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EBOLA VIRUS OUTBREAK IN WEST AFRICA: AN OVERVIEW

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INTRODUCTION:

Ebola virus (EBOV) outbreak made its first appearance in remote villages in equatorial African countries of Zaire, Sudan, Uganda and Gabon and re-emergent outbreaks have occurred in this sub region since 1976. Ebola virus appeared to be one of the deadliest global communicable diseases since onset of HIV/AIDS. It currently has no vaccine, treatment or cure akin to the latter.

Ebola virus derived its name from Ebola River proximal to the epicenter of Zaire Ebola virus outbreak, the first ever outbreak of 1976 [1-4]. Ebola virus is a zoonotic pathogen with the intermediate host or the natural reservoir thought to be bats particularly various species of fruit bats. The virus is primarily transmitted from animals to human and among humans via the body fluids [5].Ebola virus disease (EVD) is a severe and highly fatal hemorrhagic fever in human and other primates caused by four out of the five known genus Ebolavirus [1]. The genome is a negative sense single stranded RNA structure that can rapidly replicate and mutate within human host after infection [6-7]. This characteristic is feared to represent its rapid human host's adaption as it is passed among humans and likely to pose challenges to the development of a vaccine [8-9]. The Zaire Ebola virus is responsible for causing current Ebola epidemics in West African sub region, with about 21,296 suspected cases and some 8,429 confirmed deaths [10]. Its frightening mortality rate led to its being listed as a select agent; biosafety and biosecurity pathogen [11]. The scope of its spread now extend to three

continents Africa the epicenter, North America and Europe the last two by importation.

Etiology:

Zaire ebolavirus is one of the species in the genus Ebolavirus, family filoviridae order Mononegavirales [1, 12]. EBOV often causes fatal hemorrhagic fever in simian primates including human and nonhumans like great apes, with fruit bats the natural reservoir, the other implicated domestic animals are pigs and dogs [13-14]

Source:

Human activities –mining, timber operations, and deforestation from increasing human activities bring the infected wild animals (chimpanzees and gorillas) and bat species thought to be the natural reservoir of EBOV from their natural habitat of thick forests closer to man and his immediate environment. This was demonstrated in the suspected index case in the transmission epicenter Meliadou Guinea of Dec 2014, in West Africa through the 18 –month old boy. He was thought to have contracted and died from the virus few days after playing close to bat infested tree near a forest close to their settlement [15]. The transmission chain thereafter widened to his immediate family members, extended family, all that attended to the ill, burial and funeral activities in that succession contracted and died due to unprotected exposure from the mysterious disease later discovered by WHO to be the Ebola virus. Given the ease of modern transportation and global travel, the EBOV is now a risk to the entire "Global Village", with intercontinental transmission only an airplane flight away [16].

Differential Diagnosis:

A number of diseases share some of the non-specific clinical features of EVD and these were part of the challenges in early diagnosis and the containment of West Africa Ebola epidemics. EVD has been described as a flu-like syndrome at onset that can rapidly progress to full hemorrhagic fever with multi-organ failure and death

Clinically similar Marburg hemorrhagic fever was caused by Marburg virus morphologically similar to Ebola virus but immunologically distinct [17].

Diarrhea, vomiting and fever found in cholera endemic in some of the affected rural regions created confusion and delay in early diagnosis and containment of the recent outbreak.

Malaria, an endemic disease in the tropical sub region is another disease to exclude in the diagnosis of EVD as they share some of the common symptoms. Lassa fever a viral hemorrhagic disease is often encountered at the region.

