

# Human parechovirus encephalitis in an immunocompetent adult patient: A case-report and literature review

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**Abstract.** Human parechovirus (HPEV) has been identified as the cause of epidemic myalgia in adult patients and as the etiology in severe syndromes, such as myocarditis, pericarditis and encephalitis in children and immunocompromised individuals. The present study describes the case of an immunocompetent adult patient with HPEV. The case-report was written following CARE guidelines. The present study also provides a brief review of the relevant literature in an aim to raise awareness against HPEV as a rare cause of severe disease in immunocompetent adults. HPEV is a rare cause of disease in immunocompetent adults and can cause permanent sequelae. Care givers and medical professional usually aim for a rapid (7-14 days) and full recovery. The elderly and individuals with comorbidities in whom the normal functioning of the immune system is altered, such as in those with diabetes and alcohol abuse, should be aware they are at a higher risk for a negative prognosis.

## Introduction

Human parechoviruses (HPEVs) are a discovered group of non-enveloped, positive-sense single-stranded RNA viruses belonging to the *Picornaviridae* family (1). Initially classified with enteroviruses, they were later separated due to distinct pathogenicity and cytopathic effects (1). Currently, 16 different serotypes of HPEV have been identified, with two of these, HPEV1 and HPEV3, being the most frequently found in association with human diseases (2).

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HPEVs mainly cause gastrointestinal and respiratory syndromes; however, they are also associated with more severe disorders, such as myocarditis, encephalitis and sepsis-like syndrome, particularly in children <1 year of age (1,3-5). In fact, HPEVs exhibit a high infection rate during the first year of age, reaching 100% of HPEV-seropositive children in the age group of 5-9 years (1). Moreover, these viruses are more frequently detected during the peak enterovirus season, from June to October in the Northern Hemisphere (3,4).

The diagnosis of HPEV infection has traditionally been carried out with viral cultures of different specimens; however, due to the length of turnaround, viral culture may not be the optimal diagnostic method, particularly in severe syndromes (6). Therefore, molecular biology techniques, such as reverse transcriptase polymerase chain reaction (RT-PCR) and integrated systems with multiplex PCR able to test a greater number of pathogens at once, have replaced viral cultures and are currently routinely used with an even higher sensitivity than the classic techniques (2,6,7).

Treatment commonly includes symptomatic therapy, with complete recovery occurring within 1-2 weeks from the onset of symptoms (3). HPEV, and particularly HPEV3, has been recently identified as the cause of epidemic myalgia in adult patients and has also been recognized, although seldomly, as the etiology in severe syndromes, such as myocarditis and pericarditis in the same population (8-13). Occasionally, it was also found as the cause of encephalitis in immunocompromised adult individuals (12).

The present study describes the case of an adult immunocompetent patient with HPEV encephalitis and also provides a review of the cases involving adults reported in the literature (8-10,12-25). The case report was written following the case report (CARE) guidelines (26).

The aim of the present study was to raise awareness against HPEV as a rare cause of severe disease in immunocompetent adults.

## Case report

A 49-year-old male presented to the emergency room of the 'Umberto I' Hospital of Enna (Enna, Italy) in the

mid-October, 2023, complaining of fever with chills for 10 days, with lower back pain, orchiodynia, strangury and hematuria. His clinical history highlighted a colon diverticulosis diagnosed several months prior to his admission and a recent (~1 month) fracture of the head of the right radial bone; otherwise his clinical history was negative. He denied having being in any contact with children who were ill. At 3 days prior to this episode, he underwent a urology consultation with an ultrasound examination for the orchiodynia, which highlighted a prostatic hypertrophy with the presence of calcifications and a diagnosis of prostatitis was made, for which he was under treatment with levofloxacin 500 mg qd, with no improvement.

