Viral Infections in a Neonatal Intensive Care Unit

S Águeda*a, A Leitão1, G Rocha1 and H Guimarães1,2

1Neonatal Intensive Care Unit, Department of Pediatrics, Centro Hospitalar São João, Porto, Portugal
2Faculty of Medicine, University of Porto, Portugal

Abstract

Background and aims: The incidence of neonatal viral infections is probably underestimated. Our objective was to assess the incidence of viral infections among hospitalized infants in a level III neonatal intensive care unit, the associated clinical manifestations and outcome.

Material and methods: We conducted an observational retrospective study of patients admitted to the neonatal intensive care unit over a ten year period (2000-2009), analyzing data of patients with laboratory confirmed viral infection.

Results: A viral infection was diagnosed in 1.7% (n=68) of infants admitted to the NICU: 32.3% respiratory syncytial virus, 17.9% metapneumovirus, 17.9% influenza H1N1 and 13.4% cytomegalovirus. Other less found virus were rotavirus, adenovirus, enterovirus, parainfluenza, herpes simplex and varicella zoster. The medium length of stay was 30 days and most infants were not inborn. In the inborn infants the most common virus were influenza H1N1, cytomegalovirus and metapneumovirus. In 48.5% these infections occurred in preterm. The overall mortality was 4.5%.

Conclusion: In our study the respiratory infections were the most common viral infections and the overall mortality was not negligible. It’s our responsibility to prevent viral infections, as well as help in their early detection and treatment.

Keywords: NICU; Viral infection

Introduction

The incidence of viral infections in patients treated in the neonatal intensive care unit (NICU) is not well-known. Some studies suggest an incidence between 1-5.7% [1,2]. This incidence is probably underestimated because viral studies are not routinely obtained in neonates [3]. Many viral diseases in NICU infants are undiagnosed or appreciated only late in the course of a disease. This happens because of subtle or asymptomatic presentation, confusion with bacterial disease, and failure to consider viral disease. There are not many publications on this theme, with the majority reporting outbreaks of viral infections in NICUs [4-6] that certainly do not reflect the real impact of these infections. Our objective was to assess the incidence of viral infections among hospitalized infants in a level III neonatal intensive care unit, the associated clinical manifestations and outcome. If applicable, we analyzed the pharmacologic agents used for prophylaxis and treatment of such diseases.

Materials and Methods

We conducted an observational retrospective study of patients admitted to the NICU over a ten year period (from January 1st 2000 to December 31st 2009). We analyzed clinical records data of those with laboratory confirmed viral infection obtained by polymerase chain reaction and/or viral culture. All the cases interpreted as contaminants were excluded. The statistical analysis was made with SPSS® statistics 18.

Results

General data: A viral infection was diagnosed in 68 (1.7%) of 3907 infants admitted to the NICU, 50% (n=34) for each gender. The mean age at admission was 4.7 ± 3.5 days. The medium length of stay (MLS) was 30 days (minimum 5, maximum 107 days) and in 57.4% (n=39) of cases the infants were admitted from their home or another hospital. The viral infection was the cause of admission in 24 (35.3%) infants; all others were already hospitalized for other reason when a viral infection was diagnosed (Table 1).

Pathogens: Twenty two (32.3%) had a respiratory syncytial virus (RSV) infection, 12 (17.6%) a metapneumovirus infection, 12 (17.6%) an influenza virus infection and 9 (13.2%) a cytomegalovirus (CMV) infection. Also identified infections were 4 rotavirus, 3 adenovirus, 2 enterovirus, 2 parainfluenza, 1 herpes simplex virus and 1 varicella zoster virus. In the inborn infants the virus that caused the higher number of infections were influenza H1N1 (29.6%), CMV (22.2%) and metapneumovirus (25.9%).

Presentation: In the CMV cases 55.5% (n=5) of the infants had symptomatic infections (all presented with hepatosplenomegaly, 2 with cholestatic jaundice and 1 with purpuric nodules). In these cases ganciclovir was used. In 2 cases the infection was detected in utero by amniocenteses, in all others only detected after delivery. There were 2 cases of asymptomatic CMV infection. The other 2 were cases of CMV pneumonia that progressed respectively to chronic lung disease and pulmonary hypertension. The MLS of all CMV cases was 20 days.

