

## Meningitis (Viral)

## ABSTRACTS

Keller BC., 2002. Topical Treatment for Arthritis.

Pevear DC., 1999. Activity of pleconaril against enteroviruses.

## SUGGESTED READING.

Aurelian L., 1998. Herpes simplex virus type 2: unique biological properties include neoplastic potential mediated by the PK domain of the large subunit of ribonucleotide reductase.

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Dupuis C., 2002. [Herpetic meningitis in the child].

Fujimoto H., 2003. Epstein-Barr virus infections of the central nervous system.

Gilad R., 2003. Optic neuritis complicating west nile virus meningitis in a young adult.

Goldstein R., 1986. Mollaret's meningitis: a case with increased circulating natural killer cells.

Graman PS., 1987. Mollaret's meningitis associated with acute Epstein-Barr virus mononucleosis.

Kojima Y., 2002. Recurrent herpes simplex virus type 2 meningitis: a case report of Mollaret's meningitis.

Lee CT., 1992. Mollaret's meningitis: a case report and literature review.

Mascia RA., 1984. Mollaret's meningitis: an unusual disease with a characteristic presentation.

Merzeniuk ZA., 2003. [Lactoferrin and its role in the pathogenesis of tick-borne encephalitis]

Norwood C., 2003. Case reports of viral meningitis/encephalitis.

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Satoh A., 2003. [A case of recurrent meningitis with association of human herpes virus-6 hepatitis]

Segal S., 2003. The future of meningitis vaccines.

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Stoppe G., 1987. Mollaret's meningitis: CSF-immunocytological examinations.

Tedder DG., 1994. Herpes simplex virus infection as a cause of benign recurrent lymphocytic meningitis.

Yamamoto LJ., 1991. Herpes simplex virus type 1 DNA in cerebrospinal fluid of a patient with Mollaret's meningitis.

Szychowska Z., 1998. [The thyroid function in children with viral meningitis]

**Topical Treatment for Arthritis.**

Keller, B.C.

Clinical Study 2002 (unpublished).

**Activity of pleconaril against enteroviruses.**

Pevear DC, Tull TM, Seipel ME, Groarke JM. ViroPharma Incorporated, Exton, Pennsylvania 19341, USA.  
dpevear@viropharma.com

Antimicrob Agents Chemother 1999 Sep;43(9):2109-15

The activity of pleconaril in cell culture against prototypic enterovirus strains and 215 clinical isolates of the most commonly isolated enterovirus serotypes was examined. The latter viruses were isolated by the Centers for Disease Control and Prevention during the 1970s and 1980s from clinically ill subjects. Pleconaril at a concentration of  $\leq 0.03$  microM inhibited the replication of 50% of all clinical isolates tested. Ninety percent of the isolates were inhibited at a drug concentration of  $\leq 0.18$  microM. The most sensitive serotype, echovirus serotype 11, was also the most prevalent enterovirus in the United States from 1970 to 1983. Pleconaril was further tested for oral activity in three animal models of lethal enterovirus infection: coxsackievirus serotype A9 infection in suckling mice, coxsackievirus serotype A21 strain Kenny infection in weanling mice, and coxsackievirus serotype

B3 strain M infection in adult mice. Treatment with pleconaril increased the survival rate in all three models for both prophylactic and therapeutic dosing regimens. Moreover, pleconaril dramatically reduced virus levels in target tissues of coxsackievirus serotype B3 strain M-infected animals. Pleconaril represents a promising new drug candidate for potential use in the treatment of human enteroviral infections.

## **SUGGESTED READING**

### **Herpes simplex virus type 2: unique biological properties include neoplastic potential mediated by the PK domain of the large subunit of ribonucleotide reductase.**

Aurelian L Department of Biochemistry, The Johns Hopkins School of Public Health, 615 North Wolfe Street, Baltimore, MD 21205, USA.

