

SENSORY HEARING LOSS IN CHILDREN WITH MUMPS INFECTION

*S. Noorbaksh MD¹,
A. Siadati MD²,
M. Farhadi MD³,
F. Khodapanahandeh MD⁴,
H. Monavari PhD⁵*

1. Associate Professor, Iran University of Medical Sciences, Hazrat Rasool General Hospital
2. Professor, Tehran University of Medical Sciences, Children's Medical Centre & Hospital
3. Professor, Iran University of Medical Sciences
4. Assistant Professor, Iran University of Medical Sciences, Hazrat Rasool General Hospital
5. PHD student, Department of Virology, Iran University of Medical Sciences
Corresponding Author:
S. Noorbaksh MD
Tel: +98 21 66525328
Fax: +98 21 66517118
E-mail: samileh_Noorbaksh@yahoo.com

Abstract:

Objective:

Mumps infection is endemic in Iran and mumps parotiditis is a common disease in Iranian children. There has been a dramatic decrease in the worldwide incidence of mumps since the introduction and use in 1968 of the very effective and inexpensive mumps vaccine. In Iran probably due to a higher percentage of unvaccinated young persons < 15yr, the incidence rate of mumps infection and its sequela are higher in comparison to corresponding data from developed countries prior to comprehensive vaccination programs. The aim of the study was to investigate the effects of the mumps virus on cochlear function and to determine the frequency of related Sensory Neural Hearing Loss (SNHL) in children.

Material & Methods:

This descriptive case-series study was conducted in 94 children, aged less than 14 years, hospitalized between 1999 and 2001, in the pediatric ward of the Hazrat Rasool Hospital in Tehran. All patients with documented mumps infection (specific mumps-IgM antibody) were evaluated twice for audiometric function on the basis of diagnostic parameters for sensory neural hearing loss; the first evaluation was done on admission and the second three weeks later. 54 patients (age range 1-14y, mean age 4.83 ± 3.93 , male: female ratio 30:24) were studied in two years.

Results:

The highest incidence of mumps was seen in winter (37%) and spring (28%) and the lowest in summer (13%). Specific IgM antibody for mumps virus was detected in 74 children. Comprehensive audiologic evaluation was done in 54 patients at admission and again 3 weeks later. SNHL was detected in 7.2% of patients; the 4.4% incidence of SNHL in this study was higher than in other studies in developed countries prior to comprehensive vaccination programs.

Conclusion:

Implementation of comprehensive vaccination programs in young Iranians could dramatically reduce the burden and costs imposed by the infection and its sequelae.

Keywords: Mumps infection ;SNLH(sensorineural hearing loss);Mumps vaccination

Introduction

Statistics show that in the US there are 4000 and world-wide 15000 new cases of sudden deafness annually. The main etiologic factors in unilateral sudden hearing loss in children is viral infections, such as epidemic parotitis, influenza, German measles, CMV as well as traumas of the skull and viral or bacterial meningitis (1-5). The incidence of unilateral sudden hearing loss in children amounts to approximately 0.1 whereas the aetiology of most cases remains unknown; neither children nor their parents can precisely determine the time of its appearance, especially when it is not accompanied by other symptoms, such as dizziness or tinnitus. The condition is characterized by sudden-onset hearing loss that can resolve within hours or days, and unilateral symptoms indicate vascular disturbance (5, 6). In one study of SNHL in children, twenty-one children with SNHL and sixty-seven adults with SNHL as controls were investigated. Possible causes identified in 11 children (52.4%) were 4 cases of mumps, 3 upper respiratory tract infections, 2 ototoxicity from aminoglycoside antibiotics, 1 noise exposure and 1 genetic metabolic encephalopathy (7). The hearing impairment was more severe and the prognosis was poorer in children with SNHL than in adults with SNHL (6). In a significant number of children with early hearing impairments the etiology still remains uncertain; analyzing the risk factors of idiopathic sudden deafness shows, viral infection(7), epidemic parotitis (7,8) in particular, to be the most important factor. A number of cases have been reported of sudden deafness (both uni- and bilateral) in the asymptomatic course of mumps (9-12). Mumps is a common pathogen in regions where mumps vaccine is not widely used, mainly in groups less than 15 years old. The maternal antibody protects the infant in the first 6 mo of life (8). The specific IgM antibody for mumps virus is present in more than 75% of patients infected with the mumps virus (8). SNHL is a major complication of the infection (8-12).

