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Onchocerciasis in Zaïre

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Abstract

The first mention in Africa of ocular lesions and of blindness due to onchocerciasis was made by Hissette in Zaïre in 1931, although the disease had already been known there since 1903.

On a map of Zaïre were indicated all the known data of the geographical distribution of onchocerciasis: data from the literature, from field work and from the patients seen in Kinshasa. An estimation of the relative incidence of the disease was made by comparing the number of patients with the number of the latest population census for each administrative zone. The environmental and developmental factors determining the epidemiological aspects are discussed. The clinical aspects of the typical eye symptoms are reviewed. Their correlation with age, with immunology and with some specialized eye examinations are discussed.

Introduction

Zaïre is a large country, 2,345,400 square km, situated in western Africa on the equator. Zaïre includes most of the basin of the Zaïre river. Near the equator exists a depression of 400 m altitude, the 'Cuvette centrale', with tropical rain forest in a humid and hot climate where the mean temperature is between 25 and 26° C. North and south of the rain forest is a grassy humid savannah with gallery forest and a milder mean temperature, altitude 700–1,000 m. At the east, where the altitude passes from 1,500 to 2,000 m, the mean temperature is 20 to 16° C [1].

The majority of the population belongs to the Bantu group [1]. The estimated perspective of the population number for 1990 is between 34,137,755 and 35,561,939 inhabitants [2].

Onchocerciasis

Onchocerciasis (ONC) is probably the main cause of blindness in Zaïre. It is discovered by leaving the tracks and by doing field work [3].

The first observation of ONC in Zaïre was recorded by Brumpt in 1903. He was a member of the Bourg de Bozas expedition. He entered Zaïre (at that time the Belgian Congo) from the east and embarked on a pirogue at Dungu in order to descend the River Uele. He noted the presence of 'verminous' nodules on the oarsmen [4].

The first observation of ocular ONC in Africa was reported by Hissette in Zaïre in 1931 [6]. He found up to 20% blindness and 50% eye lesions in the Sankuru region, Kasaï-Oriental. He confirmed that Simulium (S.) was the vector [6].

