

COMMON COLD IN CHILDREN-DIAGNOSTIC CONSIDERATIONS

M. H. Hussain¹ and Zahir Hussain^{2*}

¹*Biomedical, Computational and Theoretical Research (BCTR) Lab, Karachi, Pakistan*

²*Department of Physiology, Faculty of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia*

*Corresponding Author: Email: zahussai@yahoo.ca

ABSTRACT

Common cold, the upper respiratory tract infection is one of the leading respiratory complications and third most common primary diagnosis in office visits. Billions of common cold infections occur worldwide each year and more than two hundred common cold viruses-rhinoviruses are the main culprits in causing most common colds. Main symptoms initially are: not feeling well, sore throat, nasal/chest congestion, coughing, sneezing etc. for several days. Other symptoms may appear in later stages of infection. Peak incidence of cold infections is in cold weather mainly in winter. Care should be given especially for younger children few months or less than a year age. Pediatrician should be called in occasions when the temperature of child is above 102 °F, child breaths fast or gets difficulty breathing or if the condition does get better in about a week or more. Medicines should be given as according to the prescription of physician/ pediatrician.

Key-words: Common cold, children, common cold symptoms, rhinovirus, diagnosis.

INTRODUCTION

Respiratory diseases range from mild and self-limiting disorders such as the common cold (Hussain, 2007; Hsiao *et al.*, 2010) to highly threatening diseases including pneumonia, asthma, pulmonary embolism, lung cancer and other respiratory disorders (Barnes, 1990; Cordonnier, 1990; Hussain, 1990, 1991, 1992, 1993; Calhoun *et al.*, 1991; Elliott, 1992; Martys, 1992; Hain *et al.*, 1995; Anjum and Hussain, 1998 b; Sengupta *et al.*, 2016; Santus *et al.*, 2019). Billions of common colds occur worldwide each year.

Common cold, the upper respiratory tract infection treated symptomatically is one of the leading respiratory complications, and third most common primary diagnosis in office visits (Anjum and Hussain, 1999 a; Hsiao *et al.*, 2010). Rhinovirus is the most involved group of viruses in most common colds. There are more than two hundred viruses that may cause cold. Since cold is a viral infection, antibiotics do not help for the treatment of these infections. Colds go away in a week or so in healthy children with no treatment and they do not cause any dangerous effects with the exception of newborns and immune-compromised children (Mahmood and Hussain, 1999).

RHINOVIRUS-THE REAL CULPRIT

Rhinovirus that belongs to Picornaviridae family was differentiated before the molecular era from enterovirus phenotypically employing acid stability and serotyping with specific antisera, and inactivated by acid while enterovirus is acid stable, but their classification into major and minor groups depends cellular receptor specificity e.g. rhinovirus A & B are classified on the basis of differential susceptibility to capsid-binding compounds (Andries *et al.*, 1990; Anjum and Hussain, 1999 c). The provision of molecular assay has helped clarifying the genetic relatedness between rhinovirus and enterovirus, and between different rhinovirus species (Blomqvist *et al.*, 2002).

Rhinovirus is a non-enveloped, spherical virus (diameter: about 30 nm and icosahedral capsid encloses a 7.2-kb positive-sense single-stranded RNA viral genome) (Jacobs *et al.*, 2013). The viral capsid is composed of 4 capsid proteins (VP1, VP2, VP3 on cell surface, VP4 beneath the capsid). There are 2A, 2B, 2C, 3A, 3B, 3C and 3D, 2A and 3C proteases (non-structural proteins for cleaving viral polypeptide) (Jensen *et al.*, 2015).