He was therefore admitted to the Infectious Diseases Ward of the aforementioned hospital. A physical examination performed upon admission highlighted a suffering man, with no specific signs, apart from a mild costovertebral angle tenderness. The patient also complained of myalgia affecting the proximal and distal muscles of the lower extremities. Antibiotic therapy with piperacillin/tazobactam 4.5 g three times a day (tid) and vancomycin 500 mg tid (20 mg/kg/day) was commenced. The results of blood tests were also normal, with a white blood cell count of 12,310 cells/ $\mu$ l (70.5% neutrophils, 17.7% lymphocytes and 9.3% monocytes). C-reactive protein and procalcitonin levels were also normal. Mild hyponatremia (131 mEq/l), with normal kaliemia (3.9 mEq/l) was highlighted. Serological tests performed during the first day of admission for cytomegalovirus (IgM and IgG), *Toxoplasma gondii* (IgM and IgG), Epstein-Barr virus (anti-VCA IgM and IgG), herpes simplex virus (HSV) 1 and 2 (IgM), HSV-2 (IgG), rubeola (IgM), *Mycoplasma pneumoniae* (IgM and IgG), *Chlamydia pneumoniae* (IgM and IgG) and *Legionella pneumophila* (IgM and IgG) yielded negative results. HSV-1 (IgG) and rubeola (IgG) tests yielded positive results. He also had normal total and free prostate-specific antigen, and normal thyroid hormone levels [free thyroxin (fT) 3, fT4 and thyroid stimulating hormone]. Urine and blood cultures yielded negative results. An interferon-gamma release assay for tuberculosis performed on day 6 of admission yielded negative results. During the admission, for the appearance of headache, a brain magnetic resonance imaging was performed, highlighting the presence in the frontal lobe of subcortical dotted areas of altered hyperintense signal in long repetition time sequences, which had a non-specific gliotic appearance (Fig. 1). On day 8 from the time of admission, the patient underwent a positron emission tomography-computed tomography with 18F-fluorodeoxyglucose (18F-FDG), which yielded negative results. On day 9 from the time of admission, for the persistence of the headache and fever, and the appearance of a slight neck stiffness during the neurological consultation, the patient underwent a lumbar puncture. The cerebral spinal fluid (CSF) was clear, with 187 cells/ $\mu$ l, high protein levels (126.8 mg/dl), a CSF albumin/serum albumin ratio of 0.02, normal glucose levels, and a high concentration of IgG. The results of Gram staining and culture were negative. A FilmArray for common pathogens causing meningoencephalitis (Biofire® FilmArray® Meningitis/Encephalitis Panel, Biomérieux) was performed, which yielded positive results for HPeV. Antibiotic treatment with piperacillin/tazobactam and vancomycin was then terminated, and an anti-inflammatory

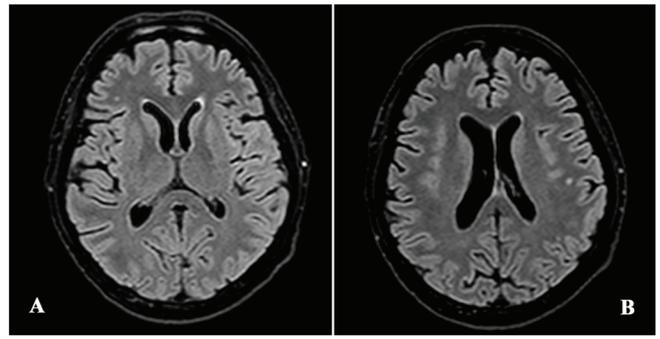


Figure 1. Magnetic resonance imaging of the patient performed on day 5 from admission, exhibiting subcortical dotted areas of altered hyperintense signal in (A) normal repetition time and (B) long repetition time sequences in the frontal lobe, which had a non-specific gliotic appearance.

treatment with dexamethasone 8 mg tid was commenced, with the immediate resolution of the headache and fever. For the persistence of the myalgia at the lower extremities, on day 12 from the time of admission, the patient underwent an electromyography, which highlighted the normal transmission of motor and sensitive signals. The patient was discharged on day 22 from the time of admission, after 14 days of steroid treatment.

At 1 week after being discharged, he complained of photophobia and blurred vision. Thus, he underwent an ophthalmologist consultation, which highlighted the presence of papilledema. The papilledema was resolved following another cycle of treatment with dexamethasone for 10 days. After 1 year since the episode, the patient is in good general conditions and does not complain of any neurological symptoms.

