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Mini Review

State of knowledge and challenges in the control and eradication of Onchocerciasis in Africa: a mini scoping review

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Abstract: Background: Onchocerciasis is a vector-borne neglected tropical disease (NTD) caused by the filarial worm *Onchocerca volvulus*. Given the high morbidity and mortality, onchocerciasis control gained great attention from many stakeholders both nationally and internationally. However, there are still the need for further solidified commitments and compelling initiatives across concerned stakeholders including regional bodies in the fight toward controlling its burden and risks. Thus, this review briefly appraised the current understanding and dynamics in the control and eradication efforts of Onchocerciasis in Africa. **Methods:** A rapid scoping review was used for this paper. Key databases used for this study include Web of Science, Scopus, Science Direct, PubMed and Google Scholar to identify a series of relevant peer-reviewed publications. The search contained just English-language articles. In addition, African government websites and specialized organizations such as WHO, UNAIDS, CDC, etc. were accessed and reviewed to gather important data on national and international control programs, related documentation and consultative expert reports. **Results:** In Africa, long-standing strides toward the control and elimination measures for onchocerciasis were conducted for several decades. Between 1974 to 2002, OCP had actively led the control and containment efforts for onchocerciasis in the context of 11 West Africa. However, endemic regions and states have switched their policies from controlling to eradication, with the ultimate objective of preventing their territories from parasite spread. Some key challenges are the insufficient identification of all endemic areas, high prevalence of both onchocerciasis and loiasis, potential development of resistance to ivermectin, inconsistent initiatives to address cross-border problems, disagreements and social disturbance. Various challenges, however, impede current efforts to eradicate African onchocerciasis. **Conclusion**: In the last decades, extensive measures have been taken with specialized state programs, largely efficient in high endemic nations, to manage and control onchocerciasis in African regions. The implications of these and other difficulties at country level control programs must therefore be identified and country-specific contextual remedies used to expedite the elimination of onchocerciasis.

Keywords: Onchocerciasis, eradication, elimination, Control, Africa

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1. Background

Onchocerciasis is a vector-borne neglected tropical disease (NTD) caused by the filarial worm *Onchocerca volvulus*. This disease is transmitted by the bite of black flies (genus *Simulium)* which were found to breed in fast-flowing water bodies [1]. Nearly 37 million individuals are believed to have onchocerciasis, with another 200 million at risk

of developing the disease. Ninety-nine percent of worldwide risk and public health burden in Africa [2,3].

Onchocerciasis is an important public health issue. The illness is the world's second-most common infectious disease after trachoma [4]. It is related to lower life expectancy, causing significant mortality among onchocerciasis-blind persons and epilepsy [5]. Onchocerciasis was also connected with emotional and economic consequences. It leads to social marginalization, stereotype and stigma among infected people including their families, disrupted sleep and lower wages across affected adults, poor academic performance, greater dropout rates across infected school-age children and costly healthcare costs/expenditure [1,2,6]. In dread of them, families usually migrate from their fertile land, reducing agricultural productivity and prolonging poverty [6,7].

Given the high morbidity and mortality, onchocerciasis control gained great attention from many stakeholders both nationally and internationally. Solidified commitments and compelling initiatives across regional bodies for the past fourty years could be considered remarkable in terms of controlling the burden; presently, this does not constitute a public health burden/risk for most countries in Africa [8,9]. There is also evidence that some localised foci eliminate the onchocerciasis disease [7]. Driven by these achievements, WHO set the objective of eliminating onchocerciasis in specific countries with high endemicity by 2020 and outstanding highly endemic regions of Africa by 2025 [10].

2. Methods including search strategy

To identify relevant publications published in peer-reviewed journals, the authors used major databases such as Web of Science, Scopus, Science Direct, PubMed and Google Scholar. Publications were considered if an article's abstract or entire content focused on the achievements, problems of past and current control efforts for onchocerciasis, challenges and measures in the context of African countries. The search contained just English-language articles. In addition, African government websites and specialized organizations such as WHO, UNAIDS, CDC, etc. were accessed and reviewed to gather important data on national and international control programs, related documentation and consultative expert reports, respectively.