Rhinovirus infections are present worldwide mostly asymptomatic or manifesting mild symptoms (Self *et al.*, 2016) and are one of the most common infections in patients with otitis media (Schilder *et al.*, 2016), bronchiolitis (Meissner, 2016), croup (Petrocheilou *et al.*, 2014), pneumonia (Jain *et al.*, 2015 a, b) and severe infections as immunocompromised than patients with influenza virus infection (Munir and Hussain, 1999; Choi *et al.*, 2015). Most of the rhinovirus are acquired in community and can survive for longer duration on the surfaces in environment (Winther *et al.*, 2007) and being naked type are relatively resistant to disinfectants and alcohol hand rub (Savolainen-Kopra *et al.*, 2012). Alcohol hand sanitizers are less effective (Aiello *et al.*, 2008). Peak incidence

of these infections is in cold weather mainly in winter weather (Mahmood and Hussain, 1998; Cheuk *et al.*, 2007; Lau *et al.*, 2009; Lee *et al.*, 2012; Foxman *et al.*, 2015).

DIAGNOSIS

In the start of cold, children do not feel well followed by other symptoms. The next symptoms might be sore throat (due to build-up of mucus that may lead later to postnasal drip- running down of mucus from the back of nose to throat; mucus coming out of the nose may get darker and thicker with the time), runny nose, rhinorrhea, and nasal/ chest congestion and cough generally. These and other symptoms may last for several days. In the starting phase of cold, the symptoms appearing might include sneezing, coughing and sore throat (Anjum and Hussain, 1999 b).

Children need special care for the symptoms of cold during any season with cough considered as the third most common and nasal congestion as the 15th most common presenting symptom in all office visits (Anjum and Hussain, 1999 a). When virus enters into the body and more and more number of viruses grow, cold gets worse, and some of the common symptoms that may appear are: runny nose, sneezing, chills, low fever (sometimes; mostly in night), malaise, watery or crusty eyes, feeling of tiredness, difficulty in swallowing, a dry or sore throat, cough, headache, body aches, sore muscles, loss of appetite, and slight swelling of glands and pus on tonsils due to strep (streptococcal) infection (Munir and Hussain, 1998). Other upper respiratory tract infections caused by rhinovirus comprise mainly acute otitis media (Chonmaitree *et al.*, 2015), rhinosinusitis (Cho *et al.*, 2013) and croup (Miller *et al.*, 2013). Cold virus can affect sinuses, throat, ears and bronchial tubes of the child. Vomiting and diarrhea may occur (Anjum and Hussain, 1999 e).

Upper respiratory tract viruses cause common colds that may occur once a month especially in children under child care. But it is for babies/ toddlers. The children above two years and school going children especially in winter can have more number of colds each year (Anjum and Hussain, 1999 d).

Colds spread by the sneeze or cough of someone with a virus. Virus containing air and water droplets are breathed by others that may cause cold sickness. Children or adult individuals touch their own nose with their hands and if they then touch the healthy persons, cold virus spread to healthy people, and healthy people if in turn touch other healthy persons, they also transfer the cold virus and so on. If a child having cold touches an object e.g. a book, pen, pencil, key board, computer, door handle, stairs etc (viruses can live on these objects for several hours) and then some other child touches that object, cold virus is transferred to the other child and so on. Hence, it is essential for children to wash their hands using warm water and soap especially before each meal and after returning back from bathroom (Anjum and Hussain, 1998 a).

CONCLUSIONS

Since colds may quickly become dangerous problems e.g. bronchiolitis, croup, pneumonia etc. in three months or younger child, and it is difficult to tell when a child is too sick, it is necessary to call the pediatrician for quite younger babies at the very first sign, and particularly if not getting better after few days, and/ or having high fever. However, if the child is older than few months, the pediatrician should be called in occasions when the temperature of child is above 102 °F, child breaths fast or gets difficulty breathing (skin above or below child's ribs is sucked in with each breath), nostrils get larger and skin above and below ribs gets retracted with each breath, heart beats faster than usual, child has ear pain, child's lips or nails get blue, or nasal mucus remains present for more than two weeks, cough lasts for more than a week, nausea/ vomiting, chills and shakes occur, child stops urinating or urinate less than usual, and the child has chest or stomach pain/ headache. The doctor should immediately be called if the child's temperature reaches 105°F. The medicines should be given as according to the prescription of physician/ pediatrician.