## Discussion

As of the day of the submission of the present study, 380 articles on viral encephalitis in adults were published between 2020 and 2024, and indexed in Medline®, excluding SARS-CoV-2 related ones. A total of 65 of these articles are indexed as case reports, and ~30% of these cases were caused by herpesviruses, followed by arboviruses (20%). The high number of published articles indicates that the attention on encephalitis is high, also due to the non-existence of a consensus over the management of the disease, apart from herpesviruses. To the best of our knowledge, this is the first report of an immunocompetent adult affected by HPeV encephalitis.

HPeV are a rare cause of disease in immunocompetent adults. A summary of all the cases reported in the literature in adult patients and their outcomes is provided in Table I. Similar to the cases reported in the studies by Mizuta *et al* (8-10), the patient in the present study was a 49-year-old male, who complained of myalgia and lower back pain, with orchiodynia, fever and weakness. Although the majority of the reported cases demonstrated that the onset of the symptoms followed interactions with ill children, the patient in the present study denied any such contacts.

The case described herein suggests the importance of performing a lumbar puncture even with mild neurological signs in cases of fever of unknown origin and close to no

Table I. Summary of the adult HPeV infection cases reported in the literature.

Sex	Age, years	Syndrome	Outcome	(Refs.)
M	54	Keratitis + anterior uveitis	Recovery	(14)
M	53	Keratitis + anterior uveitis	Recovery	(14)
F	73	Keratitis + anterior uveitis + secondary glaucoma	Trabeculectomy	(14)
M <sup>a</sup>	37	Keratitis + panuveitis + retinitis + vasculitis + papillitis	Recovery	(14)
M	38	Myalgia + weakness + orchiodynia + fever	Recovery	(8)
M	41	Myalgia + weakness + orchiodynia + fever	Recovery	(8)
M	41	Myalgia + weakness + fever + sore throat	Recovery	(8)
M	31	Myalgia + Weakness + fever	Recovery	(8)
M	35	Myalgia + weakness + sore throat	Recovery	(8)
M	36	Myalgia + weakness + fever	Recovery	(9)
F	66	Myalgia + weakness	Recovery	(9)
M	25	Myalgia + weakness + fever + orchiodynia	Recovery	(9)
M	31	Myalgia + weakness + fever + sore throat	Recovery	(9)
M	32	Myalgia + weakness + fever + sore throat	Recovery	(9)
M	43	Myalgia + weakness + fever + sore throat	Recovery	(9)
F	30	Myalgia + weakness + fever	Recovery	(9)
M	28	Myalgia + weakness + fever + sore throat + orchiodynia	Recovery	(9)
F	39	Myalgia + weakness + fever + sore throat	Recovery	(9)
M	36	Myalgia + weakness + fever + sore throat	Recovery	(9)
M	35	Myalgia + weakness + fever + sore throat	Recovery	(9)
M	38	Myalgia + weakness + fever + sore throat	Recovery	(9)
F	38	Myalgia + weakness + fever + sore throat	Recovery	(9)
F	37	Myalgia + weakness + seizures	Recovery	(9)
M	48	Myalgia + weakness + sore throat	Recovery	(9)
M	41	Myalgia + fever + sore throat	Recovery	(9)
F	26	Myalgia + weakness + fever	Recovery	(9)
M	36	Myalgia + weakness + fever + sore throat + orchiodynia	Recovery	(9)
M	23	Myalgia + weakness + fever + sore throat	Recovery	(9)
M	34	Myalgia + weakness + fever	Recovery	(9)
F	38	Myalgia + weakness + fever + sore throat	Recovery	(9)
M	55	Myalgia + weakness + fever + sore throat + orchiodynia	Recovery	(9)
F <sup>b</sup>	28	Myalgia + arthralgia + fatigue	Recovery	(17)
M	30	Fever + myalgia + weakness + orchiodynia	Recovery	(25)
M	38	Myalgia + Sore throat + tongue pain	Recovery	(25)
M	39	Fever + sore throat + myalgia + weakness	Recovery	(25)
M	26	Myocarditis	Recovery	(13)
M	19	Pericarditis	Recovery	(16)
M	32	Fever + sore throat + mild diarrhea + orchiodynia	Recovery	(18)
M <sup>c</sup>	63	Encephalitis	Recovery	(19)
M	42	Myalgia + sore throat + orchiodynia	Recovery	(20)
M	32	Myalgia + Orchiodynia + leg dysesthesia	Recovery	(21)
M	47	Myalgia	Recovery	(21)
F	38	Myalgia + stomatitis + sore throat	Recovery	(21)
M	34	Myalgia + sore throat	Recovery	(21)
M	46	Myalgia	Recovery	(21)
M	42	Myalgia + orchiodynia + sore throat	Recovery	(21)
M	38	Myalgia + orchiodynia + joint pain	Recovery	(21)
M	22	Myalgia + sepsis + hepatitis + conjunctivitis + headache + fever + pharyngitis	Recovery	(15)
M	44	Myalgia + weakness + fever + stomatitis	Recovery	(10)
F	30	Myalgia + weakness + fever	Recovery	
M	37	Myalgia + sore throat + stomatitis + orchiodynia	Recovery	(22)

