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MEASLES: A MAJOR HEALTH THREAT TO HUMAN KIDS OF MODERN ERA

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ABSTRACT
Measles is a highly contagious disease in human, caused by measles virus (MeV) and have higher mortality rate. Before the knowledge of measles vaccines it was reported that almost 98% children of 18 years old were a victim of measles. Recent studies showed that the rate of higher complications are among <5 to >20 years old. Measles can cause complications in the whole body and main symptoms are fever, maculo-papular skin rash with cough pneumonia, measles inclusion body encephalitis, gastroenteritis and blindness etc. these diseases are because MeV causes immunosuppression. This virus is transmitted by respiratory tract and can affect the systems of the body. The vaccination of measles was introduced in 1963 and vaccines contain a live weakened strain of MeV and great development has been advanced to increase international vaccination exposure to decrease measles. The school going children are likely to involve in spreading measles disease and the adults are likely to develop complications and finally results of laboratory examinations (recognition of anti-MeV IgM antibodies or viral RNA), tells the complexity of disease case. Yet, widespread broadcast continues in different areas of the world. It is a significant reason of infant death world-wide, with approximately more than 100,000 death cases occur every year. So accessibility of a very active and comparatively cheap vaccine can help to eradicate measles completely.

KEYWORDS: RT-PCR, Vaccination, CD150+ lymphocytes, Paramyxoviridae and Koplik's spot.

INTRODUCTION
Measles virus (MV) is the model member from the family Morbillivirus, belongs to the subfamily Paramyxovirinae and member of the family Paramyxoviridae. It is a wrapped disease using a lone strand, non-parceled adverse genome comprising sense RNA and just inspirations disorder in ancient times and era of today. MV is exceedingly irresistible and is transmitted by methods for the respiratory course (De Vries et al., 2015). At a point when the contamination is taken in and a basic target or desired cell is corrupted then the essential spreading outcomes and experimental of disease appear after 9 to 19 days. Then at that point diseases and side effects begin. MV contamination is typically self-constraining, because of the leeway of infection tainted cells by the insusceptible framework. Recuperation is trailed by long lasting resistance to measles. In phenomenal cases, outrageous measles-related central tactile framework (CNS) traps make: Acute dispersed encephalomyelitis (ADEM), measles thought body encephalitis (MIBE) or subacute sclerosing panencephalitis (SSPE) (Schneider-Schaulies et al., 2003). MV illness results are tremendously in a transient safe covering. The World Health Organization (WHO) evaluated that around 114,900 individuals, for the most part kids under five years old, kicked by the bucket of measles and coming about sequelae in 2014. Hailing lymphocyte establishment molecule relative 1 or SLAMF1 and besides known as CD150, which is conveyed by divisions of dendritic cells (DCs), thymocytes, macrophages, hematopoietic youthful microorganisms (HSCs), T-and B-cells, has been recognized as a cell receptor for MV. Tainting of NHPs with recombinant MV (rMV) obtained from the wild-type Japanese IC323 strain and intended to express a luminous journalist protein recognized CD150+ lymphocytes and DCs as extraordinary desired cells of MV ailment in vivo (de vries et al., 2012**)**. Nectin cell connection molecule 4 (nectin-4, in advance generally called poliovirus receptor-related 4 or PVRL4) has been recognized as another telephone receptor for MV that is conveyed by epithelial cells. This type of protein is a bit of the disciple crossing point compound, which is arranged at the basolateral side of the epithelium, beneath the exact junctions. Nectin-4 is also conveyed by keratinocytes and endothelial cells, prescribing a possible work for these sorts of cell in the contamination of the trademark, measles skin rash Both CD150 and nectin-4 accept critical services in the further pathogenesis or contamination of measles. Vaccination and research office balanced MV strains can utilize CD46 as a supplementary cell receptor in vitro, yet this receptor

does not appear as to expect a significant activity in the midst of pollution with these contaminations in vivo. The C-type lectins DC-unequivocal intercellular security particle Langerin and 3-grabbing non-integrin (DC-SIGN), imparted by Langerhans cells and DCs, independently, have been perceived as association receptors for MV. In any case, these particles don't contain MV area, anyway are supposed to get MV elements and urge CD150-intervened disease to-cell blend of DCs or lymphocytes. The accompanying overview of MV section, dispersing, transference and insusceptible covering is, all things considered, subject to observations from exploratory MV infections of NHPs (Laksono et al., 2016).