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REFERENCES

- Aiello, A.E., R.M. Coulborn, V. Perez and E.L. Larson (2008). Effect of hand hygiene on infectious disease risk in the community setting: a meta-analysis. *Am J Public Health*, 98(8):1372–1381.
- Andries, K., K. B. Dewindt, J. Snoeks, L. Wouters, H. Moereels, P.J. Lewi and P.A. Janssen (1990). Two groups of rhinoviruses revealed by a panel of antiviral compounds present sequence divergence and differential pathogenicity. *J Virol*, 64 (3):1117-1123.

- Anjum, S. and Z. Hussain (1999 a). Common cold-upper respiratory infection. *The Medicine International*, 2(1): 5-7.
- Anjum, S. and Z. Hussain (1999 b). Diagnostic features in common colds. *The Medicine International*, 2(2): 10-12.
- Anjum, S. and Z. Hussain (1999 c). Rhinovirus and common colds. *The Medicine International*, 2(4): 8-10.
- Anjum, S. and Z. Hussain (1999 d). Age of children and common colds. *The Medicine International*, 2(11): 6-8.
- Anjum, S. and Z. Hussain (1999 e). Complications in common colds. Monograph. *The Medicine International*, 2(12): 5-7.
- Anjum, S. and Z. Hussain (1998 a). How do common colds spread? *The Medicine International*, 1(2): 9-12.
- Anjum, S. and Z. Hussain (1998 b). Cellular and molecular pathophysiology of common colds. *The Medicine International*, 1(6):2-4.
- Barnes, P. J. (1990). The role of neurotransmitters in bronchial asthma. *Lung*, 168 Suppl:57-65.
- Blomqvist, S., C. Savolainen, L. Raman, M. Roivainen and T. Hovi (2002). Human rhinovirus 87 and enterovirus 68 represent a unique serotype with rhinovirus and enterovirus features. *J Clin Microbiol*, 40 (11):4218-4223.
- Calhoun, W.J., J. Sedgwick, and W.W. Busse (1991). The role of eosinophils in the pathophysiology of asthma. *Ann N Y Acad Sci.*, 629: 62-72.
- Cheuk, D.K., I.W. Tang, K.H. Chan, P.C. Woo, M.J. Peiris and S.S. Chiu (2007). Rhinovirus infection in hospitalized children in Hong Kong: a prospective study. *Pediatr Infect Dis J.*, 26 (11): 995-1000.
- Cho, G.S., B.J. Moon, B.J. Lee, C.H. Gong, N.H. Kim, Y.S. Kim, H.S. Kim and Y.J. Jang (2013). High rates of detection of respiratory viruses in the nasal washes and mucosae of patients with chronic rhinosinusitis. *J Clin Microbiol.*, 51 (3):979-984.
- Choi, S.H., J.W. Huh, S.B. Hong, J.Y. Lee, S.H. Kim, H. Sung, S.O. Lee, M.N. Kim, J.Y. Jeong, C.M. Lim, Y.S. Kim, J.H. Woo and Y. Koh (2015). Clinical characteristics and outcomes of severe rhinovirus-associated pneumonia identified by bronchoscopic bronchoalveolar lavage in adults: comparison with severe influenza virus-associated pneumonia. *J Clin Virol.*, 62:41-47.