The respiratory infections were the vast majority of the viral infections found (72%) and generally presented with apnea, respiratory distress or cyanosis.

The RVS cases were predominant in newborns admitted from their homes (72.7%, n=16), all presented with respiratory distress, 27.3% (n=6) also with cyanosis and 13.6% (n=3) also with fever. Only 22.7% (n=5) occurred in preterm newborns, with longer MLS and comorbidities appeared in only 4 cases. The MLS was 14 days, 45.5% (n=10) required mechanical ventilation (MV), 81.8% (n=18)

*Corresponding author: Sofia Águeda, M.D. Neonatal Intensive Care Unit, Department of Pediatrics, Centro Hospitalar São João, Porto, Portugal; Tel: 225 512 100; E-mail: sofiamar@gmail.com

Received June 04, 2013; Accepted June 27, 2013; Published June 29, 2013

Citation: Águeda S, Leitão A, Rocha G, Guimarães H (2013) Viral Infections in a Neonatal Intensive Care Unit. Pediat Therapeut 3: 154. doi:10.4172/2161-0665.1000154

Copyright: © 2013 Águeda S, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.
Infections in preterm newborns: These infections occurred in preterm newborns in 32 cases (47.8%), predominantly respiratory illness like infections by RSV (18.8%, n=6), metapneumovirus (25%, n=8) and influenza H1N1 (25%, n=8). In all these cases the viral infection was not the condition responsible for the infant’s clinical state because at least one bacterial septic event occurred during hospitalization.

Outcome: The outcome of CMV infections was in general favorable in congenital infections. CMV pneumonia had relevant associated morbidity. In the respiratory infections reported is remarkable the favorable outcome of all the parainfluenza and the influenza H1N1 virus infections. RSV seems to be the most aggressive virus in our study, with all newborn being symptomatic, and this infection the principal isolated cause of admission in our NICU. It also had a more exuberant presentation. However, the need for IV was higher in the metapneumovirus group. The overall mortality was 6.0%, 2 cases with enterovirus infection (mortality of 100%), 1 with adenovirus infection and 1 with RSV infection.

**Discussion**

Viral diseases are undiagnosed or appreciated only late in the course of an illness among infants requiring care in the NICU. These infections are leading causes of mortality and morbidity in newborns [7].

In our study we found a vast majority of respiratory viral infections. These infections predominated in cold months and the clinical picture with respiratory distress associated or not with cyanosis, cough or other respiratory signs was responsible for the search of a viral infection.

Multiple studies of respiratory tract infection in newborns report the favorable course of the viral respiratory disease [8,9], even when the infections are observed in preterm infants [10].

RSV infection appears to be rare in the neonatal period [11], often with mild presentation that may not include respiratory clinical signs [12]. However the serious complications are fearsome in this age group [11], especially in preterm newborns. In our study, infants were mostly symptomatic and, unlike other studies [5,13], RSV was rare in preterm infants. The incidence of RVS pneumonia was relevant.

Parainfluenza virus cases are rarely reported in the neonate [14] and the few reports of these infections describe them as indolent and without complications [15] as we observed in our study.
A recently discovered virus, metapneumovirus, is not very commonly cited in literature [16], especially in neonates. As reported in our study, seems to be a mildly aggressive virus, similar to RSV [17], but with greater need for MV.

In 2009 an outbreak of influenza H1N1 infection was responsible for 17.9% of our cases. This particular situation required specific isolation measures and even the closure of our NCU. Similar cases were reported at the same time in other NICUs, with milder and nonspecific course that resulted in a favorable outcome [18,19]. Since oseltamivir was never used before in this age group, special attention was paid to its eventual side effects, which did not occur as we previously reported [20]. The same was also reported in a recent study [21].

As described before [22,23], symptomatic congenital CMV infection occurred in more than half of newborn with infection. As it seems to be the most sensitive method [23], polymerase chain reaction was the diagnostic tool used and ganciclovir the antiviral therapy of choice [24]. It is peculiar that we have found two CMV pneumonias in newborns that did not had a congenital CMV infections nor were preterm, which is not very common [25,26].

