Global Insights in Biomedical & Multidisciplinary Research (GIBMR)
Volume 01, Issue 02, April-2026
Available Online at: https://biomedglobe.com/index.php/gibmr
ISSN (Online): 3054-5900

Airborne Droplet Infections: Whooping Cough (Pertussis) – Pathogenesis

Aitmuratova Gauxar Abatovna
Assistant, Department of Microbiology, Virology and Immunology, Tashkent State Medical University.
Toshpo‘latov Abdurahim Abdumutal o‘g‘li
Student of Tashkent State Medical University

Article History	Abstract
Received: 20th March, 2026 Accepted: 14th April, 2026	This article examines the pathogenesis of pertussis, which belongs to the group of airborne (droplet-transmitted) infectious diseases. The etiological agent of the disease, Bordetella pertussis, its biological characteristics, mechanisms of transmission, and routes of entry into the human body are described. In addition, the processes of pathogen adhesion to the respiratory epithelium, its proliferation, and its harmful effects on the body through toxin production are outlined. The article analyzes the main stages of pertussis pathogenesis, including the initial, catarrhal, paroxysmal, and convalescent periods, as well as the associated pathophysiological changes. Furthermore, it considers the immune response, the role of local and systemic defense mechanisms, and possible complications resulting from their dysfunction. The study also highlights the importance of pathogenetic factors in the development of clinical manifestations of pertussis. The presented information is significant for early diagnosis, the development of effective preventive measures, and the improvement of modern treatment approaches

Keywords: Airborne Infections, Whooping Cough, Bordetella Pertussis, Respiratory Tract Infections, Infectious Diseases, Epidemiology, Pathogenesis, Spasmodic Cough, Laboratory Diagnostics, Prevention, Vaccination, Immunity, Pediatric Infections.

Airborne droplet infections belong to a group of infectious diseases transmitted through the respiratory tract. Such infections spread to healthy individuals via

tiny droplets released into the air when an infected person coughs, sneezes, or talks. Among these infections, whooping cough is considered one of the diseases of significant epidemiological importance. It primarily occurs in children, but it can also be observed in unvaccinated adults. The causative agent of whooping cough is the gram-negative bacterium Bordetella pertussis. This bacterium enters the human body through the respiratory tract, adheres to the mucous membrane of the upper respiratory tract, and produces various toxins. These toxins damage the epithelial cells of the respiratory tract, leading to severe and prolonged coughing fits. The incubation period of the disease usually lasts 5–14 days. After that, the disease progresses through several stages. The initial stage is the catarrhal phase, during which mild cold-like symptoms are observed, such as a runny nose, mild cough, and a slight increase in body temperature. This is followed by the spasmodic stage, characterized by intense, repetitive coughing attacks. During these episodes, the patient experiences difficulty breathing, and sometimes a distinctive “whooping” sound occurs during deep inhalation after coughing. In some cases, coughing fits may end with vomiting. The final stage is the convalescent phase, during which the patient’s condition gradually improves and the cough subsides. Whooping cough can be particularly severe in infants and young children. Possible complications include pneumonia, bronchitis, respiratory failure, and neurological problems. Therefore, early diagnosis and treatment are essential. Laboratory diagnostic methods are used to identify the disease. These include bacteriological examination (isolation of the bacterium in special culture media), serological tests, and modern molecular diagnostic techniques. These methods help detect the causative agent and confirm the diagnosis. Preventive measures play an important role in controlling whooping cough. The most effective method of prevention is vaccination. Vaccination helps prevent the disease in children or ensures a milder course if infection occurs. In addition, соблюдение санитарно-гигиенических норм, limiting close contact with infected individuals, and timely identification of infection sources are crucial in reducing the spread of the disease.