- Chonmaitree, T., P. Alvarez-Fernandez, K. Jennings, R. Trujillo, T. Marom, M.J. Loeffelholz, A. L. Miller, D.P. McCormick, J.A. Patel and R.B. Pyles (2015). Symptomatic and asymptomatic respiratory viral infections in the first year of life: association with acute otitis media development. *Clin Infect Dis.*, 60 (1):1-9.
- Cordonnier, C. (1990). Clinical, diagnostic and physiopathological aspects of cytomegalovirus pneumonia after bone marrow transplantation. *Rev Pneumol Clin.*, 46(6):244-50.
- Elliott, C.G. (1992). Pulmonary physiology during pulmonary embolism. *Chest*, 101(4 Suppl):163S-171S.
- Foxman, E.F., J.A. Storer, M.E. Fitzgerald, B.R. Wasik, L. Hou, H. Zhao, P.E. Turner, A.M. Pyle and A. Iwasaki (2015). Temperature-dependent innate defense against the common cold virus limits viral replication at warm temperature in mouse airway cells. *Proc Natl Acad Sci U S A*, 112 (3):827-832.
- Hain, R.D., N. Patel, S. Crabtree and R. Pinkerton (1995). Respiratory symptoms in children dying from malignant disease. *Palliat Med.*, 9(3):201-6.
- Hsiao, C.J., D.K. Cherry, P.C. Beatty and E.A. Rechtsteiner (2010). National Ambulatory Medical Care Survey: 2007 summary. *Natl Health Stat Report*, (27):1-32.
- Hussain, Z. (2007). pathophysiology of common cold. *Human Health*, 3(6)12-14.
- Hussain, Z. (1990). Clinical study of pleural effusion. *Med Rev.*, 2 (12):7-8.
- Hussain, Z. (1991). Pneumothorax- presence of air in the pleural cavity. *Med Rev.*, 3 (2):11-12.
- Hussain, Z. (1992). Clinical study of histoplasmosis. *Med Rev.*, 4 (1):4-5.
- Hussain, Z. (1993). Pleural effusion-recent perspectives. *Med Rev.*, 5 (8):1-2.
- Jacobs, S.E., D.M. Lamson, K. St George and T.J. Walsh (2013). Human rhinoviruses. *Clin Microbiol Rev*, 26 (1): 135-162.
- Jain, S., W.H. Self, R.G. Wunderink, S. Fakhra, R. Balk, A.M. Bramley, C. Reed, C.G. Grijalva, E.J. Anderson, D.M. Courtney, J.D. Chappell, C. Qi, E.M. Hart, F. Carroll, C. Trabue, H.K. Donnelly, D.J. Williams, Y. Zhu, S.R. Arnold, K. Ampofo, G.W. Waterer, M. Levine, S. Lindstrom, J.M. Winchell, J.M. Katz, D. Erdman, E. Schneider, L.A. Hicks, J.A. McCullers, A. T. Pavia, K.M. Edwards, L. Finelli and CDC EPIC Study Team (2015). Community-acquired pneumonia requiring hospitalization among U.S. adults. *N Engl J Med.*, 373 (5): 415-427.
- Jain, S., D.J. Williams, S.R. Arnold, K. Ampofo, A.M. Bramley, C. Reed, C. Stockmann, E.J. Anderson, C.G. Grijalva, W.H. Self, Y. Zhu, A. Patel, W. Hymas, J.D. Chappell, R.A. Kaufman, J.H. Kan, D. Dansie, N. Lenny, D.R. Hillyard, L.M. Haynes, M. Levine, S. Lindstrom, J.M. Winchell, J.M. Katz, D. Erdman, E. Schneider, L.A. Hicks, R.G. Wunderink, K.M. Edwards, A.T. Pavia, J.A. McCullers, L. Finelli and CDC EPIC Study Team (2015). Community-acquired pneumonia requiring hospitalization among U.S. children. *N Engl J Med.*, 372 (9): 835-845.