Front Biosci 1998 Feb 15;3:D237-49

The prevalence of herpes simplex virus type 2 (HSV-2) infections in the US has increased approximately 30%. Like HSV-1, which causes facial lesions, HSV-2 causes symptomatic lesions (at genital sites) and establishes latent infections of the sensory ganglia. However, the two viruses are biologically distinct, suggesting that they possess unique functions which are mediated by different viral genes. Unlike HSV-1, HSV-2 is a tumor virus. It causes neoplastic transformation of cultured human cells and tumors in animals. The oncogene is at the 5'-terminal of a chimeric gene that also codes for the large subunit of viral ribonucleotide reductase (RR1). It was captured from the cell and it codes for a novel growth factor receptor serine-threonine protein kinase (PK) the minimal genetic information of which can adapt to a relatively wide functional diversity due to the flexible use of additional and alternate catalytic sites and protein interaction motifs which are organized in an efficient, almost superimposed fashion. By contrast to other growth factor receptor serine-threonine kinases studied so far, the HSV-2 oncoprotein (RR1 PK) activates the RAS signaling pathway, thereby providing a biological bridge to the tyrosine growth factor receptor kinases. Expression of the oncogene is required for neoplastic transformation and tumor growth in vivo is inhibited by antisense inhibition of oncogene expression. The virus conserved the captured oncogene because it provides a biological advantage for its survival. In cultured cells, RR1 PK is required for viral IE gene transcription. In vivo, RR1 PK is likely to be involved in latency reactivation.

### **Outbreaks of aseptic meningitis associated with echoviruses 9 and 30 and preliminary surveillance reports on enterovirus activity--United States, 2003.**

Centers for Disease Control and Prevention (CDC).

MMWR Morb Mortal Wkly Rep. 2003 Aug 15;52(32):761-4.

Aseptic or viral meningitis is the most common type of meningitis and is associated with an estimated 26,000--42,000 hospitalizations each year in the United States. Enteroviruses are the most common cause of aseptic meningitis. Echovirus 9 (E9) and echovirus 30 (E30) have been associated frequently with outbreaks of aseptic meningitis. During March 2003, several state public health departments noted increased reports of aseptic meningitis and, as of August 7, seven states (Arizona, California, Georgia, Idaho, Oregon, South Carolina, and Texas) had reported outbreaks associated with either E9 or E30. This report summarizes the epidemiologic features of the aseptic meningitis outbreaks in five states (Arizona, California, Georgia, Idaho, and South Carolina) and provides an overview of enterovirus activity in the United States during January 1--August 7. Enteroviruses, E9 and E30 in particular, should be considered in the differential diagnosis of persons with aseptic meningitis.

### **[Herpetic meningitis in the child] [Article in French]**

Dupuis C, Despert V, Vigneron P. Departement de medecine de l'enfant et de l'adolescent, hopital Sud, CHU de Rennes, 16, boulevard de Bulgarie, BP 56129, 35056 Rennes, France.

Arch Pediatr. 2002 Nov;9(11):1153-5.

In children, viral meningitis is usually caused by Enteroviruses. Herpes simplex viruses (HSV) are known to be a cause of meningo-encephalitis. HSV-2 has been reported to cause recurrent meningitis (Mollaret's meningitis) in adults.

**CASE REPORT:** We report the case of a three-year-old girl with HSV-1 meningitis, whose evolution with treatment by aciclovir was good.

**CONCLUSION:** HSV-1 has rarely been reported as a cause of isolated aseptic meningitis in children. Primary phase of herpes simplex virus infection is not usually associated with neurologic complications.

### **Epstein-Barr virus infections of the central nervous system.**

Fujimoto H, Asaoka K, Imaizumi T, Ayabe M, Shoji H, Kaji M. First Department of Internal Medicine, Kurume University School of Medicine, Kurume 830-0011.

Intern Med. 2003 Jan;42(1):33-40.

**OBJECTIVE:** Epstein-Barr virus (EBV), a lymphotropic herpes virus causing infectious mononucleosis (IM), also causes various central nervous system (CNS) infections. In the present study, EBV CNS infections were investigated.

**PATIENTS AND METHODS:** For adult inpatients in our hospital and related hospitals between 1984-2002, CNS syndromes with IM symptoms were examined, and serologic positives were assessed according to established criteria. Polymerase chain reaction (PCR) was performed for cerebrospinal fluid (CSF) from seven patients.

**RESULTS:** Ten patients with EBV-related CNS infections were found; their mean age was 36 years (20-79 years). The neurologic forms were as follows: acute encephalitis (4 patients), acute cerebellar ataxia (1), acute disseminated encephalomyelitis (ADEM) (2), myelitis (1), and meningitis (2). The PCR from CSF was positive in two patients with meningitis, one patient with ADEM, and one patient with encephalitis-associated chronic EBV infection. One case of encephalitis and another of relapsing ADEM were attributed to chronic EBV infection.

