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Managing pertussis outbreaks during humanitarian emergencies

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Preface

The purpose of this technical note is to provide health professionals in United Nations agencies, non-governmental organizations, donor agencies and local authorities working with populations affected by emergencies with up-to-date technical guidance on the management of pertussis outbreaks in emergency-affected populations.

The prevention and control of communicable diseases such as pertussis represent a significant challenge to those providing health-care services in evolving situations. It is hoped that this technical note will facilitate activities to control communicable diseases among agencies working with emergency-affected populations.

Background

Pertussis, or whooping cough, is a disease of the respiratory tract caused by the bacteria *Bordetella pertussis*. The disease is most dangerous in infants and is an important cause of infant death worldwide, even in countries with high vaccination coverage. Recent estimates from WHO indicate that, in 2003, about 17.6 million cases of pertussis occurred worldwide, 90% of which were in developing countries, and that about 279 000 patients died from this disease.

Clinical manifestations and transmission

Following an incubation period of 7–10 days, patients (mostly children aged <5 years) develop catarrhal symptoms including cough. In the course of 1–2 weeks, coughing paroxysms ending in the classical "whoop" may occur. In typical cases, cough is particularly severe at night and frequently followed by vomiting. In young infants, pertussis may cause only apnoea and cyanosis. In adolescents and adults, an uncharacteristic, persistent cough may be the only manifestation of the disease. In older children, adolescents and adults, pertussis is often unrecognized because of its frequent atypical course. The catarrhal, paroxysmal and convalescent stages of the disease may last from one to several months.

B. pertussis is transmitted from infected to susceptible individuals through droplets. In its early catarrhal stage, pertussis is highly infectious, with a secondary attack rate of up to 90% among non-immune household contacts. Untreated patients may be contagious for 3 weeks or more following the onset of symptoms, although communicability diminishes rapidly after the catarrhal stage. Older age groups represent an important source of infection for susceptible infants.

The clinical outcome of pertussis depends on factors such as age and vaccination status. In industrialized countries, lethality of pertussis is very low (<1/1000), whereas in developing countries the average lethality is estimated at 3.9% in infants and 1% in children aged 1–4 years. Severe disease and death are reported mainly in non-immune, very young infants. In malnourished, unvaccinated populations with a high prevalence of co-infections, case-fatality ratio (CFR) can reach 15%.[1] Complications occur in 5–6% of pertussis cases, most frequently in infants aged <6 months. Bronchopneumonia is the most prominent problem, with relatively high lethality. The incidence of pertussis-associated encephalopathy is 0.9/100 000.

Antibiotic treatment

Macrolide antibiotics such as erythromycin or azithromycin may prevent or moderate clinical pertussis when given during the incubation period or in the early catarrhal stage. Trimethoprim-sulfamethoxazole is an alternative antibiotic for patients who cannot tolerate macrolides. During the paroxysmal phase of the disease, antimicrobial drugs will not change the clinical course but may eliminate the bacterium from the nasopharynx and thus reduce transmission.

Laboratory

Etiological diagnosis is based on recovery of *B. pertussis* from nasopharyngeal specimens obtained during the catarrhal and early paroxysmal stages. WHO considers bacterial culture the “gold standard” of laboratory confirmation. However, bacterial culture is not very sensitive (<60%) and requires selective culture media. Polymerase chain reaction is more sensitive and can be performed on the same biological samples as the ones used for culture, but is used mainly in

specialized laboratory settings. Serological diagnosis is ideally based on detection of a significant increase in the level of specific antibodies in paired sera of infected individuals. The sera should be collected in the early catarrhal stage (acute serum) and about one month later (convalescent serum). High antibody levels in sera from non-vaccinated individuals suggest recent infection.

Vaccines

All infants, including HIV-positive individuals, should be immunized against pertussis. Except for cases where prior pertussis vaccination resulted in anaphylactic reaction, there are no strict contraindications to this vaccine. There are no data to support the perception that previous encephalitis may be a contraindication for pertussis vaccination.

Despite its efficient prevention of clinical disease, the vaccine has limited impact on the circulation of *B. pertussis* even in countries with high vaccination coverage. Remaining non-immunized children and older individuals with waning immunity may serve as reservoirs for the infection and transmit *B. pertussis* to non-immunized young infants. Furthermore, the considerable numbers of susceptible adolescents and adults allow the occurrence of pertussis outbreaks, although high vaccination coverage may prolong the inter-epidemic intervals[2].

Outbreaks of pertussis in humanitarian emergencies

Outbreaks are common in settings of population displacement, but documentation and evidence for action are rare, likely due to the difficulties with laboratory confirmation of suspected pertussis cases. Risk factors for transmission in these settings include crowding, malnutrition, and co-infection with other illnesses (HIV, malaria, tuberculosis, etc).

An outbreak in the Democratic Republic of the Congo (DRC) in 2000 involved 1136 cases including 23 (2%) deaths. Cases were defined as having coughing fits, vomiting after coughing, and characteristic "whooping". Vaccination coverage (DTP1) of infants < 12 months in the affected area was estimated to be 32%. Response activities consisted of case management support with provision of erythromycin, active surveillance, and strengthening of routine EPI services. A vaccination campaign following the outbreak was not well-accepted by the population, due to fears of secondary effects[3].

