

Fatal Primary Meningoencephalitis Caused By *Naegleria Fowleri*

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ABSTRACT

Naegleria fowleri is a free living parasite which habitats in fresh water reservoirs. It causes a fatal nervous system infection known as primary amoebic meningoencephalitis by invading through cribriform plate of nose and gaining entry into brain. We report a case of primary amoebic meningoencephalitis caused by *Naegleria fowleri* in Karachi, Pakistan, in a 42 years old male poultry farm worker having no history of swimming. Clinical course was fulminant and death occurred within one week of hospital admission. *Naegleria fowleri* was detected by wet mount technique in the sample of cerebrospinal fluid collected by lumbar puncture of patient. This is a serious problem and requires immediate steps to prevent general population to get affected by this lethal neurological infection.

Key Words: *Naegleria fowleri*. Parasite. Nervous system. Meningoencephalitis. Cerebrospinal fluid.

INTRODUCTION

Naegleria fowleri (*N. fowleri*) is a free living parasite and belongs to a group called Heterolobosea.¹ It habitats as temporary flagellate stage or in an amoeboid form in fresh water reservoirs such as rivers, ponds, unchlorinated swimming pools, lakes and hot springs. During summer season water becomes hot, and triggers proliferation of these amoeba. *N. fowleri* is capable of invading and causing disease of central nervous system in humans typically fatal meningoencephalitis, it happens when fresh water contaminated by *N. fowleri* gains access to nasal cavity, for example, due to washing face or by swimming. Once in nasal cavity, *N. fowleri* pierce cribriform plate and enter into brain where it causes granulomatous inflammation leading to meningoencephalitis called as Primary Amoebic Meningoencephalitis (PAM).²

PAM does not have effective therapeutic options and is a rapidly fatal infection. The time period between initial contact with the pathogenic *N. fowleri* and the onset of clinical signs and symptoms varies from 2 to 3 days up to as long as 7 - 15 days depending partly on the size of the inoculum and the virulence of the strain.³ Nearly about 200 cases of PAM have been reported throughout the world.⁴ Recently, 13 cases of this rare life-threatening infection were reported in persons from coastal city of Karachi, Pakistan.⁵

We report another case of PAM due to *N. fowleri* in a 42 years old male patient from Karachi.

CASE REPORT

A 42 years old male poultry farm worker was admitted in a tertiary care hospital of Karachi with the complaints of high grade fever for 2 days, vomiting and loose stools for one day, and behavioral disturbances for one day. He had no remarkable past medical or surgical history of any disease. He was married with 2 kids; he was a non-smoker and not addicted to drugs. He was a Muslim by religion and was living in Karachi for many years, and used to work for nearly 9 - 10 hours in his poultry farm daily where breeding of chickens were done. During long working hours in hot weather he used tap water of the poultry farm for washing of face and nostrils, before performing his prayers as well as to freshen up. Two days before arrival to hospital, he started having headache, which initially was mild and then its intensity gradually started increasing, for which he took paracetamol tablets, but he did not get relieve from headache. Later he started having fits and became disoriented and lethargic. His family brought him to hospital.

On admission, his initial clinical examination was done. There was no focal deficit on neurological examination but signs of meningeal irritation were present. His cardiovascular, abdomen and chest examinations were normal. He was vitally stable and maintained oxygen saturation at room air with a normal arterial blood gas examination. X-ray chest posteroanterior view and electrocardiogram were also normal. Cerebrospinal fluid (CSF) collected after performing lumbar puncture was sent for detail report, gram staining and culture, acid fast smear and culture, India ink preparation, and for polymerase chain reaction (PCR) for HSV 1 and 2.

Patient was started on empirical treatment for bacterial meningitis and viral encephalitis after collecting the CSF sample. Blood samples were also taken for complete blood picture (CBC), random blood sugar (RBS), blood urea nitrogen (BUN), blood creatinine level, serum

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Received: December 06, 2012; Accepted: June 27, 2013.

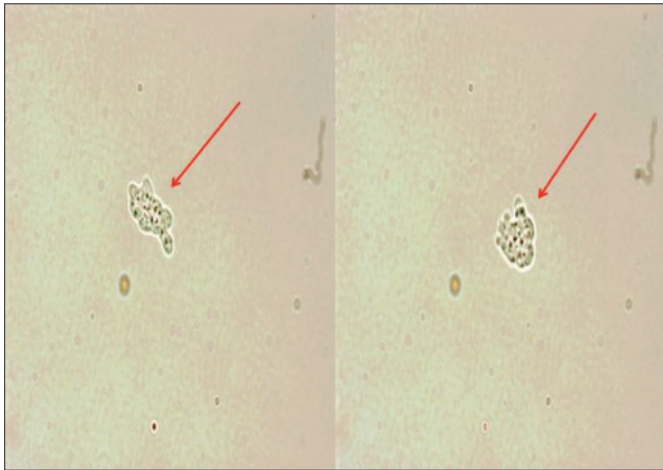


Figure 1: Wet mount of CSF showing trophozoites (amoeboid forms) of *Naegleria fowleri*.

