

Is noma a neglected/overlooked tropical disease?

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Noma is a debilitating orofacial necrotizing bacterial disease that disproportionately affects impoverished malnourished persons, particularly young children, the vast majority of whom live in tropical and subtropical areas in sub-Saharan Africa. It has a very high mortality rate; causes significant physical and psychological morbidity, stigmatization and social discrimination; could be prevented, controlled and indeed eliminated by common public health interventions; and is overlooked with regard to public health awareness, in-depth scientific research activities and allocation of funding for prevention, treatment and research.

According to the WHO, noma comprises five sequential 'stages': (1) necrotizing gingivitis, (2) edema, (3) gangrene, (4) scarring and (5) sequelae. This WHO staging of noma is contentious, leading to diagnostic confusion with misestimation of the number of noma cases reported in epidemiological studies. We therefore suggest a simpler, more practical and scientifically valid two-stage classification comprising only (1) acute noma and (2) arrested noma.

Noma meets all the WHO criteria for classification as a neglected tropical disease (NTD). Most survivors of noma live with gross physical disfigurement and disability, and with impaired psychosocial functioning, so they are very often stigmatized and unjustifiably discriminated against. Owing to the paucity of evidence-based epidemiological data on noma, the relatively low number of people affected worldwide, and its apparently limited geographic distribution, noma does not yet feature on the WHO's list of NTDs, or on any global health agenda, and thus has not become a health priority for global action. We strongly support the inclusion of noma within the WHO list of NTDs. Without doubt this will increase the awareness of noma among healthcare providers and promote the systematic international accumulation and recording of data about noma.

Keywords: acute noma, neglected tropical diseases, poverty-related disease, necrotizing orofacial mutilation, WHO

Introduction

Neglected tropical diseases (NTDs) are a diverse group of debilitating infectious diseases that affect more than one billion persons who live in extreme poverty in remote rural areas, or in urban slums or shanty towns, in resource-poor countries where access to basic healthcare services is limited.^{1–5}

The realization that noma, like other NTDs, has significant health, psychological, social and even societal effects on some of the world's most impoverished populations, should motivate global health policymakers to prioritize its combating.^{5–7} If noma were to be included by the WHO in the group of NTDs, its present neglected status might be better addressed, and those who have the disease and its survivors would hopefully receive, as do those with other NTDs, the focused attention and action necessary to try and prevent, control and even to eradicate the disease, and to

alleviate the symptoms associated with active noma and with its sequelae.^{6,8,9}

Noma is an enigmatic, bacteria-induced necrotizing orofacial disease that causes gross tissue damage in children living in an environment of malnutrition, immune impairment, chronic debilitation and poverty. The disease starts in the mouth as simply treatable necrotizing periodontal disease. Very uncommonly, this process may rapidly advance, destroying orofacial tissues and structures, causing severe functional impairment and disfigurement. This very aggressive, invasive necrotizing process is called acute noma. Untreated, noma is deadly in up to 90% of cases and leaves its very few survivors socially stigmatized, discriminated against and severely psychologically traumatized.^{6,7,10,11}

Epidemiological and demographic data about noma are scarce, and not always evidence-based.^{7,12} As a result, there are

large voids in knowledge about noma; and our understanding of its pathogenesis and the many factors that determine its clinical course is inadequate. This ignorance may contribute to the currently suboptimal treatment modalities of noma, and to its high rates of mortality and morbidity.⁶

To alleviate ignorance about the disease and the neglect and experience of its survivors, it is essential to increase both awareness of and knowledge about noma among frontline healthcare professionals, relatives of young community members at risk of noma and, more importantly, among those influential national and international political and medical agents who drive the global public health agenda. The inclusion of noma within the WHO list of NTDs will hopefully bring about an increase in the allocation of funding for research and management of noma, for the institution of programs to address noma-induced disabilities and for the promotion of education and economical empowerment in areas where noma is endemic.^{5,6,8,9}

The purpose of this article is to lobby and to motivate for the incorporation of noma in the WHO list of NTDs; and to promote and to appeal for the systemization of collection, and the official registration, of noma-related data, with a view to improving our understanding of this enigmatic neglected disease and its true geographical distribution, and thus to become better able to reduce its incidence, its prevalence and the symptoms both of those actively afflicted and of survivors.

