	4.2	-	19.6	23.1	-	5.2	-	4.2	-	-	25.4	0.5

Caption:[1] –considered as lagophthalmus when the change of moderate to heavy eyelid closure; [2] - Considered blindness the vision lowest than 20/200; [3] - The authors refer to iritis; [4] - increased IOP; [5] percentage deducted from the means presented for 93 patients, [6] - values of incidence expressed in % per patient yea

Figure 1 - Flowchart of selection of items for review



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