3. Results and discussion

3.1. Past Onchocerciasis control efforts in Africa

In Africa, long-standing strides toward the control and elimination measures for onchocerciasis were conducted for several decades. Part of these efforts includes the formation of West African Onchocerciasis Control Program (OCP) and African Program for Onchocerciasis Control (APOC). Between 1974 to 2002, OCP had actively led in the control and containment efforts for onchocerciasis in the context of 11 West Africa. They were initially focused on programs relating to vector control and later integrated MDA programs which targeted humans since 1987 [11]. In all participating nations with the exception of Sierra Leone where activities have been delayed by the ten-year civil war and 25 million hectares of land restored for agricultural use, onchocerciasis was eliminated as a public health problem [12].

3.2. Current status of onchocerciasis elimination in Africa

Since the APOC had faced out in 2015, Expanded Special Project to Eliminate NTDs (ESPEN) was instituted and it covers the control/elimination of onchocerciasis [13]. Accordingly, endemic regions and states have switched their policies from controlling to eradication, with the ultimate objective of preventing their territories from parasite spread. Control/elimination of this disease is described as "reducing and transmitting *O.*

volvulus infection to its barest minimum as per interventions implemented, but further necessities for post-intervention monitoring" [10].

3.3. Challenges of onchocerciasis control in Africa

Despite this suggestion that the absolute control of onchocerciasis from the African continent is doable, hurdles exist to achieve this by 2025 [14]. The main hurdles to eliminate onchocerciasis in Africa are as discussed as follows:

3.3.1. In-Conclusive designing of control measures in endemic regions

Regarding the control efforts, the key aim was to establish the geospatial patterns of onchocerciasis and characterize prospective vulnerable groups through the rapid epidemiological onchocerciasis technique. Indeed, progress is being done to prevent parasite transmission in some places. The challenge rests in places termed hypoendemic and nonendemic, where the prevalence of onchoceric nodules is less than 20%, as a minimum benchmark for intervention [15].

3.3.2. Prevalence of both onchocerciasis and loiasis

Loiasis is an infection caused by Loa loa nematode parasite. Africa estimates that 12–13 million people are afflicted. The quick determination and identification regarding the spread of parasites revealed a significant incidence of loiasis in the west and east foci of Africa [16].

3.3.3. Potential drug resistance

Ivermectin was known to be a common therapeutic approach to control onchocerciasis. When taken repetitively, it is an effective microfilaricidal medicine with substantial macrofilaricidal properties which could be administered yearly, every six months or even quarterly. Note that despite numerous rounds of therapy, studies on *O. volvulus* reported its inefficient reaction to anti-fecundity action of ivermectin in the selected countries in Africa [17]. These observations highlight the likelihood of ivermectin resistance.

3.3.4. Disorganized national border disease control strategies

Although onchocerciasis is widespread across various regions of Africa, there are various transboundary/cross-border concerns affecting countries' disease control initiatives efforts. Some of these include transmitting illness, human population and vector movement [2]. Endemic countries, primarily high-risk countries, have multiple common transmission zones beyond their national borders [16]. Elimination attempts along the boundaries and entry points of other countries or areas may be disorganized, and MDA actions may be managed independently at state or regional levels. Therefore, this could result to continued infection transmission and prevent disease eradication programming.

3.3.5. Conflict and instability

Conflict and internal strife is another hurdle to the control of onchocerciasis in countries across African regions. Conflict slows and diminishes political endorsement, leading to new occurrences of blindness associated with onchocerciasis every year [3,8]. The medical system is fragmented in nations with such a crisis and access to required MDA delivery and epidemiological surveillance operations for continuous monitoring/assessment and evaluating program.

3.3.6. Technical and financial challenges

Technical obstacles also exist in merging infection MDA initiatives with various functional units into a consolidated NTDs framework. Furthermore, substantial scientific

proof is required to prove prevention of infection and determination of elimination utilizing well defined laboratory and diagnostic instruments [10]. Highly trained medical entomologists in the field also need to collect programmatic information to track and evaluate service delivery. Sufficient funding is essential to control or eliminate any diseases.