HISTORY

It is predicted that measles virus (MeV) maybe evolved from cattle virus rinderpest (de Swart, et al., 2012), an ancestral virus that has been recently eradicated. Measles virus is almost closely related to cattle virus and appeared as a zoonotic infection for cattle and humans (Barrett, 1999). MeV made its accommodation in humans and about 5,000 years back when human population managed abundant size in Middle Eastern agricultural developments was present and this development continued virus transmission (Weiss, 2001). Perhaps it was first arrived in the Americas in the 15th century with the migration of Europeans, so measles distribution did not always worldwide. Then it is possibly that MeV and smallpox contaminations assisted the European downfall of Inborn American civilizations by initiating huge numbers of deaths of the entirely vulnerable Native Americans. More than 95,000 cases of measles with 3000 deaths due to plague of measles in the US Army (1917 to 1918), gave a remarkable example of the disturbing consequence of measles and related bacterial co-infections that have been arisen before the starter of antibiotics or measles vaccines (Morens & Taubenberger, 2015). It is predicted that 17.1 million deaths between 2000 and 2014 take place by preventing vaccine coverage in effected areas (REF. 8). WHA, World Health Assembly (Fig 1).

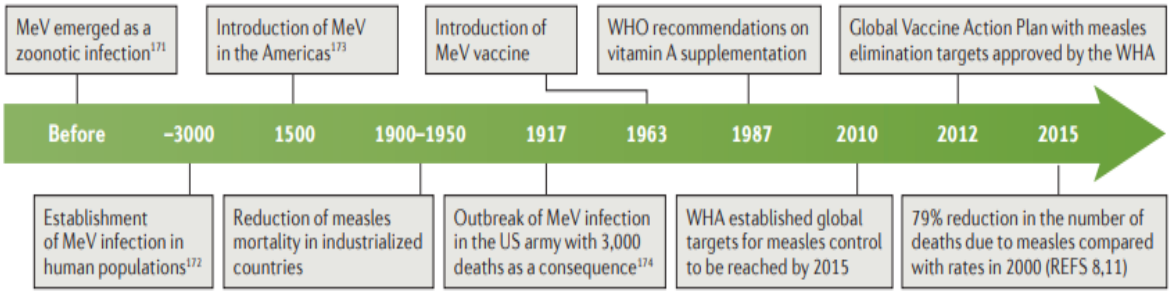

Figure 1: History of measles virus, infection and removal programs.

TRANSMISSION OF VIRAL GENOME IMMUNE SUPPRESSION AND ITS SIDE EFFECTS

Life cycle of virus for measles is given below (fig 2):

MV infection starts by access of MV into a vulnerable host with the help of membrane fusion. Two sorts of transmembrane glycoproteins are involved in fusion of viral genome with host receptor: H protein and the F protein. These are covered into the lipid wrapping that is derivative of the host cell membrane. H protein has control for receptor binding with the host cell and F protein facilitates membranes fusion (Hashiguchi, 2011) (fig 2 a). Replication and transcription of the virus genome takes place completely in the cytoplasm. After fusion, the viral RNA releases in cell and crosses the threshold and gets access to the De novo pathway produces RNP complexes which are conveyed by (RAS-related protein RAB11a-positive recycling endosomes) that travel alongside microtubules (Nakatsu, 2013) (Fig 2 b). H protein and F protein are conveyed to the plasma membrane by means of altered secretory pathways. Another protein that is known as M protein, form linkages with RNP multiplexes, the cytoplasmic ends or tail of H protein and F protein, the cell membrane and actin fibers or filaments in the host cells (Wakimoto, 2013). These complex interactions support virus assembly and order cell-to-cell fusion of viral RNA (Tahara et al., 2007). This viral RNA may cause diseases to CD150+ myeloid or can be lymphoid cells in the alveolar or the mucocilliary epithelium.