Table I. Continued.

Sex	Age, years	Syndrome	Outcome	(Refs.)
F <sup>d</sup>	16	Myocarditis + encephalitis + myalgia + ophthalmoplegia	Slow recovery	(12)
F	78	Pneumonia	Death	(23)
F	35	Flu-like syndrome	Recovery	(24)
M	49	Encephalitis + myalgia + weakness + fever + orchiodynia + papilledema	Slow recovery	The present case

<sup>a</sup>The patient was a person living with HIV; <sup>b</sup>the patient was pregnant; <sup>c</sup>the patient had an alcohol use disorder and suffered from hypertension and stage IV cholangiocarcinoma with metastases to the liver, ribs and lungs; <sup>d</sup>the patient was affected by hypogammaglobulinemia. M, male; F, female.

radiological signs. This is particularly true for HPeV, since Mizuta *et al* (9) demonstrated that serology has a low sensitivity in adults (~30%). Diagnosis was made by FilmArray<sup>®</sup> (Biofire<sup>®</sup>, Biomérieux), a multiplex PCR technique which allows the use of small amounts of samples to collect information about the presence or absence of bacterial and viral pathogens (7). Although viral culture remains the gold-standard for diagnosis, its long turnaround time renders it unpractical, particularly in severe cases which involve the CNS. In fact, all the reported cases were diagnosed using PCR techniques, both homemade and commercially available, using various types of samples, particularly feces, pharyngeal swabs and serum, with a higher sensitivity of feces compared with serum and pharyngeal swab (8,9,17). However, despite being extremely useful in having a rapid etiological diagnosis, the FilmArray does not provide a serotype differentiation. Therefore, in the present study, the serotype affecting the patient could not be identified.

The study published by Piralla *et al* (27) demonstrated that in 2012, the most frequently isolated strand of HPeV was type 1 (57.9%), followed by type 3 (36.8%) and type 6 (5.3%). On the other hand, the study by Westerhuis *et al* (11) demonstrated that the seroprevalence of HPeV3 was very low (<20%) in Finland and The Netherlands, whereas HPeV1 and HPeV2 had a higher (80-100%) seroprevalence. Almost all cases of epidemic myalgia reported from Japan have been shown to be caused by HPeV3 (8-10,13,17,20). Both HPeV1 and HPeV3 have been associated with encephalitis cases in children, although this association is stronger with HPeV3 (5,11,28,29). Given both clinical and epidemiological criteria, it can be inferred that the patient in the present study was affected by HPeV3.