1. Geographical distribution

In 1965, Fain and Hallot made a survey of all

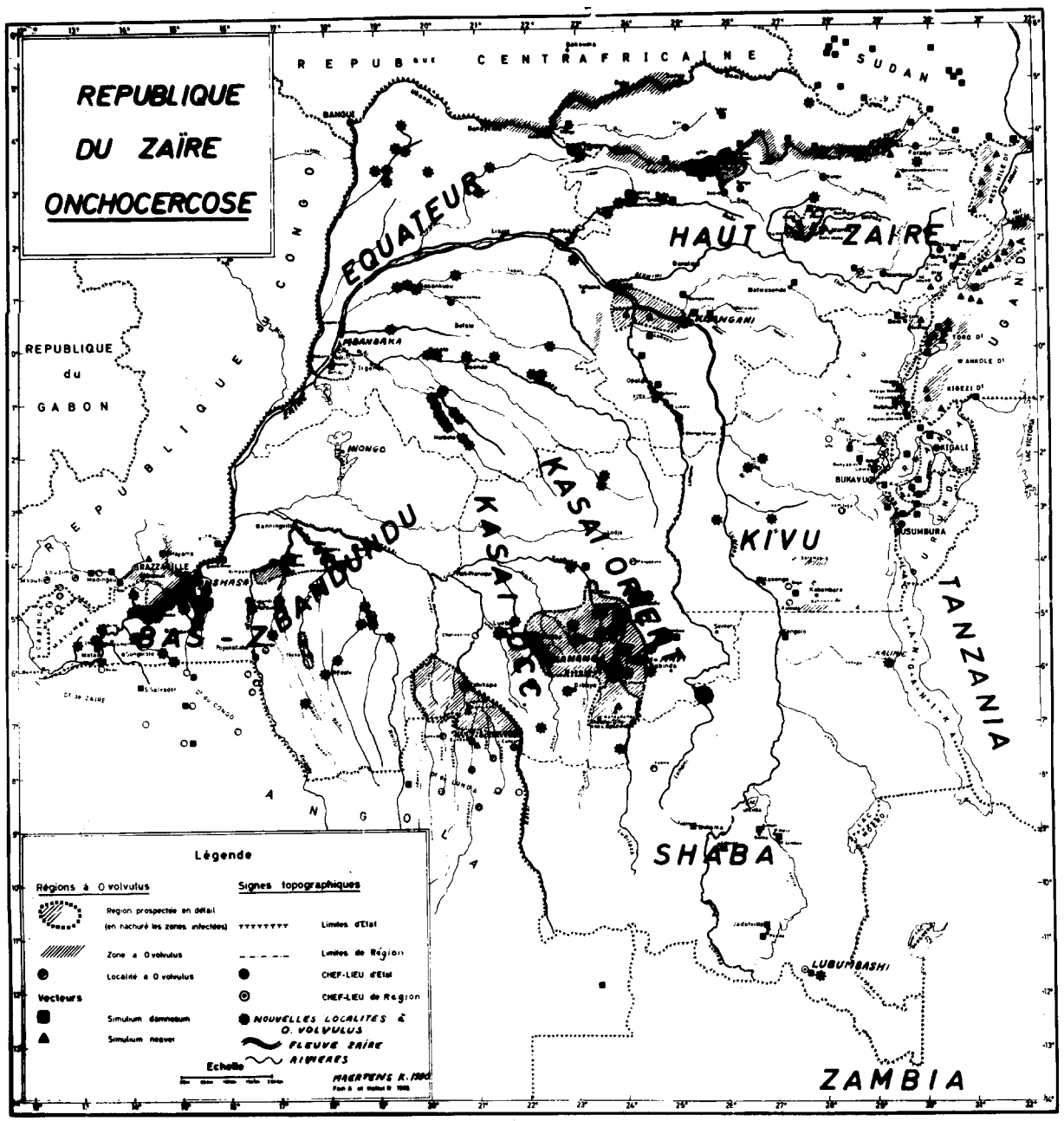

Fig. 1. New localisations of ONC (★) in Zaïre drawn on the map made by Fain and Hallot [7].

known data on the distribution of Onchocerca volvulus and its vectors in the basin of the Zaïre river [7]. In 1978, we added many new geographical locations of patients seen at the Department of Ophthalmology of the University Hospital at Kinshasa [8]. We completed the map with data from 308 patients seen in Kinshasa, with the results of our field work and with the latest literature (Fig. 1).

In 1985, we recognized the zone of origin of 267 ONC patients seen in Kinshasa, and compared their number for each zone to the latest population census [2]. The result is presented on the adminis-