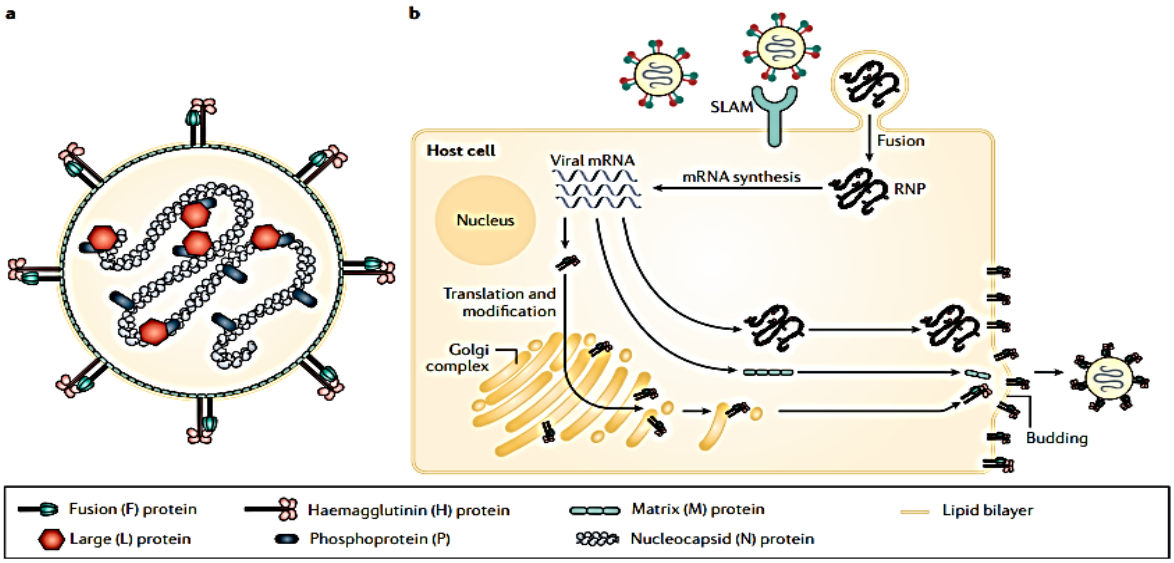

Figure 2: Measles virus and the viral life cycle.

Another possible site of entry is by the eyelid covering from the inside (the conjunctiva), that is rich in dendrite cells receptors or CD150+ lymphocytes. MV elements or spots dumped on the conjunctiva then they arrive in the interplanetary among eyelids and cornea, where they can communicate a disease to myeloid or lymphoid cells. MV elements gasped into the respiratory tract that can infect receptors on dendritic cells in the superior respiratory tract, by the help of dendrites, virus elements expanded into the respiratory mucosa or macrophages in the alveolar Lumina of the inferior respiratory tract. Septic immune cells successively transfer to neighboring tertiary lymphoid tissues and depleting lymph nodes (Holzmann et al., 2016).

MV-contaminated cells move towards depleting lymph nodes. Then they transfer the contamination to CD150+ lymphocytes (prevalently B-cells, memory CD4+ and CD8+ T-cells); amid viremia tainted cells, enter the dissemination or move foundationally towards different tissues and organs, at that place the disease can additionally enhanced. Disease of skin-occupant resistant cells consequences in infection diffusion to nectin-4+ epithelial cells: a couple of days after the fact, consumption of invulnerable cells in lymphoid organs and tissues consequences in temporary insusceptible concealment. MV-explicit T-cells penetrate the skin where they clear the contaminated cells, which results in the average measles skin rashes. The green ringer formed bend out of sight speaks to the viral burden after some time (Park et al., 2015).

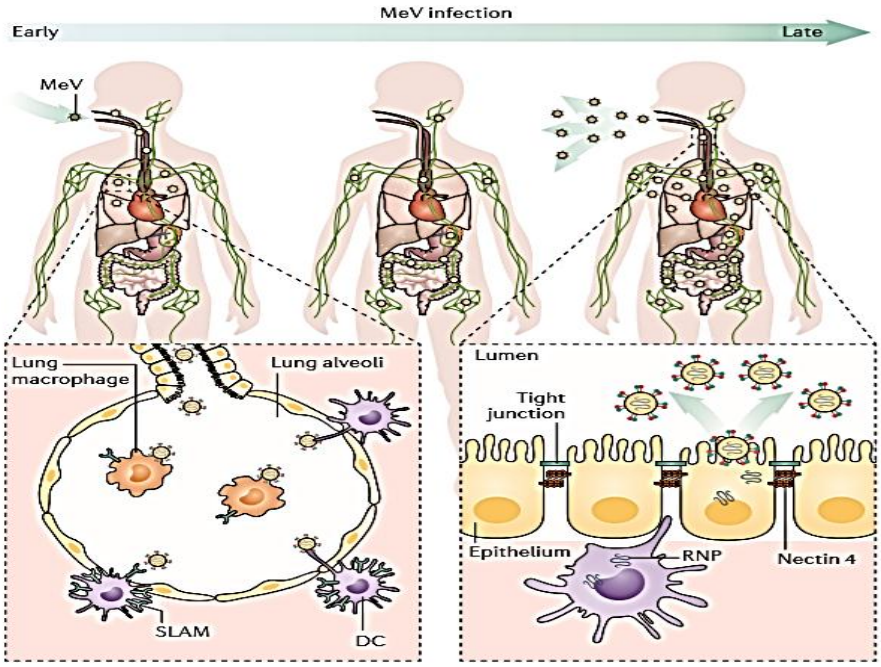

Figure 3: Measles virus infection and transmission.

The third phase of MV disease is transmission of fresh MV elements through the air. Nectin-4+ epithelial cells in the superior and inferior respiratory tract epithelium create original infection elements and discharge them into the bodily fluid covering the space of the respiratory tract. Epithelial layer may harm from contaminated lymphoid tissues, for example, the tonsils, discharges infection elements created through lymphocytes into the superior respiratory tract. Epithelial layer may also harm from the inferior respiratory tract actuates hack, improving release of mist concentrates containing MV particles. Measles virus infection is highly effective to make immune system weak thereby exposing our body to susceptible infections and a leading cause of the increase in children death. Viruses constantly make its clone in the lymphoid tissues. CD11c+ and Dendritic cells on follicles are responsible for the maintenance of structure. $CD150^+$ lymphocytes and $DC\text{-}SIGN^+$ are present within lymphoid tissues thus allow it to become an efficient site for MV infection and modification (GeurtsvanKessel, 2009). BALT and GALT have special ability to recognize the mucosal pathogens and provide defense against it, they drain them out from all the sites where they are present, as they are present at entry portals to cause infection.

