Measles encephalitis in a returning traveller: highlighting the need for MMR vaccination

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In the UK, we are currently in the midst of a measles outbreak.[1,2] During the Covid-19 pandemic, it is estimated that 20% of children missed at least one Measles Mumps and Rubella (MMR) vaccination[3] and coverage has fallen below the World Health Organisation (WHO) recommended 95% for protection from measles.[4,5] This is an opportune moment to share lessons about the importance of obtaining an immunisation history in order to facilitate catch up vaccines, address vaccine hesitancy and highlight a rare but catastrophic consequence of measles infection.

We present a 10-year-old boy with fever, myalgia, maculopapular rash and non-purulent conjunctivitis who presented during a measles outbreak. Although born and raised in London, his family had relocated to Mogadishu 12 months earlier where measles outbreaks in school were reported. He had not received any MMR vaccininations due to parental hesitation. He deteriorated and received artesunate for *Plasmodium falciparum* malaria which was identified on serial blood films. Magnetic Resonance Imaging (MRI) showed leptomeningeal enhancement and broad-spectrum antimicrobials were added.

He became obtunded with cessation of volitional movement. After three weeks he returned to the UK. Intubation and ventilation were necessary due to a GCS of 7/15. Examination revealed a morbilliform hyperpigmented rash consistent with recent measles infection, hypotonia, minimal spontaneous movement and symmetric brisk deep tendon reflexes.

Measles was confirmed on buccal polymerase chain reaction (PCR) and serology (IgM and IgG positive); cerebrospinal fluid (CSF) measles PCR and intrathecal measles antibodies were negative. Malaria testing remained negative. Dengue blood PCR was positive, with recent seroconversion.

An electroencephalograph (EEG) revealed generalised slowing without epileptiform activity. An MRI head showed bilateral changes (Figure 1). An expert multidisciplinary panel met daily during the intensive care admission. The consensus was that the epidemiology (known exposure during an outbreak in an unimmunised host) and clinical syndrome (neurological disease occurring within one month of infection) were consistent with measles encphalits and supported by positive virological results and compatible MRI findings. Malaria (adequate treatment received one month prior to admission, repeat films being negative and disease occurring late in the course) and dengue (insufficient clinical features consistent with primary infection) were much less likely causes of the encephalopathy.

The MDT carefully reviewed potential treatments (e.g. experimental antivirals (ribavirin or favipiravir), Intravenous Immunoglobulin (IVIG) and steroids). There was consensus to avoid these given his improvement with intensive care support. He remained in PICU for 10 days. Over three weeks, there was improvement in movement and consciousness. After neurorehabilitation, at 6-months follow-up, residual left-sided movement difficulties were noted, but no concerns regarding cognition or speech existed.

We recount a rare case of encephalitis with measles, dengue co-infection and recent malaria. Measles, a contagious paramyxovirus single-stranded RNA virus, can cause four types of encephalitis including acute post-measles encephalitis (presenting akin to our case).[6] This condition occurs in 0.1% of all measles cases, between 2-30 days of the first signs of measles[6] with a 5% mortality rate. Our patient's neurological sequela appeared on day 5 in keeping with acute post-measles encephalitis.[7,8]

Acute post-measles encephalitis is primarily a post-infectious, immune-mediated disease. As highlighted in our case, often neither the measles PCR nor antibodies are detected in the CSF, and there is no detectable virus in brain parenchyma[8].This is in contrast to measles encephalitis, where measles virus may be detected in the CSF. IVIG and corticosteroids are considered first and second line, respectively, there is no evidence supporting these medications after the initial period and no licenced antiviral therapies exist.

The required herd immunity for measles is high (92-96%) because of the virus's potent transmissibility. The UK lost its measles-free WHO status in 2019, as MMR vaccine uptake fell below the critical 90% threshold, a situation exacerbated by the Covid-19 pandemic[9] with current rates 84-85%. Globally, during the Covid-19 pandemic, 20% of children are estimated to have missed at least one dose of measles vaccine.[3] With measles' high transmission rate (R_0=12-18),[9] prompt recognition and rigorous infection control measures, including negative pressure rooms, FFP3 respiratory masks, personal protective equipment, and droplet isolation, are imperative.

The parents reported reluctance for MMR vaccination due to previous disproven publications linking vaccination to autism left the child susceptible. Our case highlights the importance of obtaining an accurate immunisation history in all children who present to a healthcare facility in order to facilitate catch-up vaccines, addressing vaccine hesitancy through informed dialogue and ultimately ensure coverage returns to pre-pandemic levels.

Abbreviations:

CSF	Cerebrospinal fluid
EEG	Electroencephalography
FFP	Filtering facepiece
GCS	Glasgow Coma Scale
IgG	Immunoglobulin G
IgM	Immunoglobulin M
IVIG	Intravenous Immunoglobulin
MDT	Multidisciplinary team
MMR	Measles Mumps and Rubella
MRI	Magnetic Resonance Imaging
PCR	Polymerase chain reaction
PICU	Paediatric Intensive Care Unit
RNA	Ribonucleic acid
WHO	World Health Organisation

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Figure 1: Initial MRI (day 1) shows bilateral symmetric T2 hyperintensity (A) and diffusion restriction (B,C) of the caudate and putamen as well as medial aspect and pulvinar of thalamus. Asymmetric involvement of right corticospinal tract is also noted at pontine level (C).

Bilateral parietal parenchymal swelling and subcortical white matter hyperintensity on T2 (D) and FLAIR (E).Post contrast T1 (F) shows no corresponding enhancement in involved areas.