

# Mumps: resurgence of a vanquished virus

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## Case description

A 37-year-old man presented to the emergency department of a local hospital complaining of neck stiffness, swollen glands, anorexia, fever, and trismus. Five days before presentation he experienced a prodromal period of headache, anorexia, fever, and stiffness in the paraspinal muscles of his neck. His neck stiffness resolved before he came to the hospital. He did not have a cough, but he was unable to fully open his jaw.

He was pursuing a degree at a local university and denied a history of sexually transmitted infections. The patient had not been fully immunized as a child growing up in rural Alberta, but was unable to provide specific details. He did not have a travel history and he denied any infectious contacts. There were no known outbreaks of mumps or other pathogens in the area at the time of presentation.

On examination, his temperature was 39.1°C and his heart rate was 126 beats per minute. He had obvious bilateral parotid gland enlargement (**Figure 1**) and palpable cervical lymphadenopathy; tenderness over the parotid and submandibular glands and cervical lymph nodes was marked. There were no tonsillar exudates, no meningism, and no genital enlargement.

Supportive treatment with acetaminophen and intravenous fluids was initiated. Complete blood count results revealed lymphocytosis. Liver function test results and amylase levels were normal. Test results were negative for infectious mononucleosis. Buccal swabs were sent for mumps virus detection and blood serum samples were sent for mumps serology. Reverse transcriptase-polymerase chain reaction (RT-PCR) results did not indicate mumps virus, possibly because of inadequate buccal swabbing or handling or late collection. Results of serology testing were positive for mumps immunoglobulin (Ig), but negative for IgM antibodies. Such a serologic profile is more likely in an immunized or previously infected person, but might also be present in acute cases owing to the low sensitivity of IgM testing (range 25% to 50%).

Computed tomography of the head and neck showed diffuse, bilateral enlargement of the parotid glands, with multiple enlarged lymph nodes (**Figure 2**). There was also bilateral enlargement of the submandibular glands (**Figure 3**). Submandibular lymph nodes and jugular chain lymph nodes were enlarged, particularly on the right side. Findings from the scan were compatible with mumps, along with other diagnoses.

## Mumps: a diagnostic challenge

In the end, laboratory testing did not confirm mumps in this case; the diagnosis was made clinically. This case does not meet the national criteria for a confirmed case of mumps, but does meet the criteria for a probable case (clinical illness in absence of laboratory confirmation or epidemiologic link to a laboratory-confirmed case).<sup>1</sup> As evidenced by this case, diagnosing mumps, both in the clinic and in the laboratory, can be difficult and challenging for primary care physicians. Thankfully, recently released Public Health Agency of Canada laboratory guidelines for the diagnosis of mumps provide some direction.<sup>2</sup>

## EDITOR'S KEY POINTS

- Mumps is a challenging disease to diagnose in primary care; moreover, many health care providers have never encountered a case owing to successful immunization programs in the latter half of the 20th century.
- Family physicians should familiarize themselves with the clinical and laboratory indications of mumps, as there have been several outbreaks of the disease in Canada over the past few years.
- The outbreaks in Canada might be a result of primary mumps vaccine failure or secondary failure due to waning immunity in the population. Further serologic and program-based research is required to establish the current level of protection in the population and to determine whether a second dose of vaccine is necessary to prevent future outbreaks.

## POINTS DE REPÈRE DU RÉDACTEUR

- Les oreillons sont difficiles à diagnostiquer en soins primaires; de plus, de nombreux professionnels de la santé n'ont jamais rencontré de cas, en raison du succès des programmes de vaccination entrepris au milieu du XX<sup>e</sup> siècle.
- Les médecins de famille devraient se familiariser avec les indices cliniques et les résultats de laboratoire signalant les cas d'oreillons, puisqu'il y a eu plusieurs éclosons de la maladie au cours des dernières années.
- Les éclosons au Canada pourraient être attribuables à l'échec primaire des vaccins contre les oreillons ou à l'échec secondaire dû à l'immunité fléchissante dans la population. Il faudrait d'autres projets de recherche sérologique et de recherche axée sur les programmes pour déterminer le degré actuel de protection dans la population et pour savoir si une seconde dose du vaccin est nécessaire pour prévenir de futures éclosons.