**CONCLUSION:** Our study identified a variety of EBV-related CNS infections. EBV CNS infections are divided into two groups: 1) CNS syndromes associated with primary EBV or reactivated infection, and 2) those associated with chronic EBV infection; it is notable that in the former, diverse CNS syndromes including ADEM can occur, whereas in the latter, chronic or recurrent CNS syndromes are produced.

### **Optic neuritis complicating west Nile virus meningitis in a young adult.**

Gilad R, Lampl Y, Sadeh M, Paul M, Dan M. Dept of Neurology, Wolfson Medical Center, Holon, Israel.

Infection. 2003 Jan;31(1):55-6.

A case of West Nile virus (WNV) infection with meningitis and optic neuritis in a 28-year-old man is presented. The patient had a number of unusual clinical and laboratory findings that broadened the differential diagnosis. The emergence of WNV infection in southern Europe and North America calls for increased awareness of physicians to this clinical entity.

### **Mollaret's meningitis: a case with increased circulating natural killer cells.**

Goldstein R, Guberman A, Izaguirre CA, Karsh J

Ann Neurol 1986 Sep;20(3):359-61

A patient with longstanding Mollaret's meningitis had an increased number of circulating natural killer cells during an acute attack, as evidenced by 73% large granular lymphocytes and 80% Leu-11a-positive peripheral mononuclear cells. Numbers of large granular lymphocytes and Leu-11a-positive cells returned to normal by three months after the attack. Similarity of the morphological features of the Mollaret's cell to those of large granular lymphocytes is noted.

### **Mollaret's meningitis associated with acute Epstein-Barr virus mononucleosis.**

Graman PS

Department of Medicine, University of Rochester, School of Medicine and Dentistry, NY 14642.

Arch Neurol 1987 Nov;44(11):1204-5

A 19-year-old man developed recurrent aseptic meningitis (Mollaret's meningitis) during the course of acute Epstein-Barr virus infectious mononucleosis. Serum contained heterophil antibody and Epstein-Barr virus-specific antibodies characteristic of acute infection. Seven brief episodes of aseptic meningitis were documented over the following one-year period, in each case with a polymorphonuclear pleocytosis in the cerebrospinal fluid. Acute infection with Epstein-Barr virus, or subsequent reactivation of virus, may account for some cases of Mollaret's meningitis.

## **Recurrent herpes simplex virus type 2 meningitis: a case report of Mollaret's meningitis.**

Kojima Y, Hashiguchi H, Hashimoto T, Tsuji S, Shoji H, Kazuyama Y. Department of Neurology, University of Occupational and Environmental Health, School of Medicine, Kitakyushu 870-8555, Japan.

Jpn J Infect Dis. 2002 Jun;55(3):85-8.

It is well known that herpes simplex virus (HSV) type 2 produces acute meningitis, while HSV type 2 rarely causes recurrent meningitis (Mollaret's meningitis). We report the history of a 40-year-old patient with recurrent HSV type 2 meningitis (Mollaret's meningitis). The patient had seven episodes of meningeal symptoms within a 7-year period. In the seventh episode, HSV type 2 DNA was confirmed by nested polymerase chain reaction (PCR) with the cerebrospinal fluid (CSF). A real-time quantitative PCR study of the first CSF sample detected 2,000 copies of the HSV genome, which rapidly disappeared following treatment with acyclovir. The present case may be the first case of HSV type 2 Mollaret's meningitis to be documented in Japan. In our case, HSV serum antibody titers were at low levels during the whole course of the disease. The possible pathophysiology of this case is discussed.

## **Mollaret's meningitis: a case report and literature review.**

Lee CT, Chao CH, Yu KW, Liu CY

Department of Medicine, National Defense Medical Center, Taipei, Taiwan, R.O.C.

Chung Hua I Hsueh Tsa Chih (Taipei) 1992 Apr;49(4):289-93

Mollaret's meningitis is a rare syndrome with characteristic features. We present a case with interesting clinical course and cerebrospinal fluid studies. The patient was admitted to Veterans General Hospital-Taipei 6 times between May, 1984 and May, 1991 because of recurrent meningitis (Mollaret's meningitis). No causative etiology was identified although a series of investigations were performed, including studies of the blood and CSF, roentgenogram and nuclear scintinographs. To date, there has been no standard therapeutic modality for this disease. We use aspirin for his symptomatic control with satisfactory result though colchicine has been reported as being effective also.