NTDs

The label NTD suggests that there are three dimensions to this group of diseases: social (neglected), geographical (tropical) and biomedical (diseases). The social dimension refers to the personal experience of those with noma, to how society interacts with them, to the socioeconomic status of the populations affected and to the social factors that influence the priority that populations at risk receive in relation to the global public health agenda and policies. The geographical dimension indicates that this group of diseases occurs primarily in tropical and subtropical environments. Thus, in conformity with the term NTD, integrated sociobiomedical interventions in the relevant geographic regions are required to control or to alleviate the impact of NTDs.¹³

NTDs are prevalent or endemic, as the term implies, almost exclusively in tropical and subtropical regions of the globe, are caused by either bacteria, fungi, viruses or parasites, and impose significant public health, personal, social and economic burdens.^{5,14} Young children are particularly vulnerable to some of the adverse consequences of NTDs, such as malnutrition, immune impairment, growth retardation, delay in cognitive development,³ stigmatization, discrimination and impaired mental well-being.^{3,4,15}

According to the WHO,¹⁶ to qualify as an NTD, a disease should disproportionately affect impoverished, disadvantaged people who live primarily in tropical and subtropical regions; should cause considerable physical and psychosocial morbidity; be preventable, controllable or eliminable by common public health interventions; and be neglected in scientific research, in professional, public or governmental awareness, and in allocation of funding, despite the magnitude of the overall burden that the disease imposes.^{4,14}

NOMA: a necrotizing orofacial infectious disease

Noma is a mutilating, fulminating infectious disease that, without treatment, is fatal in most cases. As far as it is known, the sequence of clinicopathological events that is necessary for, but that in fact only exceptionally rarely culminates in noma, starts intraorally as anaerobic bacteria-induced necrotizing gingivitis. Without treatment, this sometimes may progress to necrotizing periodontitis, which, in turn, though very rarely, may progress to necrotizing stomatitis. Subsequently, however, without urgent and vigorous medical intervention, the aggressive immune-inflammatory process characteristic of necrotizing stomatitis, in the setting of malnutrition and/or immune suppression/dysregulation, rapidly and aggressively advances, devouring intraoral, lower facial, nasal and adjoining soft tissues and bone, ultimately leaving one or several full thickness facial, oronasal, oropharyngeal or facio-orbital marginal defects; with functional impairment of eating, swallowing, breathing and talking, with stigmatization and social discrimination, as well as impaired mental well-being.^{6,7}

However, if noma precursors, necrotizing gingivitis or necrotizing periodontitis are recognized in time, and are treated expeditiously with antibiotics, removal of dentogingival bacterial plaques and, very importantly, with instruction in correct, regular, sustained tooth cleaning, progression to necrotizing stomatitis, with the development to noma, can almost always be prevented.^{6,17,18}

The orofacial necrotizing process that causes facial destruction and disfigurement is termed acute noma. As may be expected, this is accompanied by severe local and systemic signs and symptoms, including a loss of taste and smell, pain, diarrhea, anorexia, anemia, loss of electrolytes, fever and lethargy. Without treatment, acute noma causes death in about 80–90% of cases, most frequently as a result of septicemia, dehydration, malnutrition or a combination of these.^{7,11,19}

With regard to the clinical course of noma, it is important to understand that necrotizing gingivitis, necrotizing periodontitis and necrotizing stomatitis are not stages of noma, but rather are distinct, treatable oral necrotizing diseases that should be viewed as precursors of noma only in the very rare event that they do, in that sequence, actually develop into noma.²⁰

When the devastatingly active phase of noma is brought to a halt by vigorous treatment, or, very rarely, halts spontaneously, there is a stage of healing dominated by formation of scar tissue bordering the facial defects and by fibrosis of the surrounding muscles. The consequent severe facial disfigurement necessitates protracted, complex surgical and orofacial prosthetic reconstruction; and psychological intervention to deal with the stigmatization, social discrimination and avoidance, altered body image, depressed self-esteem and reduced self-confidence.^{7,18,19,21}

With regard to periodontal diseases in relation to arrested noma, there is no evidence in the literature that noma survivors are at an increased risk of developing further orofacial necrotizing infections; and from the personal experience of the authors, if subjects with arrested noma maintain adequate dentogingival plaque control and oral hygiene, their risk of developing periodontal disease is not higher than subjects of comparable age and socioeconomic status who have not experienced noma.