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**Figure 1. Bilateral parotid gland enlargement**



Reverse transcriptase–polymerase chain reaction assay is a reliable test for the acute diagnosis of mumps; however, results can be influenced by the timing of collection and processing of buccal saliva swabs, which are ideally taken from the area surrounding the Stensen duct within the first 3 to 5 days of symptom onset.<sup>2</sup> The presence of mumps-specific IgM-class antibodies has poor diagnostic predictive value in acute cases of mumps. Therefore, RT-PCR and IgM antibody analyses are not sufficient to rule out mumps.

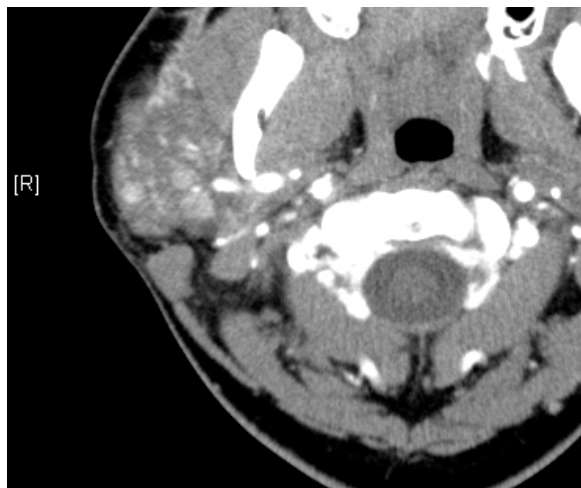
In our patient, because the immunization history was uncertain and mumps cases and outbreaks had recently been reported, mumps was high in the differential diagnosis. Other viral illnesses that should be considered in the differential diagnosis include Epstein-Barr virus, parainfluenza virus, influenza, and HIV. Other causes of parotitis include calculi, eating disorders, malnutrition, and tumours.

A provisional clinical diagnosis of mumps was discussed with the patient and he was advised to return for follow-up in 2 to 3 days. Public health officials were notified by telephone and the patient was instructed, as a precaution, not to attend his university classes for 5 days.<sup>3</sup> At a follow-up appointment 2 days later, he was afebrile and feeling somewhat better, although parotitis was still present. When he was seen again 5 days later, his parotid and salivary gland swelling had begun to abate.

### **Clinical presentation and complications**

We performed a literature search using MEDLINE and the key words *mumps*, *orchitis*, *meningoencephalitis*, *outbreak*, and *vaccine* to prepare this case report. The Public Health Agency of Canada website provided the data on recent outbreaks in Canada.<sup>4,5</sup>

**Figure 2.** Computed tomography scan showing bilateral parotid gland enlargement: *Enlarged intraparotid lymph nodes are visible on the right side.*



In the fifth century BC, Hippocrates described an illness involving swelling around the ears and sometimes the testes.<sup>4</sup> Before widespread urbanization, mumps, like other infectious diseases, was prevalent among adults in barracks, penitentiaries, orphanages, and other crowded environments.<sup>6</sup> By the middle of the 20th century, mumps became an almost universal childhood disease in increasingly urbanized societies.

Mumps is a paramyxovirus. The median incubation period is 19 days (range 12 to 24 days) and patients are infectious 7 days before to 9 days after the onset of parotitis.<sup>7</sup> Owing to waning viral presence in saliva over the course of the infection, coupled with increased compliance with shorter isolation periods, the most recent recommended exclusion period from school or workplace is 5 days after the onset of parotitis.<sup>3</sup>

The clinical hallmark of mumps is parotitis, which is bilateral in 70% of patients. When inhaled, the virus enters the upper respiratory tract, travels to local lymph nodes, and spreads hematogenously to the parotid, salivary, and other epithelialized glands.<sup>8</sup> Salivary gland inflammation might cause blunting of the angle of the mandible or outward displacement of the ears, and is usually painful. Parotitis is often preceded by a prodromal phase of low-grade fever, malaise, anorexia, and headache.