The mumps vaccine induces antibodies in 96% of seronegative recipients and has a 97% protective efficacy (8, 13-15). In the United States, there has been a dramatic decrease in the incidence of mumps since the introduction in 1968 of the inexpensive highly effective mumps vaccine (13-16).

Except for some seroepidemiological studies (17), there is no comprehensive report on annual incidence rate of

mumps and its role in SNHL in Iranian children. Mumps infection is endemic in Iran and mumps meningoencephalitis with or without parotiditis is one of the common diseases diagnosed in Iranian children (18-20). The peak incidence is seen in children 5-9 years of age, with 85% of infections occurring in children <15 yr of age, and the condition being rare in children under the age of two (17-20). The present study investigated the frequency of SNHL followed by mumps infection in children over a 2-year period.

Materials & Methods

This cross-sectional study was performed on 94 children, aged less than 14 years, hospitalized between 1999 and 2001 in the pediatric ward of the Hazrat Rasool Hospital in Tehran, Iran. Initially for all patients suspected of mumps infection, a questionnaire was completed by the authorized physician, followed by clinical exams including neurological signs and parotiditis ; Two ml of blood were drawn from each patient and samples were centrifuged and transferred to the research lab; serum was stored at 20oC below zero until the serologic Elisa tests were carried out, for evaluation of specific IgM antibody for mumps, using the commercial Elisa kits (Radim, Italy). The plate was read on an Elisa reader in 450 & 620 nm wave length. For interpretation of results, manufacturer guidelines and instructions were used. For confirmation of mumps virus, at admission and again 3 weeks later, comprehensive audiological evaluation, i.e. pure tone audiometry, evoked otoaudiological emissions (EOAEs) and tympanometric tests were done. Statistical analysis: In this study, descriptive statistics (Mean, Standard Deviation), comprehensive statistics, including Chi square test for determination of correlation between sex, season, and parotiditis with positive IgM antibody (CI=95%) were used. Also, the T-test was used to compare the average age. All analyses were conducted using SPSS10 and EPI 6 software.

Results

Ninety-eight patients suspected of mumps infection were admitted in our hospital during 2 years; four with unsatisfactory blood sampling were excluded. Serological studies of 94 patients revealed acute mumps infection (specific IgM antibody of mumps) in 74(78.7%) cases and the infection was ruled out in another 20 cases,

because of negative specific mumps- IgM antibody in their serum. Patients were aged between 1-14 years (mean=4.83±3.93y); sex: 59.2% males and 40.8% females. Most cases of mumps infection were seen in 6-9 year olds and the least in 12-14 year old children. The highest incidence of mumps was found in winter (37%), followed by spring (28%), the lowest being in summer (13%). Parotiditis: serologic tests confirmed 89.5% of mumps infection patients had parotiditis, while did not in 10.5%. Most of them presented with meningoencephalitis; pancreatitis or other signs. In contrast, parotiditis was observed only in 10.5% of unconfirmed mumps infection patients, while 72.4% did not have the condition. There was a significant relation between positive IgM and parotiditis in patients (Chi²=29.93, df=1, CI=95%, p< 0.001). Patients with unconfirmed mumps infection (IgM- negative group) were aged between 1-14yr, mean 5.34±4.72, with a male/female ratio: 36/18, 25/8% in spring and the rest in the other seasons.

Audiometric exams: Twenty patients did not cooperate for audiometric studies and were excluded. In the 74 with confirmed mumps infection, at admission comprehensive audiological evaluation, i.e. pure tone audiometry, evoked otoaudiological emissions (EOAEs) and tympanometric tests were done. Twelve cases were not followed up for the second evaluation, and in 54 patients, the abovementioned audiometric evaluation was repeated 3 weeks after parotiditis or discharge of patient. SNLH was detected in 4 (7.2 %) patients, case descriptions follow: Case 1: A 12 y old, Afghan boy, with profound bilateral SNHL following 3 weeks of mumps parotiditis; he was treated with corticosteroids, but was not followed up.