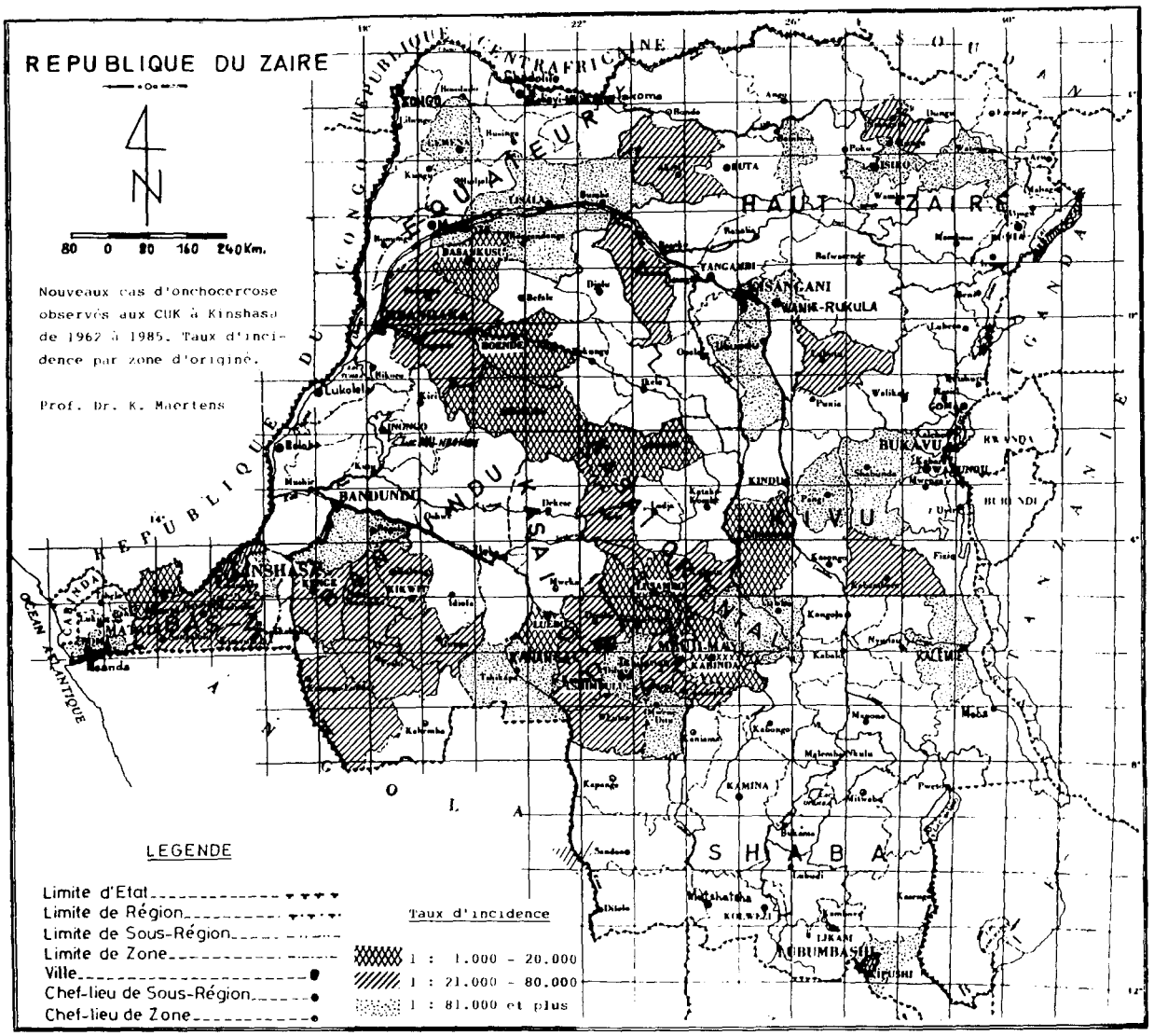

Fig. 2. Relative incidence rate of ONC in the zones of Zaïre. (Number of patients seen at Kinshasa compared to the number of the latest population census for each zone) Double hachured zones: 1 : 1,000 to 20,000 inhabitants. Single hachured zones: 1 : 21,000 to 80,000 inhabitants. Dotted zones: 1 : 81,000 and more inhabitants.

trative map of Zaïre (Fig. 2). A high incidence occurs in the Kasaï-Oriental, especially in the zone of Lusambo (1 case for 3,557 inhabitants). Further east, the incidence is also high in the zone of Kimbombo, Kivu region, and north the incidence is high in the zones of Monkoto, Boende and Basankusu, Equateur region. At Monkoto, we found the highest incidence: 1 case for 1,731 inhabitants. In the west, in the south of the region of Bandundu, in the regions of Kinshasa and of Bas-Zaïre, there is a continuous but low-grade incidence, although these regions are not far away from our hospital. ONC seems not to exist in the northern part of the region of Bandundu. The smaller incidence in the far northern and eastern regions is probably related to the great distance from Kinshasa. The different zones along the River Uele belong to a continuous focus, as shown by Fain and Hallot [7].

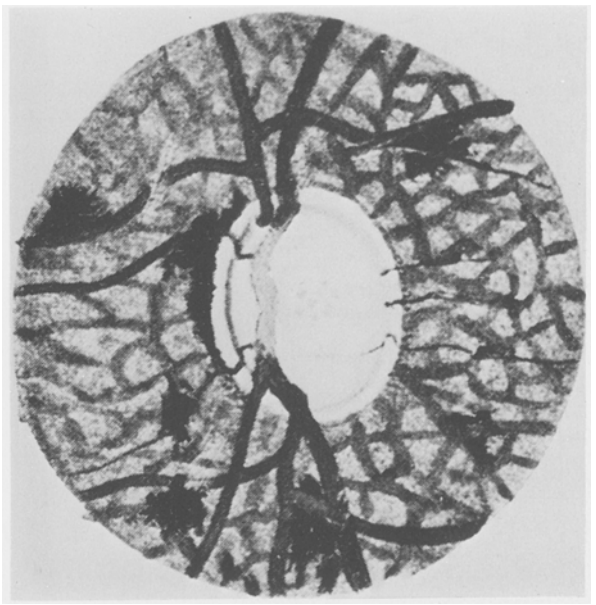

Fig. 3. Reproduction of the drawing of the 'chorio-rétinite pigmentaire de l'Onchocercose' made by Hissette in 1937 [28].