Mumps is not normally a fatal disease, and up to 30% of mumps infections are asymptomatic. There can be serious complications, however, including aseptic meningitis, orchitis, oophoritis, mastitis, pancreatitis, and deafness. Meningitis occurs in up to 10% of mumps cases; it is usually subclinical and self-limiting. Symptoms of mumps-related meningitis include fever, headache, vomiting, and neck stiffness, which peak for a period of 48 hours before resolution and might appear

**Figure 3.** Computed tomography scan showing salivary gland enlargement



up to 1 week before parotid swelling.<sup>9</sup> More serious neurologic symptoms are rare and are due to encephalitis. Hearing loss following mumps infections is rare (1 in 2000 to 30 000 cases) and usually results in mild to moderate hearing loss.<sup>10</sup>

Orchitis occurs 4 to 8 days after the onset of parotitis and is a common complication, affecting 20% of men who develop mumps after puberty.<sup>11</sup> Of those cases, 40% will develop testicular atrophy and 30% will have lasting changes in sperm count, sperm motility, and sperm morphology.<sup>11</sup>

### Recent mumps outbreaks

Before the licensure and introduction of the vaccine, mumps was a ubiquitous childhood infection. Data from the prevaccination era indicate that 90% of children were infected by the time they reached 14 to 15 years of age.<sup>12</sup> In Canada, in the 1950s, the average number of mumps cases reported per year was 34 000.<sup>13</sup>

The introduction of mumps vaccine in developed countries resulted in a remarkable reduction in the incidence of mumps infections. Following the introduction of monovalent mumps vaccine in Canada in 1969, mumps rates dropped precipitously. Based on our patient's age, he would have received a single dose of mumps vaccine after his birth in 1971.

In the 1990s, the National Advisory Committee on Immunization adopted a 2-dose schedule for the measles-mumps-rubella (MMR) vaccine as a measles control measure, further improving the effectiveness of the mumps vaccine. There were fewer than 400 cases per year in the early 1990s, and an all-time low of 32 reported cases was achieved in 2004.<sup>13</sup> Other countries with 2-dose vaccine schedules also reported a more than 99% reduction in mumps incidence rates.<sup>12</sup> Today, the incidence of mumps

has become so low that most young Canadian physicians and medical trainees have never encountered a case—but this might be changing.

Despite the success of routine vaccinations, there has been a resurgence of mumps infections in the past decade, with outbreaks reported in Canada, the United

Kingdom, and the United States (Table 1<sup>4,5,14-18</sup>). Canadian outbreaks have been documented in British Columbia (1997), Quebec (1998), Alberta (2002), and Nova Scotia (2005). In 2007, there were 1284 cases of mumps reported nationwide, mostly in Nova Scotia and Alberta, and an additional 377 Canadian cases in the first half of 2008.<sup>4,5</sup>