It has been recently reported that when there is a high level of measles infected cells in the lymphoid tissue, the level of viremia in the infected NHPS is also same causing the excitation of B cells in the germinal centers. When the virus will be completely remove, the normal number of lymphocytes recover in almost one week. If lymphophenia stays for a week, it can cause the suppressive effect of immune system for about several weeks or to two years. We will call it measles induced immune suppression. The inability of immune cells to perform its proper function provided knowledge to work on it as it is responsible in immune suppression. It was not an easy task because there were lacks of evidence that there are receptor sites on the cells that are causing the depletion of immune cells. Mutagenic and antigenic stimulation showed lesser effect when exposed to peripheral blood lymphocytes, gives the mechanism of measles immune suppression. This decreased level of proper functioning allowed observer to observe the low level of lymph proliferation in vivo conditions. Different other mechanisms were used to explain the mechanism of immune suppression caused by the measles infection. The depletion of $CD150^+$ memory cells such as B and T cells causing immune amnesia caused by the immune deficiency. The normal lymphocytes were suppressed by the new bystander and MV specific lymphocytes, showing long effect of lymphophenia and effect on immune system. This shows that immune depletion can be a useful method for immune suppression caused by the measles infection. (Laksono et al., 2016).

SYMPTOMS

Measles signs and symptoms show up around ten to fourteen days after presentation to the infection. Signs and indications of measles regularly contain: Temperature, Arid hack, Muzzle, Aching throat, Sparked eyes (conjunctivitis), Shiny or whitening acnes with pale blue white focuses on an inflamed foundation initiate from the mouth then inward covering of the cheek cutaneous rash with pathognomonic) called Koplik's spots, nausea and diarrhea that can also lead to lethal complications caused by respiratory pneumonia and encephalopathia or severe hepatitis. Skin rashness completed up of expansive level spots that regularly stream into each other. The disease happens in successive phases over a time of a minute (Steichen and Dautheville, 2009). During the initial ten to fifteen days of exposure measles virus comes out and still you do not have any signs or side effects. After 10 days measles usually shows mild fever at first followed by high degrees of infection then other side effects starts that include flowing nose, conjunctivitis and sore throat.

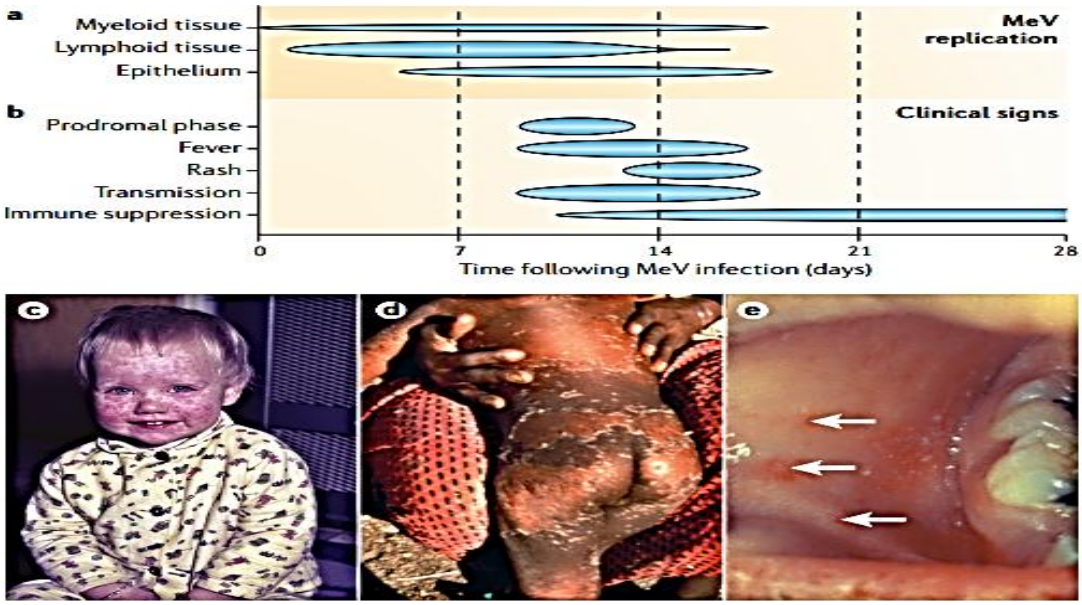

Figure 4: Pathogenesis of measles.