2. *Epidemiological aspects*

In each of the 9 regions of Zaïre ONC has different aspects that are determined by environmental and developmental factors. Due to the different techniques used in the laboratory of microbiology, it was impossible to do a quantitative study of the microfilaridermia, but we could prove that the average number of nodules per patient was significantly higher in our patients originating from the Kasaï-Oriental region (8.2 nodules), followed by those from the Kasaï-Occidental (4.9) and those from the Equateur (2.6 nodules) [8].

2.1. Kinshasa region

Wanson and Weyts observed ONC in the village Kinsuka near the rapids of the Zaïre river in Kinshasa. An antivector campaign against S. damnosum was conducted by Wanson and his staff, first by destroying the larval support by uprooting and burning the Pennisetum nodoflorum water plants during the subsidence of the river (1942–1944), then by aircraft spraying of DDT (1948–1952) [9, 10]. The invasion in 1954 of the Zaïre river basin by the water hyacinth Eichornia crassipes most probably hindered the development of the larvae by means of nutritional competition, as demonstrated in the laboratory by Henry [11]. In 1985–1986, we found a hypoendemic situation of ONC at Kinsuka [12]. An important focus is developing along the river Nsele where, during the last 12 years, many people living in Kinshasa moved to the fertile forest slopes of the valley. Henry found S. damnosum [11]. We found eye symptoms and heavy infestation already in the recent villages, and blindness in the old villages. In 1988, we captured along a small tributary 1,000 S. albivirgulatum within 10 minutes.

2.2. Bas-Zaïre region

From Kinshasa to Matadi, the Zaïre river presents many rapids and many tributaries flowing from the south or the north form rapids and waterfalls where they empty into the river. This explains the many cases we detected in the people living along the riverside (Fig. 1). The most famous breeding site of S. damnosum is situated at Inga, downstream near Matadi. There the width of the Zaïre river is 2 to 3 km and the surface of the site is 15 square km. The biggest density of female S. damnosum was found there in December 1968: the number of biting flies per person per day was counted to be 13,000, an absolute world record [13]. Life was so incomfortable that the villages were built 5 to 30 km distant from the river (mean distance was 18.6 km). We found a very low infestation and few ocular lesions. There was a good correlation between the distance of the village from the river and the rate of infection [14].

2.3. Bandundu region

The tributaries of the Zaïre river flow in a south-north direction. Some have their sources in Angola. The rivers cross a savannah at an altitude of about 1,000 m, then suddenly form big waterfalls and dig canyons which broaden to the north and result in gallery forest. Finally, they run at the surface when they arrive at the cuvette centrale.

ONC is found along this river at the site of the gallery forest (Fig. 1). The people who had been displaced to the savannah many years ago because of trypanosomiasis, migrated back to the more fer-