NOMA: an enigmatic neglected disease

Noma predominantly affects young malnourished children living in remote, rural locations in sub-Saharan Africa, but also in other impoverished parts of the globe; and immunosuppressed HIV-seropositive subjects of any age.^{7,19,22-30} It is an opportunistic necrotizing orofacial infection caused by commensal microorganisms originating within dentogingival bacterial plaques, in persons predisposed by debilitating risk factors like malnutrition, immune impairment and systemic infections; by environmental factors including extreme poverty, poor sanitation, no access to healthcare services; and by other as of yet unidentified influences. Heavy dentogingival plaques, a large proportion of gram-negative anaerobic periodontopathic bacteria within the plaques, as well as poor or non-existent dentogingival bacterial plaque control (toothbrushing), are critical risk factors.^{6,10}

There are very little reliable data about the epidemiology or the demography of noma; and what little information there is represents at best an educated guess. First, this is because in remote rural areas, cases of noma are not always recognized for what they are, and even if correctly diagnosed, are neither documented, nor accessibly recorded in national disease registries. Second, owing to the social stigma associated with the disfigurement of noma, affected persons may be shunned, or even so segregated from their communities that their whereabouts are unknown; and third, because of the fulminant onset, very rapid progression and high rate of mortality, in the absence of early diagnosis and urgent treatment, any evidence-based data about the clinical, microbiological and pathological events during the progression from the precursor disease, necrotizing stomatitis, to noma (and to death), is almost always inadequate.^{6,7,12,17,22}

Furthermore, there are significant inherent difficulties in defining the risk factors in any remote community, and in estimating the number of subjects at risk of developing noma; and to further complicate matters, most of the available epidemiological and demographic information about noma has been collected from retrospective studies based on unstructured case reports, and not from well-designed prospective studies using consistent criteria.^{7,22}

According to the WHO, noma comprises five sequential stages: (1) necrotizing gingivitis, (2) edema, (3) gangrene, (4) scarring and (5) sequelae.²⁰ Because of the accepted authority of the WHO, these diagnostic stages are no doubt used by many researchers into the prevalence and incidence of noma.^{22,28,31} However, this WHO 'staging' of noma is contentious, to say the least, because it is based on the concept that necrotizing gingivitis, a relatively common, separate, although invariable precursor disease entity that only very rarely advances to noma, or because edema, a manifestation of many physiopathological or inflammatory conditions, or because gangrene, an interruption of regional blood supply with secondary infection, are all in fact 'noma'. It also ignores the other invariable and even more ominous noma-precursor disease entities, necrotizing periodontitis and necrotizing stomatitis, which per se are not noma either.^{7,19} This cannot but lead to diagnostic confusion, with complete misestimation and probably inflation of the number of noma cases reported in epidemiological studies.

With this background in mind, we suggest that noma should be regarded as a single and invariable disease entity without

any sequential staging, but with two possible clinical manifestations. Acute noma should refer to the active, fulminant, necrotizing tissue destructive process, which includes necrotizing fasciitis, myonecrosis, osteonecrosis and skin perforation with the formation of one or more full thickness circular/irregular facial defects. These are accompanied by systemic signs such as malnutrition, dehydration, anorexia, diarrhea, anemia, septicemia and pain. Arrested noma should refer to the tissue healing phase and the sequelae, which may include scarring, fibrosis, oronasal or oroantral openings, loss of teeth, ankyloses of a temporomandibular joint, as well as functional and psychosocial impairment.^{7,17,18}