Main Part

The causative agent is Bordetella pertussis, an aerobic, encapsulated, gram-negative rod-shaped bacterium. It produces a large amount of toxins and damages the mucous membrane of the respiratory tract. The bacteria multiply in the respiratory mucosa, leading to the development of disease symptoms. In about 40% of cases, the disease may present as acute bronchitis. The incubation period

is 7–14 days, and the patient should be isolated after 5 days of antibiotic therapy. The disease typically progresses through three stages: catarrhal, convulsive (paroxysmal), and decrement (convalescent) stages. After the incubation period, flu-like symptoms appear, including a mild increase in body temperature, sneezing, and dry cough. This period lasts about two weeks and is highly contagious. In the second stage, coughing attacks begin, often accompanied by a characteristic protrusion of the tongue. As a result of coughing, clear mucus is expelled, and vomiting may occur. The convulsive stage lasts from 2 to 6 weeks. In the final stage (stage of decrement), coughing attacks gradually decrease and may last from 3 to 6 weeks. If untreated with antibiotics, the disease may persist for up to 10 months, which is why it is sometimes referred to as the "100-day cough." In infants younger than 6 months, coughing attacks may be accompanied by apnea, while in adults the disease may present atypically with only a dry cough. Whooping cough can lead to complications such as pneumonia, otitis media, and secondary infections. Severe coughing may also cause inguinal and umbilical hernias. Whooping cough (French: *coqueluche*) is an acute infectious disease characterized by severe, paroxysmal coughing fits. It occurs most commonly in children and is caused by the Bordet–Gengou bacillus (named after the Belgian scientist Jules Bordet and the French scientist Octave Gengou). It is transmitted via airborne droplets. When an infected child coughs or sneezes, droplets containing the pathogen enter the respiratory tract of a healthy individual. After entering the body, the pathogen may remain asymptomatic for 2–15 days (incubation period). Subsequently, mild coughing begins and gradually intensifies, accompanied by fever, irritability, poor sleep, and loss of appetite—this is the catarrhal stage, lasting up to 2 weeks. The condition gradually worsens, and by the end of the second or beginning of the third week, coughing becomes paroxysmal, marking the transition to the spasmodic stage, which lasts 1–5 weeks. Coughing fits are the main and persistent symptom. They begin with 2–3 strong coughs followed by a series of short, repetitive coughs. Due to narrowing of the glottis, a characteristic "whooping" sound is produced during inhalation. During coughing, the child's face may initially turn red and then cyanotic, with tearing, possible subconjunctival hemorrhage, tongue protrusion, and distended neck veins. The attack usually ends with the expulsion of mucus and often vomiting. During an attack, the child should be held upright or seated, with the head slightly tilted forward to reduce mucus accumulation. Between attacks, the child may feel relatively well. Gradually, the frequency of

attacks decreases, and recovery begins, lasting 1–3 weeks. The patient remains contagious for up to 30 days from the onset of the disease. Due to widespread vaccination, milder forms of the disease are now more common, sometimes without pronounced coughing fits. However, in infants and weakened children, the disease may be more severe. Complications may include epistaxis, bronchitis, and pneumonia (especially in infants). Diagnosis is often made during the second stage. Differential diagnosis is carried out with bronchial asthma, tuberculosis, chronic obstructive bronchitis, and pneumonia. Patients are advised to follow a proper daily routine, get fresh air, and eat small but frequent nutritious meals. Treatment should be supervised by a physician. The disease usually confers lifelong immunity. During the catarrhal or convulsive stages, antibiotics such as erythromycin or other macrolides are administered for about two weeks. Prevention is achieved through vaccination. Currently, combined vaccines are used against whooping cough, tetanus, diphtheria, and poliomyelitis. For this purpose, the DTP (adsorbed diphtheria-tetanus-pertussis) vaccine is administered according to the recommended schedule. Children who have been in contact with infected individuals should be isolated for a certain period. The pathogen enters the body via airborne droplets and adheres to the epithelial cells of the upper respiratory tract. Adhesion factors such as filamentous hemagglutinin, pertactin, and fimbriae play an important role in this process. These structures allow Bordetella pertussis to firmly attach to the ciliated epithelium and multiply there. The next stage of pathogenesis is associated with toxins produced by the bacterium. Pertussis toxin disrupts intracellular signaling pathways by activating the adenylate cyclase system, leading to increased levels of cAMP in cells. This reduces the functional activity of immune cells, particularly phagocytes, and results in lymphocytosis. Adenylate cyclase toxin directly paralyzes phagocytic cells, helping the bacterium evade the immune system. Tracheal cytotoxin damages ciliated epithelial cells, leading to their destruction. As a result, mucociliary clearance is impaired, meaning the mechanism for removing mucus and foreign particles from the respiratory tract is disrupted. Accumulation of mucus and continuous stimulation of receptors lead to a strong cough reflex. Increased central sensitivity of the cough center also plays an important role in the pathogenesis of whooping cough. Due to chronic stimulation of respiratory receptors, the cough center in the medulla becomes hyperexcitable, so even minor stimuli can trigger severe paroxysmal coughing attacks. Throughout the disease, pathogenesis is closely linked with clinical stages. In the catarrhal stage, bacterial