electrolytes; liver function tests (LFTs) and malarial parasite. Patient's CBC report revealed Hb of 13.4 g/dl, TLC of $10.4/\text{mm}^3$, platelet count of $149/\text{mm}^3$. His RBS was 137 mg/dl, BUN was 15 mg/dl, creatinine level was 0.42 mg/dl, sodium level was 140 Meq/L, potassium level was 3.9 Meq/L, chloride was 101 Meq/L, bicarbonate was 17 Meq/L, total bilirubin level was 1.26 mg/dl, SGPT was 26 IU/L, alkaline phosphatase was 55 IU/L and gamma GT was 11 IU/L. His smear for malarial parasite was negative. CSF detailed report showed protein levels of 118 mg/dl, glucose level of 0 mg/dl, WBC count of $1130/\text{mm}^3$ and RBC was $125/\text{mm}^3$. Gram stain, acid fast stain and India ink preparation were all negative. CSF bacterial culture also did not show growth of any bacteria. PCR for HSV1 and 2 were also negative. A wet mount preparation of CSF was done by placing a drop of CSF aseptically on a sterile glass slide and a plastic cover slip was placed on it, this wet mount was viewed under microscope at 40x lens and it showed trophozoites (Amoeboid form) of *N. fowleri* (Figure 1). Intensive care unit doctors were informed, a presumptive diagnosis of PAM was made and the patient was immediately switched to treatment with Amphotericin-B 1.5 mg/kg I/V divided in two divided doses daily plus 1.5 mg/day intrathecal along with dexamethasone. In spite of this treatment, patient's condition continued to deteriorate to GCS of 3/15; his oxygen saturation started decreasing and he was shifted to mechanical ventilation and supported with inotropes for maintaining his blood pressure. His electroencephalography (EEG) showed no brain activity on the third day of his admission to hospital. Ventilator support was withdrawn on request of the family and the patient expired on third day of admission.

DISCUSSION

PAM is a rapidly lethal neurologic condition caused by a free living amoeba named *N. fowleri*, leading to rapid

death in time period of less than a week. The incidence of this rapidly fatal disease has increased in Karachi which is a tropical city of Pakistan.⁵ *N. fowleri* is a free-living excavate form of protist typically found in fresh water, such as ponds, lakes, rivers, springs and wet soil. When the temperature rises during summer season, this free living amoeba acquires its pathogenic form which is called trophozoite. In their free-living state, these trophozoites feed on bacteria.

In humans, it enters the body when the affected water contaminated with these parasites enter into nose, for example, due to swimming or rinsing nose deeply and forcefully. Once inside the nose, *Naegleria* penetrates the cribriform plate and following olfactory nerve pathway reaches to brain where these trophozoites destroy brain tissue leading to neurological deficit signs and ultimately death. The time frame from appearing of first symptom which is usually low grade fever with headache progressing to signs of neurological deficit and death is very rapid over 3 - 7 days.⁶ This patient was in perfect state of health. Although he had no history of swimming but he used to vigorously rinse and clean his nose with fresh water which might be the source of *N. fowleri*. He got infected in the month of September in which weather of Karachi is hot.⁷ Recent increase in the incidence of PAM can be due to various reason, like contaminated water being supplied to city,⁸ improper chlorination of water, decrease in rain fall and increase in the recent heat wave in Karachi.⁹ All these factors have strongly contributed to increase in fresh water temperature creating ideal niches for the thermophilic *N. fowleri* and responsible for growing cases of PAM. A recent study conducted on 13 cases of *N. fowleri* causing PAM in persons of Karachi, Pakistan, showed no history of aquatic activities e.g., swimming. This finding is also similar to our patient. Shakoor *et al.* also suggested that ablution with tap water is the most likely cause of acquiring infection, and also proposed that the recent increase in cases of PAM is due to the rise in global temperatures, reduced levels of chlorine in water supplied to city, or deteriorating water distribution systems.⁵

PAM due to *N. fowleri* has a worldwide distribution and occurs most frequently in tropical areas and during summer months. From 1937 to 2007 at least 121 cases were reported in United States.¹⁰ Majority of these cases were due to the result of swimming in warm fresh water.¹¹ Cogo *et al.* from Italy reported a case of PAM in a 9 years old child leading to death, and swimming in fresh water was the source for getting infected by *N. fowleri*.⁴ The cases of PAM reported in Karachi by Shakoor *et al.* and this case do not have any history of swimming but rinsing nose vigorously with water or habits of nose cleaning may be the reason for the *Naegleria* infection in our patient.

This is a serious problem and requires immediate steps by the government to prevent general population to get affected by this lethal neurological infection. Government should take widespread efforts for prevention of this disease by ensuring that the water supply to city should be chlorinated according to recommended standards. There should be awareness programs for general public about the risk factors which can lead to transmission of this rapidly lethal disease. Methods for prevention of this disease should also be projected in the community time to time.

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