This can take a few days to recover. But if rash constitutes small red spots, like vesicles, when they are accumulating at a place they can make skin look reddish appearance at the face (Fig 4) and cannot recover in few days. Then after few days of exposure the infection goes down the body and spread in the trunk region, arms and lower legs. The temperature goes up to 104 to 105.8°F that can be equal to 40 to 41°C. The rashes starts getting disappear from the face first and then from thighs and feet. Finally, an individual can be a source of the spreading of this disease infection for almost 8 days (Manakongtreecheep and Davis, 201).

Exclusive sickness

Measles virus requires an incubation time period of 8-12 days after which there is high fever (39°C-40.5°C) accompanying cough and conjunctivitis. These symptoms have become severe after 2 to 4 days when rashes start popping out, first appear on the face and neck and then goes down the body probably looks like red patches. These rashes came with fever that lasts for 2 to 3 days and cough that can prolong up to 10 days. The rashes then transform to lesions and these lesions can be seen on the distal extremities and if observed carefully that can be seen on palms of almost 45% of infected persons. After rashes fades, the skin starts shedding from infected area (Perry and Halsey, 2004). Koplik's spot can appear 1 day after the appearance of rash and stay for almost 3 days. The diameter of these spot is 2 to 3mm can be observed on the buccal mucosa, usually facing the first molar, sometimes on the soft palate, conjunctiva and vaginal mucosa (Dirk and Suringa, 1970). Asymmetrical patches of lesions of membrane can be observed on the areas of buccal mucosa as shown in (Fig 3). An individual can himself check either he has symptoms of measles of not. He or she can call the doctor immediately and avoid the spreading of the disease. If the doctor instructs you to stay in the house then stay because measles can be contagious and transmit by respiratory route and can affect a number of people around you. Especially children should not be allowed to go out or attend their school events as well.

INCREASE OF INFECTION FROM DECEASED PERSON IN HEALTHY PERSON

Measles is a broad infection causing disease that has its favorite points of expression like nose and face. When a person suffering from measles sneeze or talks, there are chances of spreading the infection to the individuals around him through the air. Tainted beads may reach on a surface; they stay there dynamic and infectious for a few hours. A person can get the infection by putting fingers in mouth or nose or scouring eyes in the wake of contacting the tainted surface. Being unvaccinated and malnutrition (causes lack of white blood cells) are also main causes for measles. Around 90% of individuals with weak immunity are affected with this infection by others and a flow sheet showing the circulation of infection in figure 5.

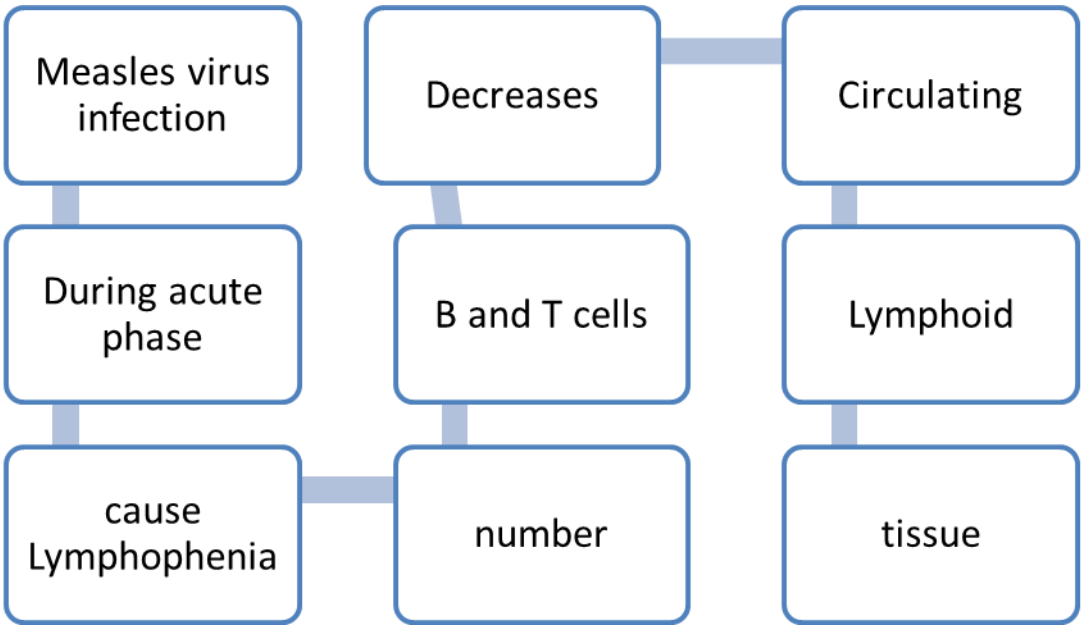

Figure 5: Flow sheet of infection circulation from one site to another.