Another outbreak of pertussis in DRC in 2001 involved 2633 cases, including 17 (0.6%) deaths, detected by active surveillance. Eighty-nine percent of the cases were ≤5 years of age. Cases were defined as having the characteristic coughing fits, "whooping", and vomiting after coughing for ≤ 2 weeks (suspect case) or longer than 2 weeks (probable case). Suspect cases were treated with erythromycin for 2 weeks. A vaccination campaign in one village targeted children 6–72 months old and covered 81% of the targeted population[4].

An outbreak of pertussis in Afghanistan in 2003 involved 115 cases and 17(14.8%) deaths in an isolated border population with estimated vaccination coverage of <40%. A 10-day treatment regimen of erythromycin was given to all children (regardless of immunization status, contact with cases, or presence of symptoms) under 15 years of age in 5 affected sub-districts, involving 189 villages[5].

In 2004 an outbreak of severe respiratory illness in southern Sudan, diagnosed clinically as pertussis, resulted in over 300 deaths and an unknown number of cases. The affected populations

lived in two remote counties not covered by health services. Outbreak control measures included door-to-door mass treatment of cases and all children and contacts in the affected families using erythromycin[6].

Another outbreak of pertussis in southern Sudan in 2005 involved 419 cases, including 13 (3.1%) deaths. Response activities included mass treatment of cases and contacts with erythromycin. Routine vaccination of children under 5 years of age was accelerated in the affected counties[7].

Methods of control

1. **Establishment of a case definition.** The establishment and application of a clinical case definition is critical to accurately characterize and define the extent of the outbreak.

   Recommended clinical case definition for pertussis:

   A person with a cough lasting at least two weeks with at least one of the following symptoms:

   - Paroxysms (i.e. fits) of coughing
   - Inspiratory whooping
   - Post-tussive vomiting (i.e. vomiting immediately after coughing) without other apparent cause

2. **Confirmation of the diagnosis in the laboratory.** Laboratory confirmation is necessary to verify the cause of the outbreak, but rarely useful for case management. Nasopharyngeal samples for laboratory testing (see box) should be collected at the first available opportunity. A Dacron or calcium alginate swab (cotton swabs should not be used as they are harmful to *B. pertussis*) and a transport tube are necessary, and shipment of the samples to the reference laboratory should be done as soon as possible (due to the fragility of the organism). Response activities should not wait for laboratory confirmation.

3. **Strengthening of case management and treatment response protocols.** Early treatment of identified cases can be life-saving, particularly for infants. All cases should be treated for 7–14 days with erythromycin (children:40–50 mg/kg/day divided QID, Adults: 2g/day divided QID).

4. **Application of the case definition using active surveillance.** In previous outbreaks, teams have gone door-to-door in affected villages to identify and treat cases and contacts of cases. Treatment priority is given to children under one year of age and pregnant women in the last stages of pregnancy. Review of registers (if available) in health centres may also be useful to establish the geographical extent of the outbreak.

5. **Consider antibiotic prophylaxis of contacts.** Early prophylactic treatment (a 7-day course of erythromycin) of known contacts can reduce risk of infection Again, the priority is given to children under one year of age and pregnant women in the last stages of pregnancy. Family members of cases should be given antibiotic prophylaxis, particularly mothers caring for children.

6. **Protect health workers.** Prophylaxis of health workers in contact with active cases is recommended, using erythromycin for seven days following last contact[8]. Transmission of

pertussis is by droplets; those within one meter of cases should wear a properly-fitting surgical mask[8]. Immunization status of health workers should be checked and brought up to date if delinquent.

7. **Vaccination activities.** Vaccination activities in response to a pertussis outbreak are usually avoided due to largely theoretical concerns about adverse events among older recipients of whole-cell DTP vaccine. Although there is no increased risk of encephalopathy or other severe adverse reactions with the whole-cell DTP vaccine, the acellular vaccine is currently recommended as a booster dose for adolescents; reactions (local and transient systemic) are less commonly associated with the acellular vaccine than with the whole-cell vaccine. Accelerated immunization, with the first dose at 4–6 weeks of age and 2nd and 3rd doses at 4-week intervals, may be indicated. The attention resulting from an outbreak of pertussis can be used to address immunization gaps; immunizations should be completed for those whose schedule is incomplete[8].

Method of collecting nasopharyngeal swabs for suspected pertussis:

- Seat the patient comfortably and tilt the head back.
- Insert a flexible calcium alginate/Dacron swab parallel to the floor of nose without pointing upwards.
- Rotate the swab on the nasopharyngeal membrane a few times, remove it carefully and insert it into a screw-cap tube containing transport medium (Regan-Lowe, Bordet-Gengou, Amies with charcoal, others).
- Break off the top part of the stick without touching the tube and tighten the screw-cap firmly.
- Label the specimen tube, indicating left or right side.
- Complete the laboratory request form, including name, age, date of collection, village, etc.
- Repeat on the other side. The specimens can be shipped at ambient temperature.

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