Pathogenesis:

The Ebola viron requires majorly two host cell entry proteins; the cholesterol transporter protein (the host –encoded Niemann-Pick C1 (NPC1) for host cell entry and replication [18-19]. NPC1

mediates Ebola virus infection by directly binding to viral envelope glycoprotein (GP) [19-20]. The implication is that lack or mutation or modification of this protein in an individual may result in some individual resistance to the Ebola virus deadly disease. It is evidence that the NPC1 is a critical receptor mediating Ebola infection by its direct binding to the viral GP. The second lysosomal domain of NPC1 is thought to mediate the binding [21]. The second receptor is T-cell immunoglobulin and mucin domain 1 (TIM-1) [22] binding to the receptor binding domain of the EBOV glycoprotein. TIM1 is found in tissues seriously impacted by EBOV lyses- trachea, cornea and conjunctiva. As an acellular agent, viruses like Ebola virus use the combination of host and the viral encoded enzymes and host structures to produce multiple copies of themselves that eventually self-assemble viral macromolecules in the host cells [23]. Three phases of Ebolavirus infection pathogenesis have been noted [16]:

Phase I can be characterized as the transfer of EBOV from an animal carrying the virus (reservoir-bat, nonhuman primate) to a human, usually via small cutaneous breach. Similar principles apply in human-to-human transmission during Ebola outbreaks via contacts with infected blood, stool, vomitus, urine.

Phase II can be characterized as the early symptomatic stage — usually between days four and ten — where symptoms of a viral illness appear and gradually progress toward more advanced manifestations of the disease.

Finally, Phase III represents the advanced Ebolavirus disease, with hemorrhagic manifestations, impaired immunity, and end-organ failure [16]. Limited laboratory evidence indicated that pathogenesis of the disease included non-icteric hepatitis and possibly acute pancreatitis as well as disseminated intravascular coagulation [17].

EBOLA virus disease (EVD):

EVD is severe often fatal hemorrhagic fever with multi-organ failure caused by Zaire Ebola virus which is one of the 4 ebolaviruses known to cause disease in human. This has the highest case-fatality of all the ebolaviruses, average 83% since first outbreak in 26 August 1976 in Yambuku, Zaire [24]. The first recorded case was Mabalo Lokela,a 44 year old schoolteacher and the first clinical description was by Ngoy Mushola. Transmission is via body fluid through the use of unsterilized sharps like needles, close personal contact or contaminated objects.

Clinical Presentation:

Incubation period of 1-21 day, EVD begins with an influenza-like syndrome, including high fever; body temperature can be as high as 39 Celsius, fatigue, headache, joint and muscle pains, then disease soon followed by diarrhea, vomiting, chest pain, pain and dryness of the throat. There were indications of mild or subclinical Ebola

infections [25]. After 3-4 days of non-specific symptoms and signs, patients typically experienced progressively severe sore throat, maculopapular rash, and impairment of liver and renal functions, intractable retrosternal and abdominal pain, prostration, rapid deterioration to death after a mean of three days.

Hemorrhagic manifestations are common (71%) being present in half of the recovered cases and in almost all the fatal cases [25]. Bleeding from multiple sites, in some cases internal and external bleeding e.g. from gums, diarrhea with blood, haematemesis, principally the gastrointestinal tract.

The disease in human varies in severity from rapid fatality to mild illness and in some times asymptomatic response [26] .Increasing evidence suggest the possibility of the severity of the disease correlating with genetic variations in victims and not the genetic nature of the virus [27]. There is no path gnomonic feature of EVD. However, evidence indicates that some of the clinical features are indicative of the severity of the disease [28].

Gastrointestinal symptoms of anorexia, abdominal pain and diarrhea and difficulty in breathing may be similarly seen in ebola survivors and non survivors [28].

Neurological symptoms: confusion, loss of consciousness or coma were more frequent in those that died than the survivors [28]. Hemorrhagic symptoms: bleeding from puncture sites like needle sites, vaginal bleeding in females, haematemesis, epistaxis, bleeding from gums manifested more in the fatal cases [28]. These perhaps are secondary to disseminated intravascular coagulopathy. Miscellaneous symptoms of chest pain, cough and sore throat were seen more in those who died from the disease [28].