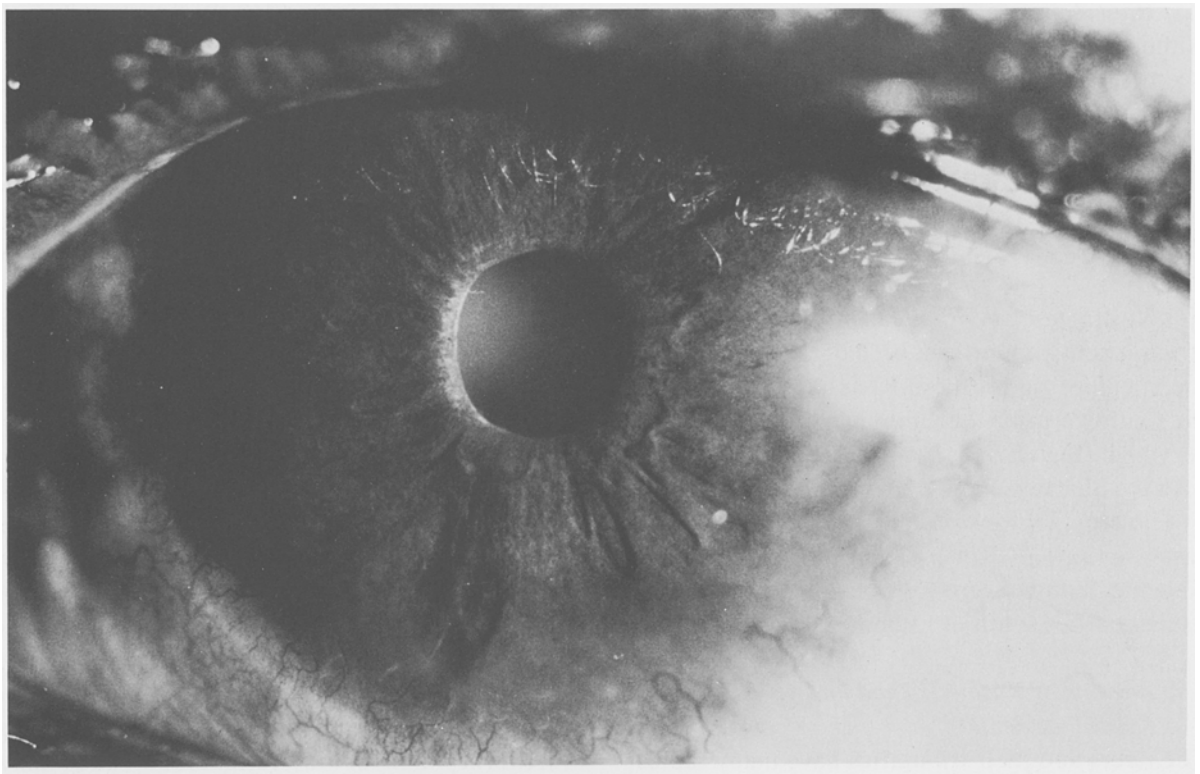

Fig. 4. Holding the light source almost parallel to the iris, the entropion and the depigmentation of the pupillary ruff can be seen (Photo Karel Maertens).

tile gallery forest. We examined 394 adults living in two villages on the River Inzia. We found 1.75% respectively 0.2% blindness due to ONC and 86% respectively 73% infestation. S. damnosum and S. naevei were collected [15]. Our treatment was to give exact information on the disease and its prevention.

The northern part of this region is characterized by the lower situation and slow flowing flood lake Mai Ndombe and corresponding rivers [16]. During ophthalmological fieldwork in Bolobo in 1976, in Inongo in 1983, and in Nioki and Bosobe on the River Fimi in 1985 and 1986, we did not find a single case of onchocerciasis; the causes of blindness in Inongo, Bosobe and Nioki were primary open-angle glaucoma and senile cataract [3].

2.4. Equateur region

The southern part of this region is called the 'Cuvette centrale'. There many large rivers flow slowly (maximum speed 2 km/h) in a westernly direction through the forest [17]. ONC is probably very important (Fig. 2). Fain et al. found 76.9% infection by examining 720 adults from 10 different villages. In one village, they counted 25 blind [17]. In 1980, Fain et al. observed infective larvae of Onchocerca volvulus in 11.4% of the vector S. albivirgulatum [18].

The northern part is a transition to savannah. In three villages, Bobindo, Bogoso and Bobalingana near the River Lua, west of Gemena, we found ONC in 1970. The eye lesions were most pronounced and most frequent in Bobindo. The Lua presents waterfalls only during the dry season at one site, and this is near Bobindo. The treatment was to move the village away from the Lua. The infection rate was much smaller in the more northernly situated villages. At Businga, we saw 12 adults blinded by ONC. The vector was S. damnosum [19, 20].

2.5. Haut Zaïre region

Although ONC had already been observed in 1903 [4] and ocular lesions in 1933 [21], eye lesions and blindness are poorly documented. There is an important focus on the Uele. In Niangara, we examined 44 blind, 22 of whom had severe onchocercal lesions. In Konde, we saw 2% blindness due to ONC [22].