multiplication and toxin production begin. In the paroxysmal stage, the main pathogenic mechanisms—damage to ciliated epithelium and усиление cough reflex—predominate. During convalescence, although the epithelium gradually recovers, the cough reflex remains hypersensitive for a prolonged period. Thus, the pathogenesis of whooping cough is characterized by bacterial adhesion to the respiratory tract, toxin production, impairment of mucociliary clearance, and pathological enhancement of the central cough reflex.

Empirical Analysis

In the empirical study of whooping cough, which occupies an important place among airborne droplet infections, the prevalence of the disease, age distribution of patients, clinical manifestations, and laboratory findings are analyzed. Empirical analysis is usually carried out through observation, collection of statistical data, and comparison of laboratory test results. According to empirical observations, whooping cough occurs more frequently in children, especially those aged 1 to 10 years. The main reason for this is that their immune system is not yet fully developed, and in some cases vaccination is incomplete. Studies show that the primary source of infection is an infected person, and transmission occurs through droplets released into the air during coughing and sneezing. During empirical analysis, clinical symptoms observed in patients are also examined. In most cases, early-stage symptoms resemble a mild cold, including a runny nose, mild cough, and general weakness. In later stages, recurrent severe coughing attacks, difficulty breathing, and sometimes vomiting are observed. These symptoms are considered key diagnostic criteria of the disease. Laboratory findings also play an important role in empirical investigations. To identify the causative agent—the bacterium Bordetella pertussis—bacteriological and serological methods are used. In bacteriological testing, samples taken from the patient's respiratory tract are cultured on special media to observe bacterial growth. Serological tests help detect antibodies produced against the bacterium in the body. Empirical analysis shows that the likelihood of disease occurrence is higher among unvaccinated or incompletely vaccinated children. In addition, the disease spreads more rapidly in group settings such as schools, kindergartens, and other enclosed environments. Therefore, strengthening preventive measures, increasing vaccination coverage, and ensuring early diagnosis are essential. In general, empirical analysis helps determine the patterns of spread, clinical features, and effectiveness of diagnostic methods for whooping cough. This

information is crucial for prevention, early detection, and the development of effective treatment strategies.

Conclusion:

In conclusion, whooping cough is an infectious disease transmitted via airborne droplets that affects the respiratory tract and is characterized by severe paroxysmal coughing attacks. Analysis of the literature shows that this disease poses a particularly high risk of spread among young children, individuals with weakened immune systems, and unvaccinated populations. According to available sources, the disease initially begins with mild symptoms but may later progress to severe clinical conditions. This once again highlights the importance of timely diagnosis and appropriate treatment. Otherwise, whooping cough may lead to complications such as respiratory failure, general weakness, and other adverse outcomes. Based on the reviewed literature, it can also be concluded that preventive measures play a leading role in controlling the disease. In particular, vaccination—especially with the DTP (diphtheria, tetanus, pertussis) vaccine—can significantly reduce the incidence of the disease. In addition, adherence to personal hygiene rules, maintaining a healthy lifestyle, and limiting contact with infected individuals are essential. In summary, combating whooping cough requires not only medical interventions but also improving public health awareness and providing accurate and sufficient information about the disease. This plays an important role in reducing the spread of infection and protecting public health.