BEFORE THE MEASLES RASH APPEARS

It may be seen that you have been suffering from a respiratory virus such as influenza, respiratory syncytial virus (RSV), or rhinovirus, that cause common cold, these all occur before measles rash appears. The Koplik's spot in the mouth can also be disordered with the enlarged oil glands (Fordyce spots). Measles can be significantly identified by the intensity of fever because in case of measles fever can be distinctively higher than other viral diseases. Blood test is the best test to clear all confusions. Rash causing viruses: There are many other diseases that can be responsible for the appearance of rashes such as chicken pox, *Roseola Infantum*, rubella and many other diseases. These can be distinguished by

the appearance of the rash. Scarlet fever and toxic shock syndrome (TSS): Scarlet fever is a streptococcus infection can be responsible for the appearance of rashes but can be identified by other signs while TSS can cause low blood pressure and kidney problems. Reaction to drugs: Due to hypersensitivity to a specific drug can result in the appearance of the rashes that looks like measles rash, if you stop taking that drug for a time period these rashes will disappear. Bacteria (*Meningococcemia*) that can cause meningitis also show rashes but this can be clarified by blood test. Rocky Mountain spotted fever is also a bacterial disease and can be caused by ticks resulting in rashes but can be identified by blood test or skin biopsy. Infectious mononucleosis is a viral infection caused due to allergy to a certain antibiotic resulting in the appearance of rashes. Blood test can confirm the situation (Jenkin et al., 1999).

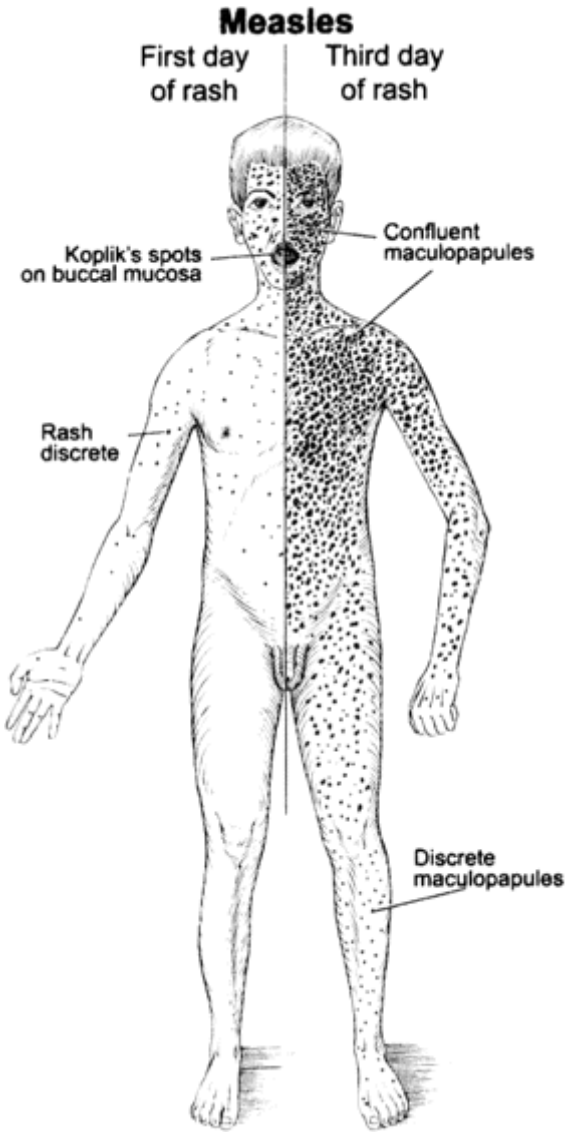

Figure 6: Pattern of appearance of rashes.

SEVERE COMPLEXITIES

A standout amongst the most widely recognized complex case of measles is a bacterial, external ear contamination. Measles may prompt irritation of anyone's voice box (larynx) or aggravation of the internal dividers that line the fundamental air ways of his lungs (bronchial cylinders) (Ganstanaday et al., 2018). It is a typical complexity of measles. Individuals with traded off insusceptible frameworks can build up a particularly unsafe assortment of pneumonia that is now and again deadly. Around 1 of every 1,000 individuals with measles builds up a confusion called encephalitis. It can happen directly after measles, or it probably won't happen until some other time. In case of pregnancy, woman has to take uncommon consideration to maintain a strategic distance from measles in light of the fact that the sickness can cause preterm work, low birth weight and maternal passing (Rasmussen and Jamieson, 2015).

DIAGNOSIS

Measles (Rubeola) can be diagnosed by the appearing symptoms such as fever, measles rash as well as bluish white spots having red background on the inner lining of the cheek that are known as Kopliks spot can also be observed and reported to be seen in 60 to 70% of the people with measles (Babbott and Gordan, 1954) but some can also be similar to other common disease symptoms. That is why blood test can be efficient to test whether the person is suffering from measles or not.