2.6. Kivu region and Shaba region

It was recently found that 67% of the adults of two forest villages in northern Kivu had ONC [23]. In the south-west zone of Kimbombo, the incidence is very high (Fig. 2).

In the Shaba, we know of only the case reported by Hissette [21] west of the river Lomani, and the cases we saw in Kinshasa: one originated from Kalemie and two were Europeans infected during fishing parties south of Lubumbashi.

2.7. Regions of Kasaï-Oriental and Kasaï-Occidental

The rivers and their tributaries have many rapids, the south is savannah with gallery forest, the north is a transition to rain forest. Fain and Hallot consider these regions second in importance of infection to those of the Haut-Zaïre [7]. We found a high incidence (Fig. 2) and a spreaded localization (Fig. 1). In 1976, we found 8% resp. 6.5% blindness north of Lusambo [24]. Hissette found in 1931 20% blindness in the more western forest [6]. In 1977, we reported many eye lesions but less blindness in villages situated more to the south [25], S. damnosum were caught and 1.7% were found with the developing stages of Onchocerca volvulus [26].

3. Clinical aspects

In his voluminous 'Mémoire' of 1932, Hissette gave an accurate description of eye lesions, especially those of the iris. He was the first to mention the clinical aspects and the pathology of the retinal lesion: pigment spots on a pale fundus with normal vessels, haemorrhages and alterations of the outer and inner nuclear layer [27]. In his 1937 publication, four drawings of ONC retinitis can be seen [28] (Fig. 3). Later, in 1945, Ridley described the same retinal lesion [29].

All the ocular structures are invaded and affected by Onchocerca volvulus.

The conjunctiva has a red 'haematic' aspect [27], linked to the migration of microfilaria in the tissues [30]. A rare reaction is the conjunctival nodule: it is a small transient elevation on the bulbar conjunctiva, where no microfilaria were found [10, 30].

The punctate subepithelial keratitis is the early sign of ONC and in hyperendemic zones it is already seen in young children (in Lusambo at age 2 years, mean age 28.6 [24], in Bobindo at age 5 years, mean age 30 [20]). The typical localisation is the peripheral cornea at the 3–4 o'clock and 8–9 o'clock positions. Sometimes microfilaria are seen within the lesion. The frequency of the punctate keratitis is parallel to the titer of antibodies demonstrated with immunofluorescence on ONC nodules [24].

The other symptoms of the cornea and those of the uvea develop at an older age. A limbal haze, an arciform pannus of the inferior limbus, and finally a progressive infiltration of the whole cornea, leaving a small clear upper segment, called the sclerosing keratitis, can be seen (mean age 47–48 years) [20, 24].

At the same time, signs of atrophy of the uveal tract become apparent [27]. Typical symptoms are seen at the iris: depigmentation, entropion and disappearance of the pupillary ruff (Fig. 4), depigmentation and disappearance of the relief and translucence of the anterior surface, pathognomonic decentration and ovalization of the pupil [30]. Posterior synechiae are rare, but a pupillary membrane and an anterior peripheral synechia at 6 o'clock, called the pseudohypopyon, are sometimes observed [30].

Microfilaria can be seen moving free in the aqueous or fixed with one extremity to the lens, to the cornea or the iris, or assembled as 'Gorgon heads'. They can be very numerous or very few and even absent [30].

The same atrophy is supposed to exist at the level of the ciliary body. It explains the high frequency of luxation and subluxation of the lens [24] and the hypotony of the eye associated with the atrophic

iris and with the chorioretinitis of Hissette [12, 15]. With tonography, it was shown that in eyes with atrophic irises, the intraocular pressure was normal although the outflow facility was strongly decreased; this can only be explained by a decreased function of the ciliary body [31].

The chorioretinitis of Hissette seems to have an independent evolution. It is seen in a younger group, starting at 7 years, and in an older age group. The end stage is a chorioretinal atrophy with pigment migration. The lesion has sharp limits with the normal retina and, when examined with the Goldmann perimeter, corresponds to an absolute scotoma with steep margins [30]. The adaptation curve, measured with the Goldmann–Weekers adaptometer is normal [30].

The final stage is the complete atrophy of the eye.

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