Mumps is a common viral infection frequent among children. The causative agent is mumps virus (MuV) belonging to the family Paramyxoviridae, genus Rubulavirus. While there is only one serotype, there are 12 genotypes from A to N (E and M are lacking) based on the variation of the SH gene (IASR 34: 224-225, 2013).

The main symptoms are fever and swelling and tenderness of the parotid gland. The prognosis is generally good. About 30-35% of infections are asymptomatic, but the proportion of symptomatic cases increases with age (20% among 1 year olds and 90% among those ≥4 years, according to some reports). Complications among cases include aseptic meningitis (1-10%), encephalitis (0.02-0.3%), pancreatitis and orchitis. The sensorineural hearing loss that occurs in 0.1-0.25% of cases is difficult to cure (see pp. 199 & 201 of this issue).

MuV is excreted into the saliva. Transmission is by droplet or contact from symptomatic or asymptomatic patients. The incubation period is 2-3 weeks. Cases are infectious from 6 days before to 4 days after the swelling of the parotid gland. The School Health and Safety Act designates mumps infection as a Class 2 school infectious disease; after the appearance of the swelling of the parotid, submandibular or sublingual gland, school attendance is prohibited for at least 5 days and till recovery of general health. The basic reproduction number (R₀) of mumps (the average number of persons infected by one patient in a 100% susceptible population) has been estimated to be 4.7 or 11.4, comparable to that of rubella or varicella (7-9 and 8-10, respectively) (see p. 199 of this issue) (R₀ for measles is estimated to be 16-21, http://isdc.nih.go.jp/training/20knnr/003.html). Based on this R₀, the level of immunity necessary in the population for preventing a mumps epidemic is estimated to be 75-93% (see p. 199 of this issue).

Cases notified under the National Epidemiological Surveillance of Infectious Diseases: Mumps (infectious parotitis) is a category V infectious disease under the Infectious Diseases Control Law. It is monitored by approximately 3,000 pediatric sentinel sites, which report cases on a weekly basis (see http://www.nih.go.jp/niid/images/iasr/34/402/de4021.pdf for the notification criteria) (Fig. 1).

Though immunization with the mumps vaccine started in 1981 on a voluntary basis, the coverage remained low and large scale epidemics recurred at 3-5 year intervals. In April 1989, a measles-mumps-rubella (MMR) vaccine became possible to select as a routine immunization, which increased the mumps vaccine coverage and mumps notifications decreased. However, MMR vaccine was discontinued in April 1993 on account of the occurrence of aseptic meningitis following vaccination, which was attributed to the mumps vaccine.
Gkh genotype, which was phylogenetically related to the 2014 Hong Kong strain, was isolated in Okinawa Prefecture and L in 1999, and genotype G since 2000 (IASR 34: 224-225, 2013). Till 2016, the genotype G isolates were either Ge or Gw. However, specimens obtained from designated pathogen sentinel sites (~10% of the pediatric sentinel sites) and from all sentinel hospitals, detections and its detection rate increased during mumps epidemics (Fig. 3).

Pathogens were detected from 10-20% of the patients notified as "aseptic meningitis" and among them, MuV occupied 42% of the detections and its detection rate increased during mumps epidemics (Fig. 3).

Among the patients notified, however, the proportion of patients aged <6 years has been declining (63.9% in 2009 and 55.6% in 2015) while that of patients older than ≥10 years has been increasing (~7% in 2004-2005 and 9.9-10.5% in 2013-2015) (Fig. 2).

There are, in addition, mumps patients reported as "aseptic meningitis" (see http://www.nih.go.jp/niid/images/iasr/37/440/de4401.pdf for the notification criteria) that were reported from the 500 designated sentinel hospitals with ≥300 beds. In 2006-2016, pathogenic were detected from 10-20% of the patients notified as "aseptic meningitis" and among them, MuV occupied 42% of the detections and its detection rate increased during mumps epidemics (Fig. 3).

**Mumps virus isolation/detection:** Prefectural and municipal public health institutes (PHIs) conduct laboratory tests of specimens obtained from designated pathogen sentinel sites (~10% of the pediatric sentinel sites) and from all sentinel hospitals. From January 2006 to August 2016, PHIs isolated/detected MuV in 2,012 cases, among which 1,366 cases (68%) were diagnosed as mumps and 444 (22%) as aseptic meningitis (as of 14 September 2016) (Fig. 4).

The epidemic MuV strain in Japan was genotype B in the 1980’s, a mixture of B and J during 1993-1998, a mixture of G and L in 1999, and genotype G since 2000 (IASR 34: 224-225, 2013). Till 2016, the genotype G isolates were either Ge or Gw. However, Ghk genotype, which was phylogenetically related to the 2014 Hong Kong strain, was isolated in Okinawa Prefecture and Kitakyushu City in 2015-2016, and genotype F, which is endemic in mainland China, was isolated in Aichi Prefecture (see p. 194 of this issue).

**Laboratory diagnosis:** For the definitive diagnosis of mumps, laboratory diagnosis is indispensable (see p. 197 of this issue). The IgM test is useful if the patient has not been vaccinated. The methods detecting mumps genome include the RT-PCR method (MuV detection manual: http://www.niid.go.jp/niid/images/lab-manual/Mumps2015.pdf) and the simple and rapid RT-LAMP (MuV detection manual: http://www.niid.go.jp/niid/images/lab-manual/Mumps2015.pdf) methods. The RT-PCR method is particularly useful in identifying the genotype of the isolates, which is necessary for the definitive diagnosis of vaccine-related aseptic meningitis, phylogenetic analysis of the field isolates and tracing of infection routes (see pp.187-195 & 203 of this issue).

**Mumps vaccine and its future perspective:** Mumps is a vaccine-preventable disease. Currently 121 countries in the world implement the two-dose schedule as a routine vaccination (see p. 201 of this issue). Among the developed countries, only Japan has not yet included the mumps vaccine in the routine vaccination schedule. In a document that reviews vaccination systems, the Health Science Council of the Ministry of Health, Labour and Welfare, Division of Infectious Diseases, Vaccination Branch, stated that mumps vaccine is one of the vaccines that should ideally be promoted widely.

Currently, Hoshino and Torii strains are used for mumps vaccination in Japan, which is provided on a voluntary basis. Based on the number of vaccines delivered, across all age groups, the estimated rate of the post-vaccination aseptic meningitis of these vaccines was 1.62/100,000 (Ihara, et al., Rinsho to uirusu 42: 174-182, 2014). According to Ihara et al.’s investigation, among those aged 1-3 years, post-vaccination aseptic meningitis occurred in 0.185/100,000 vaccinees, which was similar to the Jeryl-Lynn strain that has been used safely worldwide. It was also found that the frequency of aseptic meningitis declined with a decrease in the vaccinee’s age. These figures were considerably lower than the frequencies of adverse events described in the document attached to the currently used vaccines, i.e. 1/2,300 for the Hoshino strain and 1/1,600 for the Torii strain.

From past experience, the development of a safe MMR vaccine is necessary. So as to prevent mumps epidemics and prevent mumps infection associated complications such as hearing loss, inclusion of the mumps vaccine into the routine vaccination schedule should be considered.