TESTS AFTER DAIGNOSIS

Once you are diagnosed with the symptoms of measles, your doctor will take your blood sample and take a throat or nose swab and also will ask you about you vaccination and travel history because many people can likely to get measles if they have travelled to the countries or areas where there is outbreak of measles infection. These previously termed tests detect the virus specific indirect immunoglobulin M (IgM); it is an antibody that can be present for almost 3 days after the appearance of rash. This antibody can pop up at the 14th day of the infection and usually disappear after 30 days of rash appearance. Measles virus can also be present in urine so it can be helpful if you give a urine sample as well. Immune-colorimetric tests may be compulsory to confirm virus isolation. Results by this test can be achieved within 3 days; the result would be confirmed when stained small foci of infection become observable (Vaidya et al., 2015). This technique is as sensitive as immunofluorescence tests for verification of virus isolation and may also be used in neutralization tests to identify neutralizing antibodies (Chen et al., 2007). These samples were then allowed to culture in order to observe the genotypes of the virus that will show either you are committed to the measles virus or not.

TREATMENT

Care is required to ease the person suffering from measles while in some cases vitamin A supplements, a post exposure vaccination, immunized serum globulin or ribavirin can be given.

Treatment at home

Measles start showing its symptoms after 14 days of infection resulting in fever that stays for at least 3 days cough accompanying runny nose and sore throat. Rashes start to appear after a few days and the symptoms begin to get severe with high fever and then the temperature goes down to normal and rashes start to disappear. Some preventions that should be taken in measure are; one should take plenty of fluids including water and fruit pulps to avoid dehydration, take rest, take medicines to control fever such as Ibuprofen, take bath with cool water and wear light cloth that will provide ease and comfort. Ribavirin and Vitamin A supplementation can be used in severe infections (Bichon et al., 2017). Vaccination is therefore the most efficient solution to prevent this disease.

Medical Interventions

The person can have high fever of 103 to 105 degrees for more than five days, many people require medical attention because they can develop some other diseases such as; Eye and ear infections, can also cause hearing loss, diarrhea, vomiting, respiratory tract infections like laryngitis and bronchitis, febrile seizures (full body convulsions or fever fit). People with weak immune system are likely to suffer from pneumonia as well and can be fatal if untreated. Hepatitis can also occur in some individuals. Encephalitis is an inflammation of the brain and can also be fatal. It affects around one out of thousand people suffering from measles. Thrombocytopenia is the condition of having low thrombocytes or platelets and will also decrease blood clotting ability. Some treatments that should be provided in the hospital are Intravenous or IV fluids to avoid dehydration, Oxygen availability and Antibiotics to treat complications such as eye or ear infection (Gastanaday, 2018).

SOME OTHER TREATMENTS WITH NEW RESEARCH AND EMERGING TECHNOLOGIES

Improvements are required to control the logistic tests related with the present vaccine, and other delivery or distribution approaches that are being advanced (Tannous et al., 2014). For example, improvements in nanotechnology have been managed for the advancement of original measles microneedle spot that has been displayed to be immunogenic for skin vaccination in primates (not human). This spot, would be a possible game changer for policies to attain high vaccination coverage treatment, mainly in resource limited situations (Eden et al., 2015). Other preventions that should be taken to treat measles or to avoid further complications are depending upon one's age, immune system, or the history of vaccination. Vitamin A supplements should be provided to the patient because vitamin A deficiency can cause keratitis, corneal scarring and acquired blindness in children and can also get severe to cause cortical damage due to measles encephalitis (Orenstein, 2004). Advanced outreach policies are required to expand information in people and self-assurance in vaccination significant for their children, so this may develop the interest of implementation of measles vaccine. Measles Vaccination is the most useful health procedure. If it has given to the patient within 72 hours of disease occurrence, it can easily prevent further complications. Even if a person did not recover he can get the immunity against its future infections. So, immunization programs should be improved and use of immunization facilities, by means of tools to recognize vulnerable populations, policies manipulated to expand immunization among distance areas or where hard to reach and communication strategies that develop understanding of the significance of vaccination and decrease vaccine rejections in human body (Rota et al., 2016). New laboratory procedures have been directed to the advancement of great output, multiplex serological assays (Smits *et al.*, 2012) and clinical point of care tests for the recognition of IgM and IgG (Shonhai, 2015), as well as innovative molecular techniques for complete genome sequencing. New information systems, programmatic control panel and measles threat evaluation tools have been established to routine the current information more efficiently and these tools are presently being used to advance program monitoring and performance (Rota et al., 2016).