Rotavirus infection had clinical features similar to the literature [27,28] but we found less clinical impact, without cases of mortality or necrotizing enterocolitis.

In the neonate, as in other age groups, adenovirus infection can produce severe disease and even death. The typical presentation, as we reported, is the respiratory compromise [29,30].

Enterovirus infections are other feared group of infections in this age, being associated with significant morbidity and mortality [31,32] and, also as we found in our study, outbreaks have been described [33].

Because of the overlap with comorbidities it is difficult in a retrospective study to define the morbidity associated with each viral infection and the associated increase in MLS and health costs. In future it could be useful to continue this study in a prospective perspective. For example, premature infants had longer MLS but this fact cannot be associated solely with the associated viral infection.

Conclusion

In our study the respiratory infections were the most common and the overall mortality was not negligible. Infants in a NICU who develop respiratory signs must always be tested for RSV and other common respiratory viruses, especially during winter season.

The outbreaks in general are of great impact on health care delivery, outcomes and costs and so the appropriated preventive measures must be reminded, to avoid situations like the outbreak of influenza H1N1 virus.

It is necessary to prevent these infections but also to consider them in a sick neonate. With the improvement of diagnostic tools such as antigen detection techniques, molecular technology and viral culture the diagnosis is now easier. The treatment options often are limited, but improving with the increasing knowledge.