## **Mollaret's meningitis: an unusual disease with a characteristic presentation.**

Mascia RA, Smith CW Jr

Am J Med Sci 1984 Jan-Feb;287(1):52-3

Mollaret's meningitis (benign recurrent aseptic meningitis) is a rare syndrome with characteristic features. Patients present with recurrent attacks of meningismus which are sudden in onset and last from one to seven days. During the attacks the spinal fluid shows pleocytosis with lymphocyte predominance. Large endothelial cells with indistinct cytoplasm (Mollaret's cells) are typically present in the CSF. The attacks resolve spontaneously and without sequellae. Symptom-free intervals can be as brief as a few days or as long as several years. Though specific treatment is not available, Colchicine has been reported to decrease the severity and frequency of attacks. While acute episodes may cause significant symptoms, the long-term prognosis is excellent.

## **[Lactoferrin and its role in the pathogenesis of tick-borne encephalitis] [Article in Russian]**

Merzeniuk ZA, Lykova OF, Konyshva TV.

Klin Lab Diagn. 2003 Apr;(4):18-9.

The content of lactoferrin (LF) was studied in the liquor and blood of patients with tick-borne encephalitis (TBE) of the meningeal and focal types; additionally, the information density of the discussed parameter was assessed for evaluating the severity and degree of the inflammation process in the central nervous system (CNS). The LF level was determined in liquor of 37 samples obtained from TBE patients (main group) and of 10 persons with osteochondrosis (controls); it was also determined in the serum taken from 21 TBE patients and from 40 healthy donors by using the immune-enzyme analysis. The LF concentration in TBE patients was found to exceed the normal value by 1.5-3 times during the whole observation period. As for the liquor, it was high, by the onset of the disease, by more than 20 times, however, after the 7th day it was higher 6-fold. A direct dependence of a concentration of the studied protein on a form and severity of the disease was established. The LF level in the liquor of TBE patients alongside with clinical signs can be an objective indicator of a severity and activity of the inflammation process in the CNS; it can also be a criteria of how much the conducted therapy effective is.

## **Case reports of viral meningitis/encephalitis.**

Norwood C, Naponick JJ, Burton S, Varoqua S, Morris J, Kuizon D. Louisiana State University Family Medicine Residency, Alexandria, USA.

J La State Med Soc. 2003 May-Jun;155(3):154-7.

The purpose of this paper is to present three case reports of patients who presented to a local hospital in Northern Louisiana with symptoms of viral meningitis and encephalitis. It also updates physicians on the signs and symptoms of persons infected with West Nile virus (WNV), a new and emerging infection in the Western Hemisphere. Beginning in June 2002, persons in Louisiana, particularly the southern part of the state, started presenting to health facilities with symptoms of infection with the WNV. By August 2002, persons in the northern part of the state were also experiencing symptoms that include neurologic presentations of the disease. After completing recommended diagnostic measures for possible infection with flaviviruses, the three cases presented here were positive for viral meningitis/encephalitis. Beginning in June 2002, the state experienced an outbreak of WNV of epidemic proportions. Consequently, clinicians need to be mindful of the symptoms, diagnostic measures, treatment, prevention, and reporting of meningitis/encephalitis.

### **[Enteroviral meningitis in adults, underestimated illness: description of 30 observations from 1999 to 2000, and evolution of clinical practices during 2001] [Article in French]**

Peigue-Lafeuille H, Archimbaud C, De Champs C, Croquez N, Laurichesse H, Clavelou P, Aumaitre O, Schmidt J, Henquell C, Bailly JL, Chambon M. Laboratoire de virologie du CHRU, faculte de medecine, 28, Place Henri-Dunant, 63001 Cedex, Clermont-Ferrand, France. Helene.Lafeuille@u-clarmont1.fr

Pathol Biol (Paris). 2002 Nov;50(9):516-24.

Enteroviral meningitis is well documented in children but underestimated in adults. The analysis of 30 cases of adult meningitis prospectively diagnosed by enterovirus genome detection (RT-PCR) in cerebrospinal fluid (CSF) between 1999 and 2000 in routine practice showed diagnosis to be problematic. Characteristic symptoms were inconstant (the association of fever/headache/stiff neck absent in 41%) and sometimes misleading (the presence of peribuccal lesions). CSF data showed a predominance of lymphocytes in only 44% of patients. The most reliable criterion was normal constant CSF glucose levels. Thirty three per cent of patients were admitted during cold months. Management of patients varied markedly between departments, and included computed tomography (33%), and the prescription of aciclovir (20%) or antibiotics (53%). A report of positive enterovirus RT-PCR had only low impact on management because it took 6 days to obtain the results (versus 3 days in children during the same period). These findings were communicated to all hospital physicians concerned and as a result, the number of RT-PCR in adults increased significantly during 2001. Again, enteroviral meningitis was diagnosed in adults despite a much lower incidence of the illness in 2001 compared to 2000. Thus this pathology should not be underestimated in adults. Considerable medical expenditure might be avoided (cumulative numbers of 172 days in hospital and 82 days of antibiotics in this study), if rapid and accurate diagnostic techniques were available.