3.3.7. Potential recommendation for elimination of onchocerciasis

The elimination of onchocerciasis by 2025 needs requirements to halt MDA by 2022 [21]. Nations must regularly assess and analyze their state policies and uncover major problems preventing targeted termination of transmission of parasites. The following suggestions to address the aforesaid challenges and suggested initiatives to speed up the elimination targets include the following:

3.3.7.1. A comprehensive mapping of diseases

The shift from containment to onchocerciasis removal from all endemic parts of Africa requires modification of current methodologies to characterize the spread of onchocerciasis and consequently the implementation of MDA. Mass treatment decision must be contingent on the presence or lack of infection transmission [18]. All endemic regions there is a possibility of prolonged local parasitic infection but formerly disregarded as non-endemic or hypoendemic must be mapped. Therefore, onchocerciasis elimination mapping helps target assistance in locations where parasite transmission clearly occurs.

3.3. 7.2. Collaboration & consolidation of national programs

A robust policy, management and formalized cooperation will be necessary between the relevant stakeholders to enable full success in the control of onchocerciasis. Coordinated cooperation and cross-border control measures and strategies are needed in national neighborhood eradication programs [16] to ensure that it does not have any impact on progress towards elimination. Continuous communication to provide a common understanding, to reach all nearby endemic areas of MDA countries, to harmonize MDA and monitoring operations and to share data are considered as best practices [19].

3.3.7.3. Alternative approach to drug delivery in violence locations

The structure of the population is disrupted by significant migration and resettlement in war zones or regions. Therefore, MDA approaches in war zones must differ from CDTI in usual circumstances [13]. MDA could be conducted in a conflict zone in association with concerned local organizations and groups who are actively providing humanitarian services to achieve better services including ivermectin targets [13]. Moreover, migrants and displaced persons must be raised through proper techniques during MDA campaigns in their destinations.

3.3.7.4. Continuous monitoring and evaluation

Interrupting onchocerciasis transmission, monitoring and evaluating the impact of MDA programs in reducing the prevalence level remains very critical. This can assist identify regions that fail in an eradication program [18]. WHO has issued guidelines to stop MDA and the evidence needed to verify transmission interruption in 2016. The regulations stipulate, according to local regional guidelines, that regular pathogenic and serological assessment in a form surveillance at least five yearly should be conducted [20]. Ongoing community engagement and training in healthcare should maintain the awareness of the community.

3.3.7.5. Strong alliances and continuous funding

It is essential to have strong collaborations and a range of funders. Current ESPEN needs to engage with key global donors and other stakeholders to support previous programs' achievements and give all forms of support to control onchocerciasis [13]. Government and its development partners for countries that are highly endemic must assume total responsibility for their state level control efforts by providing sufficient resources for the purposes stated.

4. Conclusions

In the last decades, extensive measures have been taken with specialized state programs, largely efficient in high endemic nations, to manage and control onchocerciasis in African regions. In other African regions, onchocerciasis control was also achieved, creating hope to total elimination of the infection out from Africa in 2025. Various challenges, however, impede current efforts to eradicate African onchocerciasis. The biggest challenges are the insufficient identification of all endemic areas, high prevalence of both onchocerciasis and loiasis, potential development of resistance to ivermectin, inconsistent initiatives to address cross-border problems, disagreements and social disturbance. The implications of these and other difficulties at country level control programs must therefore be identified and country-specific contextual remedies used to expedite elimination of onchocerciasis are used.

Declarations

Ethics approval and consent to participate

Not applicable to this review.

Consent for publication

Not applicable

Availability of data and materials

The data used to support the findings of this study are publicly available across identified search engine repositories mentioned in the methods section of the paper.

Competing interest

No conflicts of interest was disclosed.

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Authors' contributions

AB and FM conceptualized the study, reviewed literature and wrote the initial draft of the review. All authors critically reviewed and approved the manuscript for its intellectual content. AB had the final responsibility to submit for publication.

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