Although notable, knowing the serotype however, does not alter the management. In fact, there is no specific (or aspecific) antiviral drug available against HPeV, and the review by Kadambari *et al* (30) highlights how randomized clinical trials (RCTs) for the most commonly reported therapeutic approaches are lacking. An intravenous immunoglobulin administration was attempted in two reported cases of myocarditis, although its efficacy has not been proven (13). In one case, corticosteroids were added due to severe myalgia (21). However, in other cases the treatment was reported as supportive (20). The patient described herein was managed with symptomatic treatment, with the

addition of corticosteroids when encephalitis was diagnosed. The use of corticosteroids in the treatment of viral encephalitis remains controversial and is based on the decision of the single physician. The only RCT on this matter has been terminated prematurely due to the difficulty in enrolling patients, although dexamethasone is anecdotally useful for the prevention of vascular edema, whenever the patient is suspected for or diagnosed with intracranial hypertension (31-33).

HPeV rarely causes permanent sequelae, and usually, medical providers aim for a rapid (7-14 days) and full recovery. The cases reported in literature all had a full recovery, apart from one case affected by several comorbidities, who succumbed due to of respiratory complications (23). In the case in the present study, despite the patient being an immunocompetent adult, he had a slow recovery, with the appearance of new symptoms even following the termination of the corticosteroid therapy.

In conclusion, the present study reported the first case of HPeV encephalitis in an immunocompetent adult. HPeVs usually have a benign prognosis, although the elderly and individuals with comorbidities which alter the normal function of the immune system, such as diabetes and alcohol abuse, should be aware they are at a higher risk of a negative prognosis. The use of corticosteroids remains controversial, and a short course should be preferred over a longer one in HPeV, when their use is deemed necessary.

Further studies are warranted to determine whether HPeV is a novel cause of encephalitis in immunocompetent adults. The hypothesis is that climate changes may have contributed to this shift in pathogenicity.

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#### Availability of data and materials

The data generated in the present study may be requested from the corresponding author.

### Author's contributions

MC, AG and FS conceptualized the study. MC, FS, DV, SB, AN, LG and SDM were responsible for the treatments of the patient and the patient's data. FS, DV, AG, SB, AN, LG and SDM were involved in literature review. FS, DV, SDM, AG, LG and MC were involved in the writing of the original draft of the manuscript. LG and MC were involved in the writing, reviewing and editing of the manuscript. MC, AG and AN were involved in table editing. All authors have read and approved the final manuscript and confirm the authenticity of all the raw data.

### Ethics approval and consent to participate

Ethical committee approval was waived given the observational and anecdotal nature of a case report. A written informed consent for the use of anonymized data for research and publishing purposes was obtained from the patient in the present study.

### Patient consent for publication

A written informed consent for the use of anonymized data for research and publishing purposes was obtained from the patient in the present study.

### Competing interests

The authors declare that they have no competing interests.