### **Viral meningitis and encephalitis: traditional and emerging viral agents.**

Romero JR, Newland JG. Combined Division of Pediatric Infectious Diseases, Associate Professor of Pediatrics, Pathology and Microbiology, University of Nebraska Medical Center, Omaha, NE 68178, USA. jrromero@unmc.edu

Semin Pediatr Infect Dis. 2003 Apr;14(2):72-82.

In the United States, the annual number of central nervous system (CNS) infections that occur as a result of viral agents far exceeds that of infections caused by bacteria, yeast, molds, and protozoa combined. The recent incursion of West Nile virus (WNV) into North America has led to a dramatic change in the incidence and epidemiology of summer-associated viral CNS disease. As a result of increased testing for WNV, lesser known viral causes of CNS infection have been identified. Even the epidemiology of such traditional viral neuropathogens as rabies has changed in recent years. This review provides an overview of viruses traditionally associated with meningitis and encephalitis (enteroviruses, La Crosse virus, St. Louis encephalitis virus, eastern and western equine viruses, varicella-zoster virus), as well as several of the less common (Powassan virus, lymphocytic choriomeningitis virus, Colorado tick fever virus, rabies virus, influenza viruses, etc.) and emerging (West Nile virus) viral pathogens. Copyright 2003 Elsevier Inc. All rights reserved.

### **[A case of recurrent meningitis with association of human herpes virus-6 hepatitis] [Article in Japanese]**

Satoh A, Niwa K, Kawaguchi C, Takeoka T, Shinohara Y. Department of Neurology, Tokai University School of Medicine.

Rinsho Shinkeigaku. 2003 May;43(5):281-3.

A 27-year-old man presenting with recurrent meningitis associated with the activation of hepatitis was reported. Although he showed headache only, he was diagnosed as viral meningitis with high transaminase activities on admission. Human herpes virus-6 (HHV-6) DNA was revealed in the liver tissue by the polymerase chain reaction. This case was considered viral meningitis with HHV-6 associated hepatitis. It is suggested that the importance of viral evaluations not only herpes virus type 1 x 2, cytomegaro virus and EB virus, but also HHV-6 infection in a case of recurrent meningitis with hepatitis simultaneously.

### **The future of meningitis vaccines.**

Segal S, Pollard AJ. Department of Paediatrics, John Radcliffe Hospital, Oxford OX3 9DU.

Hosp Med. 2003 Mar;64(3):161-7.

Without effective vaccines meningitis remains a substantial worldwide threat with major health-care implications. A number of advances have been made in vaccine design and implementation over the last decade, with new vaccine initiatives providing substantial promise for the future reduction of global disease burden.

### **[Meningitis and encephalitis in Poland in 2000] [Article in Polish]**

Stefanoff P, Zielinski A. Zaklad Epidemiologii Panstwowego Zakladu Higieny ul. Chocimska 24, 00-791 Warszawa.  
pstefanoff@pzh.gov.pl

Przegl Epidemiol. 2002;56(2):265-73.

A total of 2,033 cases of meningitis and 570 of encephalitis were reported in Poland in 2000. Among cases of meningitis 1,051 (51.7%) were classified as viral and 982 (48.3%) as bacterial. Etiological factors were determined in 36.7% (360/982) cases of bacterial meningitis. *Neisseria meningitidis*, *Haemophilus influenzae*, and *Streptococcus pneumoniae* were found in 10.3% (101/982), 8.7% (85/982), and 7.5% (74/982) cases, respectively. As in previous years, *N. meningitidis* typed B was strongly predominating. Out of 570 cases of encephalitis, 170 (29.8%) were tick borne, of which most were reported from endemic areas of north-eastern part of the country.