References

1. Rudd PT, Carrington D (1984) A prospective study of chlamydial, mycoplasmal, and viral infections in a neonatal intensive care unit. Arch Dis Child 59: 120-125.
2. Richards MJ, Edwards JR, Culver DH, Gaynes RP (1999) Nosocomial infections in pediatric intensive care units in the United States. National Nosocomial Infections Surveillance System. Pediatrics 103: e39.
3. Verboon-MacIeolek MA, Krediet TG, Gerards LJ, Fleer A, van Loon TM (2005) Clinical and epidemiologic characteristics of viral infections in a neonatal intensive care unit during a 12-year period. Pediatr Infect Dis J 24: 901-904.
4. Ng W, Rajadurai VS, Pradeepkumar VK, Tan KW, Chan KP (1999) Parainfluenza type 3 viral outbreak in a neonatal nursery. Ann Acad Med Singapore 28: 471-475.
5. Halasa NB, Williams JV, Wilson GJ, Walsh WF, Schaffner W, et al. (2005) Medical and economic impact of a respiratory syncytial virus outbreak in a neonatal intensive care unit. Pediatr Infect Dis J 24: 1040-1044.
6. Syriroupoulou VP, Haridchistidouloiu Ch, Daikos GL, Pirounaki M, Chatzioiu V, et al. (2002) Clinical and epidemiological aspects of an enterovirus outbreak in a neonatal unit. J Hosp Infect 51: 275-280.
7. Barford G, Rentz AC, Faix RG (2004) Viral infection and antiviral therapy in the neonatal intensive care unit. J Perinat Neonatal Nurs 18: 259-274.
8. Roe M, O’Donnell DR, Tasker RC (2003) Respiratory viruses in the intensive care unit. Paediatr Respir Rev 4: 166-171.
9. Carveli T, De Halleux V, Lombet J (2007) [Management of acute bronchiolitis in newborns]. Rev Med Liege 62: 293-298.
10. Diniz EM, Vieira RA, Ceccon ME, Ishida MA, Vaz FA (2005) Incidence of respiratory viruses in preterm infants submitted to mechanical ventilation. Rev Inst Med Trop Sao Paulo 47: 37-44.
11. SaviÄ‡ N, JankovÄ‡ B, MiniÄ‡ P, VasilijeviÄ‡ Z, Sovilj Ä‡, et al. (2011) Clinical characteristics of respiratory syncytial virus infection in neonates and young infants. Vojnosanit Pregl 68: 220-224.
12. Piedra PA, Wells JM, Cron SG, Fan LL, Byrd RL, et al. (1999) Immune Responses to Respiratory Syncytial Virus (RSV) in Infants and their Mother. Pediatric Research 45:171
13. Kilani RA (2002) Respiratory syncytial virus (RSV) outbreak in the NICU: description of eight cases. J Trop Pediatr 48: 118-122.
14. Simmonds A, Munoz J, Montecalvo M, Clones B, Lagamma EF (2009) Outbreak of parainfluenza virus type 3 in a neonatal intensive care unit. Am J Perinatol 26: 361-364.
15. Stralotito SM, Siqueira MM, Machado V, Maia TM (2004) Respiratory viruses in the pediatric intensive care unit: prevalence and clinical aspects. Mem Inst Oswaldo Cruz 99: 883-887.
16. Schlapbach LJ, Agyeman P, Hutter D, Aebi C, Wagner BP, et al. (2011) Human metapneumovirus infection as an emerging pathogen causing acute respiratory distress syndrome. J Infect Dis 203: 294-295.
17. Wilkesmann A, Schildgen O, Eis-Hubinger AM, Geikowski T, Glatzel T, et al. (2006) Human metapneumovirus infections cause similar symptoms and clinical severity as respiratory syncytial virus infections. Eur J Pediatr 165: 467-475.
18. Hon KL, Cheung KL, Wong W, Ng PC (2010) Neonates investigated for influenza-like illness during the outbreak of pandemic H1N1 2009: trivial infections but major triage implications. Indian J Pediatr 77: 1033-1035.
19. Sert A, Yazar A, Odabas D, Bilgin H (2010) An unusual cause of fever in a neonate: Influenza A (H1N1) virus pneumonia. Pediatr Pulmonol 45: 734-736.
20. Rocha G, Piasarra S, Silva G, Guimarães H (2010) Experience with oseltamivir in term and preterm newborns. J Pediatr Infect Dis 5: 327-331.
21. Pannaraj PS, Tam B, Akan D (2011) Oseltamivir treatment and prophylaxis in a neonatal intensive care unit during a 2009 H1N1 influenza outbreak. J Perinatol 31: 487-493.
22. Tomaski T, Opozda A, Pietrzyk JJ (2010) [Cytomegalovirus infection–diagnostic and therapeutic difficulties in neonatal intensive care unit]. Przegl Lek 67: 18-24.
23. Lanari M, Lazzarotto T, Venturi V, Papa I, Gabrielli L, et al. (2006) Neonatal cytomegalovirus blood load and risk of sequelae in symptomatic and asymptomatic congenitally infected newborns. Pediatrics 117: e76-83.
24. Bell SG (2008) Ganciclovir: antiviral therapy for congenital cytomegalovirus. Neonatal Netw 28: 41-46.
25. Fischer C, Meylan P, Bickle Graz M, Gudinchet F, Vaudaux B, et al. (2010) Severe postnatally acquired cytomegalovirus infection presenting with colitis, pneumonitis and sepsis-like syndrome in an extremely low birthweight infant. Neonatology 97: 339-345.
26. Xiao YM, Hu ZH (2010) Differences of clinical manifestations from cytomegalovirus infection in children of various age groups. Zhongguo Dang Dai Er Ke Za Zhi 12: 21-23.

27. Sharma R, Hudak ML, Premachandra BR, Stevens G, Monteiro CB, et al. (2002) Clinical manifestations of rotavirus infection in the neonatal intensive care unit. Pediatr Infect Dis J 21: 1099-1105.

28. Haffejee IE (1991) Neonatal rotavirus infections. Rev Infect Dis 13: 957-962.

29. Kelley CJ (2010) A fatal case of neonatal adenovirus infection. Neonatal Netw 29: 297-305.

30. Faden H, Wynn RJ, Campagna L, Ryan RM (2005) Outbreak of adenovirus type 30 in a neonatal intensive care unit. J Pediatr 146: 523-527.

31. Tebruegge M, Curtis N (2009) Enterovirus infections in neonates. Semin Fetal Neonatal Med 14: 222-227.

32. Jordán I, Esteva C, Esteban E, Noguera A, García JJ, et al. (2009) Severe enterovirus disease in febrile neonates. Enferm Infecc Microbiol Clin 27: 399-402.

33. Kusuhara K, Saito M, Sasaki Y, Hikino S, Taguchi T, et al. (2008) An echovirus type 18 outbreak in a neonatal intensive care unit. Eur J Pediatr 167: 587-589.