- Jensen, L.M., E.J. Walker, D.A. Jans and R. Ghildyal (2015). Proteases of human rhinovirus: role in infection. *Methods Mol Biol.*, 1221: 129-141.
- Lau, S.K., C.C. Yip, A.W. Lin, R.A. Lee, L.Y. So, Y.L. Lau, K.H. Chan, P.C. Woo and K.Y. Yuen (2009). Clinical and molecular epidemiology of human rhinovirus C in children and adults in Hong Kong reveals a possible distinct human rhinovirus C subgroup. *J Infect Dis.*, 200 (7): 1096-1103.
- Lee, W.E., R.F. Lemanske Jr., M.D. Evans, F. Vang, T. Pappas, R. Gangnon, D.J. Jackson and J.E. Gern (2012). Human rhinovirus species and season of infection determine illness severity. *Am J Respir Crit Care Med.*, 186 (9): 886-891.
- Mahmood, A. and Z. Hussain (1999). Common colds- prevention and general measures. *The Medicine International*, 2(2): 7-9.
- Mahmood, A. and Z. Hussain (1998). Clinical and epidemiological aspects of common colds. *The Medicine International*, 1(5): 3-5.
- Martys, C.R. (1992). Asthma care in Darley Dale: general practitioner audit. *BMJ*, 304(6829): 758-60.
- Meissner, H.C. (2016). Viral bronchiolitis in children. *N Engl J Med.*, 374 (1): 62-72.
- Miller, E.K., T. Gebretsadik, K.N. Carroll, W.D. Dupont, Y.A. Mohamed, L.L. Morin, L. Heil, P.A. Minton, K. Woodward, Z. Liu, T.V. Hartert and J.V. Williams (2013). Viral etiologies of infant bronchiolitis, croup and upper respiratory illness during 4 consecutive years. *Pediatr Infect Dis J.*, 32 (9): 950-955.
- Munir, R. and Z. Hussain (1999). Epidemiology of common colds. *The Medicine International*, 2(3): 3-5.
- Munir, R. and Z. Hussain (1998). Common symptoms in common cold. *The Medicine International*, 1(1): 11-13.
- Petrocheilou, A., K. Tanou, E. Kalampouka, G. Malakasioti, C. Giannios and A.G. Kaditis (2014). Viral croup: diagnosis and a treatment algorithm. *Pediatr Pulmonol*, 49 (5): 421-429.
- Santus P, M. Pecchiari, F. Tursi, V. Valenti, M. Saad and D. Radovanovic (2019). The Airways' Mechanical Stress in Lung Disease: Implications for COPD Pathophysiology and Treatment Evaluation. *Can Respir J.*, doi: 10.1155/2019/3546056. eCollection.
- Savolainen-Kopra, C., T. Korpela, M.L. Simonen-Tikka, A. Amirouyefi, T. Ziegler, M. Roivainen and T. Hovi (2012). Single treatment with ethanol hand rub is ineffective against human rhinovirus—hand washing with soap and water removes the virus efficiently. *J Med Virol.*, 84 (3): 543-547.
- Schilder, A.G., T. Chonmaitree, A.W. Cripps, R.M. Rosenfeld, M.L. Casselbrant, M.P. Haggard and R.P. Venekamp (2016). Otitis media. *Nat Rev Dis Primers*, 2: 16063.
- Self, W.H., D.J. Williams, Y. Zhu, K. Ampofo, A.T. Pavia, J.D. Chappell, W.C. Hymas, C. Stockmann, A.M. Bramley, E. Schneider, D. Erdman, L. Finelli, S. Jain, K.M. Edwards and C.G. Grijalva (2016). Respiratory viral detection in children and adults: comparing asymptomatic controls and patients with community-acquired pneumonia. *J Infect Dis.*, 213 (4):584-591.
- Sengupta, N., M. Sahidullah and G. Saha (2016). Lung sound classification using cepstral-based statistical features. *Computers in Biology and Medicine*, 75(1): 118–129.
- Winther, I.B. K. McCue, K. Ashe, J.R. Rubino and J.O. Hendley (2007). Environmental contamination with rhinovirus and transfer to fingers of healthy individuals by daily life activity. *J Med Virol.*, 79 (10): 1606-1610.

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