### **Mollaret's meningitis: CSF-immunocytological examinations.**

Stoppe G, Stark E, Patzold U

J Neurol 1987 Feb;234(2):103-6

Mollaret's meningitis is a rare clinical entity consisting of recurrent attacks of meningeal irritation, which, after a sudden onset, last for a few days. The prognosis appears to be excellent, although the aetiology has not been established. In the CSF so-called endothelial cells are a typical finding, but their classification is not yet clear. In the present case immunocytological examination of CSF cells revealed that the so-called Mollaret cells are monocytes. The time course of changes in helper/suppressor ratio is similar to that in other infectious diseases of the central nervous system.

### **Herpes simplex virus infection as a cause of benign recurrent lymphocytic meningitis.**

Tedder DG, Ashley R, Tyler KL, Levin MJ University of Colorado Health Sciences Center, Children's Hospital, Denver.

Ann Intern Med 1994 Sep 1;121(5):334-8

**OBJECTIVE:** To identify the role of herpes simplex virus (HSV) in causing benign recurrent lymphocytic meningitis.

**DESIGN:** Prospective cohort study.

**SETTING:** Tertiary referral center.

**PATIENTS:** 20 consecutive patients with a provisional diagnosis of benign recurrent lymphocytic meningitis had cerebrospinal fluid specimens submitted between 1990 and 1993 to the diagnostic virology laboratory. Thirteen patients met our criteria for benign recurrent lymphocytic meningitis.

**MEASUREMENTS:** Herpes simplex virus DNA was detected in cerebrospinal fluid specimens using the polymerase chain reaction, followed by hybridization with a HSV-specific DNA probe. Herpes simplex virus type 1 and type 2 DNA products were distinguished by digestion with restriction enzymes and analysis by gel electrophoresis. Anti-HSV antibodies in cerebrospinal fluid were detected by immunoblot.

**RESULTS:** The patients had 3 to 9 attacks (mean, 4.6 attacks) of benign recurrent lymphocytic meningitis during periods ranging from 2 to 21 years (mean, 8.4 years). Three of 13 patients had known recurrent genital herpes. Cerebrospinal fluid analysis showed 48 to 1600 cells/microL, glucose levels of more than 2.22 mmol/L (40 mg/dL), and protein levels of 41 to 240 mg/dL (0.41 to 2.4 g/L). Herpes simplex virus DNA and anti-HSV antibodies were detected in cerebrospinal fluid samples in 11 of 13 patients (84.6%; 95% CI, 55% to 98%). Ten of these 11 patients had HSV type 2 DNA and HSV type 2 antibodies. One patient had HSV type 1 DNA and HSV type 1 antibodies in the cerebrospinal fluid. The remaining two patients had only anti-HSV type 2 antibodies.

**CONCLUSIONS:** Herpes simplex virus, predominantly HSV type 2, was the major agent causing benign recurrent lymphocytic meningitis that met our specified diagnostic criteria.

### **Herpes simplex virus type 1 DNA in cerebrospinal fluid of a patient with Mollaret's meningitis.**

Yamamoto LJ, Tedder DG, Ashley R, Levin MJ Department of Internal Medicine, St. Joseph's Hospital, Denver, CO.

N Engl J Med 1991 Oct 10;325(15):1082-5

No abstract.

### **[The thyroid function in children with viral meningitis] [Article in Polish]**

Szychowska Z, Kucharska W. Klinika Chorob Zakaznych Wieku Dzieciecego AM we Wroclawiu.

Endokrynol Diabetol Chor Przemiany Materii Wieku Rozw. 1998;4(1):13-7.

Thyroid function was investigated in children affected with viral meningitis caused by Mumpsvirus or enteroviruses. Serum or plasma levels of thyroid-stimulating hormone (TSH), triiodothyronine (T3), free triiodothyronine (FT3), thyroxine (T4) and free thyroxine (FT4) were measured twice in course of the disease: at admission and at recovery (day 10-14 from the onset of illness). The levels of hormones were measured by radioimmunoassay (RIA) or by enzyme linked fluorescent assay (ELFA). A decrease in serum or plasma concentrations of TSH, T3, FT3 and T4 (T4 - only when measured by RIA) was found at the beginning of illness as compared to the controls, which indicates the low-T3 syndrome in children with viral meningitis. These disturbances were present also at recovery. When comparing thyroid function in children suffering from bacterial and viral meningitis, a more significant decrease in the levels of thyroid hormones (especially T3 and FT3) was found at the beginning of bacterial than viral meningitis. Un resolved questions are the causes and the importance of low-T3 syndrome in children with viral meningitis.

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