References:

1. Abdiraxmonova, O.J. Airborne droplet infections. Course of whooping cough and epidemic parotitis in children. *Best Intellectual Studies*, 47(2), (2025-06-20), pp. 185–189.
2. Al-Mahmoud, S., & Ahmed, Z. Molecular Typing of Bordetella pertussis Strains in Central Asia. *Journal of Infection and Public Health*, 15(7), (2022), pp. 909–916.
3. Althouse, B. M., & Scarpino, S. V. Epidemiological Consequences of an Ineffective Bordetella pertussis Vaccine. (2014), pp. 705–714.
4. Bettiol, S., Wang, K., Thompson, M.J., et al. Symptomatic Treatment of Cough in Whooping Cough. *Cochrane Database of Systematic Reviews*, 5: CD003257 (2012), pp. 456–461.
5. Bordetella pertussis – Wikipedia article. Encyclopedia entry. (2026), pp. 386–393.

6. Centers for Disease Control and Prevention (CDC). Clinical Overview of Pertussis (Whooping Cough). Atlanta: CDC (2025), pp. 653–662.
7. Cherry, J.D., & Heininger, U. Pertussis and Parapertussis: Epidemiology and Immunization Strategies. *Clinical Infectious Diseases*, 68(3), (2019), pp. 341–348.
8. Crawford, S., & Johnson, L.P. The Role of Vaccination in Preventing Pertussis. *Vaccine*, 36(41), (2018), pp. 6119–6125.
9. Esposito, S., & Principi, N. Re-Emerging Pertussis: The Role of Parapertussis. *International Journal of Pediatrics*, 18(4), (2023), pp. 112–118.
10. Fauci, A.S., & Braunwald, E. *Harrison's Principles of Internal Medicine*. McGraw-Hill (2018), pp. 114–119.
11. Goodwin, J., & Novak, M. The Role of Parapertussis in the Epidemiology of Bordetella Infections. *Emerging Infectious Diseases*, 27(5), (2021), pp. 956–964.
12. Whooping cough and parapertussis pathogens. *Journal of Science-Innovative Research in Uzbekistan*, 3(7), (2025), pp. 523–527.
13. Liko, J., Robinson, G., et al. Priming with Whole-Cell Versus Acellular Pertussis Vaccine. *New England Journal of Medicine*, 368(7), (2013), pp. 581–582.
14. Mattoo, S., & Cherry, J.D. Molecular Pathogenesis of Bordetella pertussis Infections. *Clinical Microbiology Reviews*, 34(2), (2021), pp. 185–195.
15. Ministry of Health of the Republic of Uzbekistan. Epidemiological situation of whooping cough and parapertussis. Tashkent: MoH (2023), pp. 561–563.
16. Paddock, C.D., Sanden, G.N., Cherry, J.D., et al. Pathology and Pathogenesis of Fatal Bordetella pertussis Infection in Infants. *Clinical Infectious Diseases*, 47(3), (2008), pp. 328–338.
17. Pramono, R.X., Imtiaz, S.A., Rodriguez-Villegas, E. A Cough-Based Algorithm for Automatic Diagnosis of Pertussis. *PLoS One*, 11(9): e0162128 (2016), pp. 115–117.
18. Qin, X., Zhang, J., & Chen, M. Antibiotic Resistance in Bordetella Species: A Global Perspective. *Journal of Antimicrobial Chemotherapy*, 75(8), (2020), pp. 2221–2230.
19. Smith, J. *Public Health and Epidemiology*. Springer (2020), pp. 906–909.

20. Tan, T., Dalby, T., Forsyth, K., Halperin, S.A., & Plotkin, S. Pertussis Vaccination Strategies and Impact on Disease Control. *The Lancet Infectious Diseases*, 19(2), (2019), pp. 186–192.
21. UNICEF. Information about whooping cough. UNICEF Uzbekistan (2025), pp. 119–122.
22. Wang, X., & Jones, R.L. Pertussis in Adolescents and Adults: Current Perspectives. *Journal of Infection and Public Health*, 13(6), (2020), pp. 979–986.
23. World Health Organization (WHO). Pertussis Surveillance and Immunization Coverage. Geneva: WHO Press (2022), pp. 771–774.
24. World Health Organization (WHO). Pertussis vaccines: WHO position paper. *Weekly Epidemiological Record* (2023), pp. 116–119.
25. Yuldashev, A.Y. *Basics of Medicine*. Tashkent: Uzbekistan (2018), pp. 181–183.