### References

- Joki-Korpela P and Hyypiä T: Parechoviruses, a novel group of human picornaviruses. *Ann Med* 33: 466-471, 2001.
- Mirand A, Archimbaud C, Chambon M, Regagnon C, Brebion A, Bailly JL, Peigue-Lafeuille H and Henquell C: Diagnosis of human parechovirus infections of the central nervous system with a commercial real-time reverse transcription-polymerase chain reaction kit and direct genotyping of cerebrospinal fluid specimens. *Diagn Microbiol Infect Dis* 74: 78-80, 2012.
- Centers for Disease Control and Prevention (CDC): Nonpolio enterovirus and human parechovirus surveillance-united states, 2006-2008. *MMWR Morb Mortal Wkly Rep* 59: 1577-1580, 2010.
- Nielsen ACY, Böttiger B, Midgley SE and Nielsen LP: A novel enterovirus and parechovirus multiplex one-step real-time PCR-validation and clinical experience. *J Virol Methods* 193: 359-363, 2013.
- Harvala H, McLeish N, Kondracka J, McIntyre CL, Leitch ECM, Templeton K and Simmonds P: Comparison of human parechovirus and enterovirus detection frequencies in cerebrospinal fluid samples collected over a 5-year period in edinburgh: HPeV type 3 identified as the most common picornavirus type. *J Méd Virol* 83: 889-896, 2011.
- de Crom SC, Obihara CC, van Loon AM, Argilagos-Alvarez AA, Peeters MF, van Furth AM and Rossen JW: Detection of enterovirus RNA in cerebrospinal fluid: Comparison of two molecular assays. *J Virol Methods* 179: 104-107, 2012.
- Leber AL, Everhart K, Balada-Llasat JM, Cullison J, Daly J, Holt S, Lephart P, Salimnia H, Schreckenberger PC, Desjarlais S, *et al*: Multicenter evaluation of BioFire FilmArray Meningitis/Encephalitis panel for detection of bacteria, viruses, and yeast in cerebrospinal fluid specimens. *J Clin Microbiol* 54: 2251-2261, 2016.
- Mizuta K, Yamakawa T, Nagasawa H, Itagaki T, Katsushima F, Katsushima Y, Shimizu Y, Ito S, Aoki Y, Ikeda T, *et al*: Epidemic myalgia associated with human parechovirus type 3 infection among adults occurs during an outbreak among children: Findings from Yamagata, Japan, in 2011. *J Clin Virol* 58: 188-193, 2013.
- Mizuta K, Kuroda M, Kurimura M, Yahata Y, Sekizuka T, Aoki Y, Ikeda T, Abiko C, Noda M, Kimura H, *et al*: Epidemic myalgia in adults associated with human parechovirus type 3 Infection, Yamagata, Japan, 2008. *Emerg Infect Dis* 18: 1787-1793, 2012.
- Mizuta K, Yamakawa T, Kurokawa K, Chikaoka S, Shimizu Y, Itagaki T, Katsushima F, Katsushima Y, Ito S, Aoki Y, *et al*: Epidemic myalgia and myositis associated with human parechovirus type 3 Infections occur not only in adults but also in children: Findings in Yamagata, Japan, 2014. *Epidemiol Infect* 144, 1286-1290, 2016.
- Westerhuis B, Kolehmainen P, Benschop K, Nurminen N, Koen G, Koskiniemi M, Simell O, Knip M, Hyöty H, Wolthers K and Tauriainen S: Human parechovirus seroprevalence in finland and the netherlands. *J Clin Virol* 58: 211-215, 2013.
- Mardekian SK, Fortuna D, Nix A, Bhatti T, Wiley CA, Flanders A, Urtecho J, Sloane J, Ahmad J and Curtis MT: Severe human parechovirus type 3 myocarditis and encephalitis in an adolescent with hypogammaglobulinemia. *Int J Infect Dis* 36: 6-8, 2015.
- Kong KL, Lau JSY, Goh SM, Wilson HL, Catton M and Korman TM: Myocarditis caused by human parechovirus in adult. *Emerg Infect Dis* 23: 1571-1573, 2017.
- de Groot-Mijnes JD, de Visser L, Zuurveen S, Martinus RA, Völker R, ten Dam-van Loon NH, de Boer JH, Postma G, de Groot RJ, van Loon AM and Rothova A: Identification of new pathogens in the intraocular fluid of patients with uveitis. *Am J Ophthalmol* 150: 628-636, 2010.
- Yamamoto SP, Kaida A, Naito T, Hosaka T, Miyazato Y, Sumimoto S, Kohdera U, Ono A, Kubo H and Iritani N: Human parechovirus infections and child myositis cases associated with genotype 3 in Osaka City, Japan, 2014. *J Méd Microbiol* 64: 1415-1424, 2015.
- McGregor T, Bu'Lock FA, Wiselka M and Tang JW: Human parechovirus infection as an undiagnosed cause of adult pericarditis. *J Infect* 75: 596-597, 2017.
- Shinomoto M, Kawasaki T, Sugahara T, Nakata K, Kotani T, Yoshitake H, Yuasa K, Saeki M and Fujiwara Y: First report of human parechovirus type 3 infection in a pregnant woman. *Int J Infect Dis* 59: 22-24, 2017.
- Nakamura K, Saito K, Hara Y, Aoyagi T, Kitakawa K, Abe Y, Takemura H, Ikeda F, Kaku M and Kanemitsu K: Severe epidemic myalgia with an elevated level of serum Interleukin-6 caused by human parechovirus type 3: A case report and brief review of the literature. *BMC Infect Dis* 18: 381, 2018.
- Chimunda T, Subramanian R, Smith J and Mahony A: First reported case of human parechovirus encephalitis in an adult patient complicated by refractory status epilepticus. *IDCases* 15: e00475, 2019.
- Miyazaki M, Hara K, Takayoshi T, Kawase T, Nakagawa Y, Arai T, Sugimoto T, Nishiyama K, Gonzalez G, Hanaoka N, *et al*: Epidemic myalgia associated with human parechovirus type 3 infection. *Intern Med* 59: 739-744, 2020.
- Orimo K, Hatano K, Sato N, Okabe S, Suzuki A, Mori K, Chiba T and Hashida H: Clinical characteristics of epidemic myalgia associated with human parechovirus type 3 during the summer of 2019. *Intern Med* 59: 1721-1726, 2020.
- Masuda S, Koizumi K, Sato M, Uojima H, Kimura K, Nishino T, Ichita C, Sasaki A, Makazu M, Kobayashi M, *et al*: Severe generalized epidemic myalgia in an adult due to human parechovirus type 3: A case report. *Cureus* 14: e30587, 2022.
- Abed Y and Boivin G: Human parechovirus infections in Canada. *Emerg Infect Dis* 12: 969-975, 2006.
- Watanabe K, Oie M, Higuchi M, Nishikawa M and Fujii M: Isolation and characterization of novel human parechovirus from clinical samples. *Emerg Infect Dis* 13: 889-895, 2007.
- Tanaka S, Kunishi Y, Ota M, Ono A, Kanno N, Kurakami Y, Yanagibashi T, Matsubayashi M, Hao Y, Iwabuchi K, *et al*: Severe human parechovirus type 3 infection in adults associated with gastroenteritis in their children. *Infect Dis (Lond)* 49: 772-774, 2017.
- Gagnier JJ, Kienle G, Altman DG, Moher D, Sox H and Riley D: CARE Group: The CARE guidelines: Consensus-based clinical case reporting guideline development. *BMJ Case Rep* 2013: bcr2013201554, 2013.
- Piralla A, Furione M, Rovida F, Marchi A, Stronati M, Gerna G and Baldanti F: Human parechovirus infections in patients admitted to hospital in Northern Italy, 2008-2010. *J Méd Virol* 84: 686-690, 2012.