An Appraisal of the Outbreaks:

With reference to the table above, Ebola has recently directly or indirectly transmitted in three continents. Equatorial African region has experienced ebola outbreaks since 1976 almost four decades, some of the countries with repeated outbreaks. Despite their weak healthcare system, they appeared more readily prepared with high index of suspicion which favors their early detection of cases. There are readily available laboratory services for rapid and reliable diagnosis, isolation wards, trained staff on ebola infection prevention and control [29].

Governments treat confirmed ebola as a national emergency in this sub region [29]. On the contrary, risk factors in the recent West Africa sub region outbreak which so far was the deadliest of the outbreaks since its onset in 1976, was fuelled by inexperience and lack of preparedness for the outbreak. The borders are porous and high population mobility making spread easy and across border contact tracing difficult [29]. Very ill sneak across border easily to

safer countries for care exporting the virus. Cultural practices and behavioral practices such as traditional ancestral burial and funeral practices were linked to 60-80 cases in Guinea and Sierra Leone [29].

There was high reliance on traditional healers and herbalists which delayed early effective intervention with consequent increased transmission and mortality. Spread by international air travel play a vital role in the importation of the virus to Lagos Nigeria, Dallas Texas USA, and Europe. This was the marking of importation of Ebola across the borders via air travel [29].

Twenty first century brings with it increased and rapid cross-border mobility due to high global interconnectivity and interdependence therefore an ebola transmission any point on the globe puts other points, in fact the entire globe at the risk of importation by storm the invisible deadly cargo, ebola virus.

The two imported cases in Spain died while the female health attendant to one of them who contracted the virus was successfully managed. Similarly a medical evacuee the only confirmed case in 2014 outbreak in UK was successfully managed. There were few other imported cases in Europe mostly in Germany and Netherland. The lesson here is that ebola has lost its barriers and confines therefore an outbreak anywhere anytime should be treated as a global public health emergency before it breezes into our bed rooms since man can traverse round the globe just an airplane travel. Currently as at January 2015, 8641 deaths have been reported in six most affected countries; Liberia, Guinea, Sierra Leone, Nigeria, USA and Mali and 21,689 reported cases were even considered by WHO as being under reported. UN health agency declared an international public health emergency in West Africa outbreak. The coordinated teams of international agencies are still tirelessly battling Ebola to containment especially in sub-Sahara Africa.

It is pertinent to note the three categories of Ebola cases managed in the other continents outside Africa within the reviewed period. They were those infected and evacuated from West Africa epidemics, those diagnosed in USA and Europe after return from West Africa and three in all who contracted the disease from taking part in the management of the other two groups in their various countries.

Table: Ebola Outbreaks at a Glance as at 2014:

	Date	Country	Suspected focal of transmission	Number region affected	Number confirmed cases	Deaths	Case Fatality ratio
Central (equatorial) Africa: epicenter	1976,August	(Yambuku) Zaire(DRC)*	44 year old teacher	-	318	280	88.1
	1995,April	(Kikwit) DRC	-	-	316	250	79.1
	1976	Sudan	-	4	284	151	53.2
	2014	DRC	Unrelated West Africa outbreak	-	70	43	61.4
West Africa Outbreak	2014,March	Guinea**	18-month old boy	4	86	59	68.6
	2014,August	Guinea	-	2 new	1,825	1,096	60.1
	2014,March	Liberia	Across border from Guinea	All 15 districts	6,776	2,823	41.7
	2014,May	Serra Leone	,,	All	4,964	1479	29.8
	2014,July	Nigeria	Airplane traveler from Liberia	2	19	7	36.8
	2014,August	Senegal	Traveler from Guinea	1	1	0	-
	2014,October	Mali	Girl age 2yrs traveler from Guinea		8	6	75.0
Other Continents							
North America	2014,October	USA	Airplane from W. Africa	2	10	2	20.0
Europe	2014,	U K	,,	8 countries	14	5	35.7

*epicenter of the outbreaks. **Meliadou, Gueckedou Guinea origin of outbreak via a 2 year old toddler

Diagnosis:

Traditionally EVD or Ebola hemorrhagic fever (EHF) diagnosis relies on the viral isolation [30] and serological assay and antibodies detection [31] and Immunohistochemistry testing [32]. Due to High biosafety hazards only few recognized specialized laboratories perform the assays. High index of clinical suspicion is very important in this disease without path gnomic symptom. Diagnosis must be confirmed by detection of viral antigens or Ribonucleic acid (RNA) in the blood or other body fluids [16].