Case 2: An 8 y old boy with unilateral moderate SNHL, again after 3 weeks of infection; he still had mild SNHL 2 months later.

Cases 3 and 4: A 6 yr old girl and an 8 yr old boy, with mild unilateral SNHL in high frequency tone; both recovered completely during follow up.

Discussion

In Iran, due to a lack of a comprehensive vaccination program, mumps infection is endemic (17-20). A previous seroepidemiological study by Vojgani et al showed that

children aged below 5 yr, were the most susceptible to mumps (p< 0.05) and those over the age of 10yr were the least susceptible to mumps infection, with no sex differences. Overall, about 50% of population are vulnerable to the infection (17). Mumps is considered to be one of the most prevalent and important causes of aseptic meningoencephalitis in children admitted in hospitals (18-20).

Our present study demonstrated that SNHL, following documented mumps infection occurred in 7.2% of children, aged 1-14 y (mean 4.83±3.93 y), with the highest incidence between the ages of 6 and 9 years. Compared to its incidence rate in developed countries (4%), this incidence of 7.2% is higher(8-12). It is however lower than that of one study conducted in Croatia (21), in which the overall prevalence of hearing impairment was 13% (1241 out of 9540 individuals); 142 had sensorineural hearing (1.5%), and 68 (0.7%) suffered from severe to profound (76-100 decibels) loss. Seven suffered from unilateral while 135 suffered from bilateral sensorineural hearing loss. They concluded that the high prevalence rate of severe to profound sensorineural hearing loss in their country compared to that of developed countries. In another study conducted by us from 2002-2004, to determine the role of mumps in SNHL in children, CMV was the most common cause of SNHL, acute mumps infection was seen in 8% of 3-5 y old SNHL in children. Our results (8%) were higher than those of the Fukuda study (7.2%) in 131 SNHL cases; this could be due to the lower age of our unvaccinated patients, in comparison to the Fukuda study. Fukuda, et al concluded that asymptomatic mumps infections were apparently closely related to sudden deafness (12). In the United States and other developed countries, there has been a dramatic decrease in the incidence of mumps since the introduction of the mumps vaccine in 1968(8-13); in 1987 there were 683 reported cases of mumps (0.27/100.000 population), and over 99% decrease from the 152,209 cases reported in 1922-1967 was observed(12-14). A recent study in Japan however, shows an increase of the mumps epidemic and mumps related deafness. Based on its findings, the annual number of mumps deafness cases was estimated to be 300 in 1987, 400 in 1993 and 650 in 2001, statistics which were correlated with the overall incidence of

mumps in those years. Because the majority of cases exhibited severe or profound sensorineural hearing loss, usually without recovery, immediate improvement of mumps vaccine coverage is strongly recommended (22). We conclude that probably, as in other countries, CMV is the most common cause of SNHL in our children. In these two recent studies, we investigated mumps as a possible cause of sudden deafness. By measurement of the anti-IgM antibody for mumps, it was possible to detect silent mumps infection in SNHL. The positive rate of anti-IgM antibody in SNHL was 7.2% suggesting that the silent mumps infection could be considered as one of the causative factors of SNHL, particularly in older patients, even though its incidence is not so high. Mumps infection in SNHL children aged between 4 to 6 yr is more common. We present a case of total bilateral deafness due to mumps infection, similar to a Chinese report (23). Hearing loss caused by Mumps is often sudden in onset, unilateral, profound and permanent. Conservative therapy is of no help; the cochlear implant is a useful procedure for those with severe and profound sensorineural hearing loss but hearing aids must first be tried first (23-24). Both hearing aids and language training are very important to the outcome of speech perception and speech production after cochlear implantation(23-24).

Conclusion

From the viewpoint of prophylaxis of profound hearing loss and deafness, we should understand the Mumps epidemiology and vaccination status. Prevention of mumps by inexpensive and very effective mumps vaccine is helpful. With regard to the role of mumps infection and its sequel in children, the importance of comprehensive vaccination of young Iranians(< 20yr old) against mumps virus should be recognized and the necessary steps be taken in our country.

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