28. Benschop KSM, Schinkel J, Minnaar RP, Pajkrt D, Spanjerberg L, Kraakman HC, Berkhout B, Zaaijer HL, Beld MG and Wolthers KC: Human parechovirus infections in dutch children and the association between serotype and disease severity. *Clin Infect Dis* 42: 204-210, 2006.
29. Sharp J, Harrison CJ, Puckett K, Selvaraju SB, Penaranda S, Nix WA, Oberste MS and Selvarangan R: Characteristics of young infants in whom human parechovirus, enterovirus or neither were detected in cerebrospinal fluid during sepsis evaluations. *Pediatr Infect Dis J* 32: 213-216, 2012.
30. Kadambari S, Harvala H, Simmonds P, Pollard AJ and Sadarangani M: Strategies to improve detection and management of human parechovirus infection in young infants. *Lancet Infect Dis* 19: e51-e58, 2019.
31. Meyding-Lamadé U, Jacobi C, Martinez-Torres F, Lenhard T, Kress B, Kieser M, Klose C, Einhäupl K, Bösel J, Mackert MB, *et al*: The German trial on aciclovir and corticosteroids in Herpes-simplex-virus-Encephalitis (GACHE): A multicenter, randomized, double-blind, placebo-controlled trial. *Neurol Res Pract* 1: 26, 2019.
32. Moscatt V, Marino A, Ceccarelli M, Cosentino F, Zagami A, Celesia BM, Nunnari G and Cacopardo B: Possible role of low dose dexamethasone administration in listeria monocytogenes meningoencephalitis: A case series. *Biomed Rep* 17: 73, 2022.
33. Beaman MH and Wesselingh SL: 4: Acute Community-acquired meningitis and encephalitis. *Méd J Aust* 176: 389-396, 2002.



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