**Table 1. Recent mumps outbreaks in Canada, the United Kingdom, and the United States**

COUNTRY	YEAR	NO. OF CASES	PRIMARY GROUP AFFECTED
Canada			
• British Columbia	1997	83	Greater Vancouver area outbreak involving mainly youth aged 15 to 24 years <sup>14</sup>
• Quebec	1998	37	Montreal area school-based outbreak with an average age of 10 years among those infected <sup>15</sup>
• Alberta	2002	193	Outbreak in an undervaccinated community in northern Alberta following exposure to imported virus from Bolivia <sup>5</sup>
	2007	258	Part of ongoing 2007 outbreak centred in Alberta <sup>4</sup>
• Nova Scotia	2005	32	Two separate outbreaks among high school and university students, most of whom had received 1- or 2-dose vaccinations against mumps <sup>16</sup>
	2007	777	Part of ongoing 2007 outbreak centred in the Maritimes <sup>4</sup>
United Kingdom	2004- 2005	56 390	Unvaccinated young adults <sup>17</sup>
United States	2006	6584	Outbreak in 8 midwestern states (Minnesota, South Dakota, Iowa, Wisconsin, Nebraska, Kansas, Missouri, Illinois) involving university-aged young adults between 18 and 24 years of age, most of whom had received 2 doses of mumps vaccine <sup>18</sup>

Outbreaks in Canada have predominantly affected adolescents and young adults, in part because these individuals are too young to have acquired natural immunity from childhood exposure but too old to have received the benefit of the 2-dose MMR vaccine.

The outbreak in the United Kingdom involved mostly unvaccinated people in England and Wales, peaking in 2005 with 56 390 notified cases.<sup>17</sup> The United States, in a 2006 outbreak involving 8 midwestern states, reported 6584 cases of mumps that affected mostly university-aged young adults between 18 and 24 years of age, including some who had received 2 doses of the mumps vaccine.<sup>18</sup> The mumps outbreak in the United Kingdom was protracted. Conversely, the US and Canadian outbreaks have been regional and self-limiting. The high incidence of mumps in 2007 and 2008 suggest, however, that in Canada there might be a growing susceptibility in the population.

### Considerations for vaccine programs


The most evident and important question from an immunization program perspective is whether an additional dose of mumps vaccine is now required to control this disease. Postmarketing surveillance has reported vaccine effectiveness as 90% after 2 doses; however, the level of protection that currently exists in various segments of the population has not been quantified.<sup>19</sup> A large number of older children received a second dose of measles vaccine in the 1990s as a “catch-up” program to control outbreaks of measles; the second dose was given as a monovalent measles vaccine formulation without a mumps component. These individuals depend on a single dose of MMR vaccine, administered in childhood, to protect them for life against mumps.

The patient described in this case report might never have received the vaccine (a potentially preventable case) or he might represent a vaccine failure following a single dose, assuming mumps was indeed the diagnosis. To address the latter situation, it would be useful to know whether additional doses of vaccine are required for control, as was the case for measles.

The outbreaks that have occurred in Canada are likely a reflection of both primary mumps vaccine failure (given the vulnerability of this live virus vaccine to cold-chain insult) and, possibly, secondary failure due to waning immunity, as no booster dose has been provided. It might be possible to ascertain the current level of protection in the population through serologic research. Although imperfect, as a number of people in the United States who were affected during the outbreaks had received 2 doses of vaccine and had IgG antibodies (a marker of long-term protection),<sup>19</sup> this approach would give a clearer comparison of the susceptibility level in these populations and a clearer indication of whether a second dose of vaccine is indeed needed to prevent future outbreaks.

In the absence of such information, one can only surmise population susceptibility based on the occurrence of

outbreaks from time to time. So far, in Canada, even when outbreaks of mumps occur they affect far fewer people compared with the large measles outbreaks of the 1990s. Without susceptibility data, however, the recommendation of an additional dose becomes simply a policy decision, based on whether the current mumps outbreaks are disruptive enough. Decision makers should weigh the inconvenience of the quarantine measures that have been used to control the outbreaks, rather than solely consider the published evidence. Ontario has made such a decision and has been providing a second dose of MMR vaccine to all students in postsecondary settings since early 2009.<sup>20</sup>

It is important to ensure that immunization programs are based on evidence. Clearly, more program-based research is needed to provide the data necessary to make truly evidenced-based decisions. Quebec has become a leader in this area, and British Columbia and Ontario are following suit. Other provinces also need to become enthusiastic partners in serologic research so that immunization program decisions are based on the true levels of susceptibility and risk in the population. 

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#### Competing interests

None declared

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