ADVANCES IN DAIGNOSIS MEASLES

There are three main components of the laboratory diagnosis of measles, these are: serum IgM testing, viral culture and the recognition of MeV RNA by RT-PCR known as reverse transcription PCR. Viral culture is less sensitive than RT-PCR and is not presented by all public health laboratories. RT-PCR and culture are usually performed on a throat or nasopharyngeal swab specimen and also includes the testing of oral liquid, urine and outer or peripheral blood mononuclear cells (Van Binnendijk, 2003). The most common technique for measles laboratory verification is IgM testing, it is a capture enzyme immunoassay (EIA), although indirect EIAs may also be used (Helfand, 1997). IgM testing should be sent as soon as the patient presents with symptoms, but levels may not be detectable until 3 days after the rash appears, so a negative IgM result obtained earlier than this should be repeated. Moreover, molecular and serological tests are also achieved on dehydrated blood samples and oral fluid samples are very precise, their sensitivity can be to some extent lesser than tests done on serum or throat swabs A very new technology that is bioinformatics also gives DNA or protein sequences, relate these sequences and find the treatment by comparing these sequencing (Liu et al., 2008).

MEASLES IN PAKISTAN

There have been a lot of efforts made in the last decade to decrease the burden of measles from the world but still some developing countries suffer from this condition. It all depends upon the delivery of effective and low cost vaccination that will provide protection for a longer duration. It was observed that in 2004 Pakistan was among those countries which are suffering from the outbreak of measles because of many causes such as

corrupt factors, backwardness of parents resulting in refusal to vaccine, unvaccinated invaders and insufficient awareness of health care professionals related to vaccination schedule, useless vaccine (Paules et al., 2019). It is extremely contagious disease, and laboratory confirmed measles cases in Pakistan have been increased and became more than doubled from 2016 to 2017. Recent Demographic and Health Survey (DHS) of Pakistan from 2012 to 2013 evaluates measles vaccination coverage in 1 to 2 years old children at 61.4% nationwide, with important subnational heterogeneity 26.4 to 85.2%. Given this comparatively low RI reporting, up-to-date and active SIAs are required to slow and possibly interrupt measles transmission (Thakkar et al., 2019). A study revealed that Karachi the largest city of Pakistan was under the attack of measles epidemic. Only 3% of children from 1 to 5 years are immunized while further analysis showed that 78% of children received single vaccine and 12% received both (Niazi, 2014). When their blood was tested measles antibodies were observed in only 55% of the children. Recent studies revealed that Baluchistan and Sindh province has more outbreaks of measles while those areas where refugees have arrived such as those from Afghanistan who are unvaccinated are probably contributing in the spread of diseases. These two provinces have more number of outbreaks than Punjab province (Wesolowski, 2018). Pakistan has organized many programs to provide awareness to the citizens in Anti-measles countrywide immunization campaigns. 24000 or above cases were reported in 2017 and it increases to 30000 in last year.

CONCLUSIONS

Excessive improvement has been made in decreasing measles frequency, illness, and death by the extensive use of measles vaccines. Many children die because of the complications of measles such as Pneumonia, diarrhea and malnutrition. Vitamin A deficiency causes blindness. Finally death has already been decreased, millions of death per year before the extensive use of measles vaccines. Worldwide measles vaccine exposure is very high and many countries are presenting a 2nd dosage of measles vaccine by repetitive immunization services. Micro needle patches, could revolutionize measles vaccination plans. But still all is not controlled. Measles frequency rate, deaths rate, and vaccination coverage are mostly based on bad quality data, delaying the capability to track improvement and objective mediations. Table 1:

Table 1: Parameters of small pox, polio and measles.

Parameters	Smallpox	Polio	Measles
Eradication status	Eradicated	Wild polio virus type 2 eradicated, type 3 potentially eradicated as of publication of this paper and type 1 nearly eradicated	Candidate for eradication
Clinical presentation	Fever and rash	Acute flaccid paralysis	Fever and rash
Asymptomatic infections or carriers	No	Yes	No
Primary mode of transmission	Respiratory droplets	Fecal–oral route or oral–oral route	Aerosolized respiratory secretions
Period of contagiousness	25 days	4–6 weeks	9 days
Basic reproductive number (R_0)	5–7	4–13	9–18
Herd or population immunity threshold	80–85%	75–92%	89–94%
Serotypes	1	3	1
Vaccine delivery	Intradermal injection	Oral drops (oral polio vaccine) or intradermal or intramuscular injection (inactivated polio vaccine)	Subcutaneous injection
Number of vaccine doses needed to stop transmission	1	≥3	1–2
Vaccine-derived virus transmission	No	Yes	No

The Measles "International Strategic Plan" (2012-2020) Mid-Term Analysis recognized lacks in applying present plan or strategies, mainly because of insufficient country possession, international political will, and incomes. Serious efforts are desired to recover measles observation and vaccine treatment with two doses of measles and through support, tutoring, and the establishment of repetitive immunization systems. People should themselves come up to get their children immunized to prevent any kind of future infections As polio legacy, the governmental motivation and l funds must be gathered to attain the local removal aims and ultimate worldwide measles extinction.

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