Treatment:

Currently there is no licensed vaccine for prevention or drug for treatment of ebola disease. These are still at various experimental levels of development. However some interventions have been applied with some promises especially if timely instituted. Confirmed cases should be

admitted in isolation ward best in designated center/treatment facilities. Early aggressive supportive care including rehydration and correction of electrolytes imbalance should be done. Life-saving supportive care is essential. Use of human interferon and convalescent serum has been previously tried [33]. The Core interventions including contact tracing, preventive initiatives, active surveillance, effective isolation and quarantine procedures and timely response to patients are essential for a successful outbreak control. [34]. These measures, combined with public health education, point-of-care diagnosis, promising new vaccine and pharmaceutical efforts and coordinated efforts of the international community, give new hope to the Global effort to eliminate Ebola as a public health threat [34].

Prevention and Control:

The key to management of EVD is its prevention and control. As at October 2014, there has not been any licensed vaccine for clinical use [35-37]. At personal level avoid areas of outbreak, wash your hands regularly, avoid contact with infected people or contaminated objects. Surveillance of border traffic to contain the disease in affected areas, setting up community ebola surveillance teams and closing of borders should be promptly effected at onset of outbreak. The identified contacts should be quarantined and physically monitored daily for 21 days for development of symptoms.

Health boarding, all departing and arriving travelers should be screened at the entry point at sea and air ports and frontiers to prevent importing and exporting the ebola virus among regions.

Government policies; banning crowding events like games and sports during outbreak, closure of schools, prompt and safe disposal of deaths should be ensured. Any identified ebola case should be seen and treated immediately as a national emergency by the government. All suspected cases should be managed in designated isolation wards and common treatment centers for confirmed cases. Good laboratory services especially good virology laboratory services are key to prompt diagnosis of cases. Point-of-care diagnosis should be the target. As a biosafety hazard the health personnel should be trained in handling the specimens and other materials which is crucial to contain the transmission. There should be quality protection of health workers who must be trained on the use of personal protective equipment (PPE) and application of barrier nursing procedures. Sanitation and personal hygiene are vital in the containment of Ebola outbreak.

National preparedness; regular revision and refining of the steps are vital.

Government should demonstrate strong leadership role by adequate and timely fund disbursement and coordination of all the activities via her health ministry. Prompt high quality contact tracing and movement of detected cases

to isolation wards to break transmission. Construction of isolation centers and designated treatment facilities; Prompt involvement of international agencies for early collaboration is essential for ebola containment.

Mobilization of all the relevant sectors for inter-sectorial collaboration as all have role in the case. Communication plays a vital role in social mobilization and ensuring early community involvement and support of containment measures. Health education; the print, electronic and social media public awareness campaign should be provided.

Door-to-door provision of information on preventive measures particularly sanitation, personal hygiene and the need for prompt reporting of symptoms and its prospects for survival should be carried out by the health personnel in local languages. The community, traditional and religious leaders should be used for sensitizing the public. In DRC outbreak of 1995, the outbreak was terminated by the initiation of barrier-nursing techniques, health education efforts, and rapid identification of cases [38]

CONCLUSION:

Deadly Ebola disease fast becoming endemic with its reemergence in some parts of sub-Sahara Africa is a great global health threat challenging the medical world especially in the recent wide rapidly spreading and ravaging outbreak in West African Sub region. Quality preventive and control measures, prompt contact tracing, safe and active management of cases backed by quality public education are crucial to its containment. Meanwhile the scientific world continues in search to unravel its mystery.

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