As true, evidence-based epidemiological and demographic data about noma are scarce,^{6-8,10} the WHO, understandably, is reluctant to include noma in its list of NTDs;¹² for it is not possible to explain the great variation in the reported occurrence of noma among comparable populations in different but equally impoverished regions of the world; or why only a very small minority of cases of the three recognized noma precursors (necrotizing gingivitis, necrotizing periodontitis and necrotizing stomatitis) ever progress to noma; or even to identify the factors that either mitigate against or facilitate the development of noma. Moreover, even the true global geographical distribution of noma is uncertain.^{6,7,32} Photographs that document necrotizing gingivitis/periodontitis/stomatitis, acute noma and arrested noma can be found in.^{7,19}

The way forward

The experience that noma inflicts upon those affected, and the neglect that survivors of noma all too frequently experience, constitute a significant humanitarian problem.^{6,33} As noma affects almost exclusively poor marginalized populations, and as it is not contagious, neither the active disease itself nor its survivors attract the focused attention of public health policymakers. It therefore goes unrecognized, unfunded and unmanaged as a national or global health priority.³⁴

Although it is deemed a basic human right to have ready access to public health services, to be able to live with dignity and to be socially secure in one's own country, by and large the public health, political, financial and many other institutional elements of the establishment disregard, or ignore, or most commonly, through no fault of their own, are simply unaware of the existence of noma. Therefore, because of uninformed officialdom, those with noma lose out on their basic human rights.

Thus, from a humanitarian perspective, in all regions of the world where noma is known or thought to be endemic, it is necessary to urgently focus the attention of officialdom upon, and to prioritize organized action to be taken to reduce the incidence, the prevalence, the experience from and the mortality of noma.^{13,33} At the same time it should be regarded as a moral obligation of organized society to strive to uplift the impoverished communities where noma is prevalent, through an integrated social/educational/economic/public health program, while taking into consideration the relevant contextual environments.^{13,15}

There is still a good deal of uncertainty about the demographic, epidemiological, clinical and bacteriological features of noma and about its pathogenesis, even among well-informed

healthcare personnel. At least the basics about noma should therefore be included in the curricula of medical, dental and nursing students in countries where noma occurs; and it should certainly feature as a topic in continuing education courses and in conferences dealing with poverty-related and neglected diseases.^{6,8,9} Such measures, together with the inclusion of noma in the WHO list of NTDs, should go far to raise the awareness, and improve the knowledge and understanding of noma among healthcare workers, and even secondarily among politicians, governmental officials and philanthropists.

Hopefully, this may engender collaborative measures to reduce the prevalence and incidence of noma, and to alleviate or obviate the experience from this devastating disease. Most importantly, however, without serious attempts to eliminate malnutrition and immune suppression and to address the socio-economic and educational plight of the populations at risk, and without making medical services reasonably accessible to them, the likelihood of controlling, preventing or eradicating noma is very small.^{6,8,9}

As malnutrition relief and childhood vaccination programs are fairly widespread in remote rural locations where the people at risk of noma live, it would be advantageous to teach people providing these services to recognize signs and symptoms of the noma precursors, and if identified, to urgently refer to the nearest available health service units; and themselves to inform and educate mothers of small children in these rural locations about the importance of regular effective tooth-cleaning, and how to screen their own children for early signs and symptoms of necrotizing gingivitis/necrotizing periodontitis.^{6,8,9}

Conclusion

At present, as has been the case in the past with many other NTDs, organized research on noma is, on the whole, rather overlooked, and subjects with acute noma or its sequelae are neglected for remedial actions driven by national health authorities, and in allocation of funding and resources for promoting research, prevention, treatment and social support.

If noma were to be included in the WHO list of NTDs, global intervention strategies against NTDs could be brought to bear on noma, promoting prevention, control or perhaps even eradication of this devastating disease. For this to occur, there must be alleviation of the poverty of affected communities by promoting local economic and educational development, improved housing and sanitation, functional civil infrastructure, access to affordable commodities and access to affordable healthcare facilities. All this might be facilitated by mainstreaming noma, as is the case with other NTDs, within national health systems in the context of universal healthcare coverage.^{2,14}

However, critically importantly, there must be dependable, WHO-supported, evidence-based research information about all aspects of noma, otherwise it is unlikely that other national and international health agencies will prioritize the battle against noma.

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