CASE REPORT

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Meningococcal meningitis in a young adult – case report and literature review

Natalia Biedroń[1,A-D] ✉, **Zuzanna Paluch**[1,A-D], **Michał Borys**[2,E-F]

[1] *Student Research Group, Second Department of Anaesthesiology and Intensive Therapy, Medical University, Lublin, Poland*
[2] *Second Department of Anaesthesiology and Intensive Therapy, Medical University, Lublin, Poland*
A – Research concept and design, B – Collection and/or assembly of data, C – Data analysis and interpretation, D – Writing the article, E – Critical revision of the article, F – Final approval of the article

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Abstract

Meningococcal meningitis is an inflammation of the meninges caused by Neisseria meningitidis. Clinically, meningococcal meningitis does not differ from other bacterial meningitis. Initially, the symptoms of the disease may be non-specific, such as fever, muscle pain, and weakness, only later do the symptoms typical of meningitis appear. Adolescents and adults have a lower incidence of neck stiffness and altered consciousness than younger patients. The disease is characterized by a rapid onset and progression of symptoms within a few hours. The detection of Neisseria meningitidis in the cerebrospinal fluid allows for the correct diagnosis and appropriate treatment. Antibiotics reduce mortality in meningococcal disease by up to five times. The case is presented of a young adult patient with a history of viral meningitis in childhood who was hospitalized for severe meningococcal meningitis and successfully treated.

Key words

treatment, epidemiology, vaccination, meningococcal meningitis

INTRODUCTION

Meningococcal meningitis is an inflammation of the meninges caused by *Neisseria meningitidis* [1] which can colonize the throat, and is associated with asymptomatic carriers. Severe invasive disease occurs only in some cases [2]. Bacteria are transmitted by droplets from person to person, and large groups of people are conducive to its spread. The highest incidence of meningococcal meningitis occurs between December and June. It is characterized by a high epidemic potential every 8–12 years in certain regions where epidemicsoccur [3]. Yearly and epidemic incidence rates and risk factors were presented in Figure 1 [3].

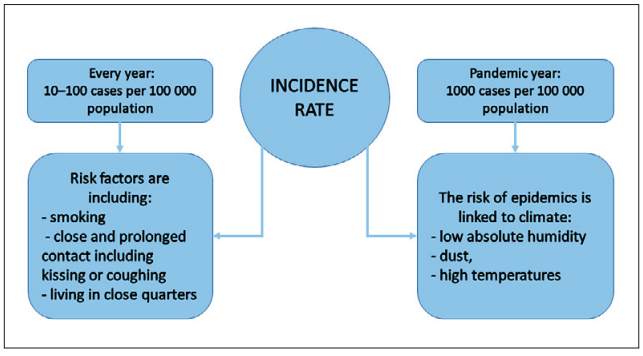

Figure 1. Incidence rate and risk factors of meningococcal meningitis

Invasive meningococcal disease is primarily observed in two age groups: infants who are susceptible to infection due to the disappearance of maternal antibodies early in life, and adolescents with a high rate of nasopharyngeal colonization [4]. In addition, children under five years of age do not have adequate immunity to *N. meningitidis* polysaccharide antigens. In addition, risk factors in the paediatric population of infection include frequent oral contact with objects in the environment, or lack of awareness and practice of good hygiene in childcare facilities [4]. Meningococcal meningitis has a significant mortality rate, of which adolescents and young adults may have a higher mortality risk than infants [5]. Data for EU countries in a review from 2004 – 2014 indicate mortality due to invasive meningococcal disease at the level of about 8% [3]. There are 12 groups of serotypes of which most meningococcal meningitis is caused by serotypes A, B, C, W, X, and Y. Vaccines are currently available for five of the six serogroups: A, B, C, W, and Y. Vaccine programmes using meningococcal serogroup C (MenC) vaccines in Europe have been successful in reducing MenC disease and carriage [6].

CASE REPORT

A 28-year-old male was transferred from the Department of Infectious Diseases to the Intensive Care Unit (ICU) due to meningococcal meningitis for the continuation of treatment. The patient had been suffering from low-grade fever for about a week, and on the day before admission, the fever was up to 40°C. The patient was transported to hospital due to loss of consciousness. The diagnosis of meningitis was made on the basis of a positive result of the *Neisseria meningitidis* test in the cerebrospinal fluid performed at the Department of Neurology in another hospital. Computed tomography of the head performed at the Department of Neurology showed smoothed cerebral grooves suggesting generalized cerebral oedema, without signs of intussusception into the foramen magnum, and asymmetric dilatation of the right lateral ventricle. There was no intracranial bleeding.

✉ Address for correspondence: Natalia Biedroń, Student Research Group, Second Department of Anaesthesiology and Intensive Therapy, Medical University, Lublin, Poland
E- mail: nataliabiedron7@gmail.com

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In the anamnesis, the patient was reported to have had viral meningitis at the age of. The patient has been in remission from ulcerative colitis for several years. The patient was taking mesalazine and prednisolone. Information on the patient's vaccination against *Neisseria meningitidis* was not received.

At the time of admission to the ICU, the patient was conscious, periodically agitated, and did not make logical contact. He periodically opened his eyes and localized the pain stimulus. Neck stiffness and a Babinski sign on the right side were evident. The patient received mannitol, dexamethasone, furosemide, and paracetamol. Antibiotic therapy with vancomycin and ceftriaxone was introduced.

Initially, the patient was in a very serious general condition. In the ICU, the patient was intubated. Analgosedation with propofol and remifentanil was started and mechanical ventilation was performed. Norepinephrine infusion started. A gastric tube was placed and enteral nutrition was started. Glycaemia was controlled. In the ultrasound examination, the diameter of the optic disc in the right eye was 7.7 mm and in the left eye – 7.6 mm.

After two days, the patient was extubated, breathed spontaneously, was agitated, and reported pain without indicating its location. Contact with the patient was difficult. Sedatives and painkillers were administered. The patient breathed through a face mask with passive oxygen therapy.

Neck stiffness persisted for four days of ICU hospitalization. The patient was moving strength four, muscle tone, and tendon reflexes were normal and symmetrical.

After six days in the ICU, the patient was in good general condition, conscious, in logical contact, auto- and allopsychically oriented, and circulatory efficient. He was transferred to the Department of Infectious Diseases. In laboratory tests, elevated values of inflammatory parameters were maintained. In the treatment, antibiotic therapy with ceftriaxone was continued and antifungal treatment with voriconazole was initiated due to the detection of a clinically significant concentration of Candida antigen in the blood serum on the 13th day of hospitalization. Magnetic resonance imaging of the head performed on the 14th day showed no abnormalities within the brain structures. As a result of the applied treatment, the patient's general condition improved and the symptoms subsided. After 17 days of hospitalization, the patient was discharged home in good condition.

DISCUSSION

The Infectious Diseases Society of America (IDSA) recommends that suspected meningitis is an absolute indication for hospital treatment [7]. A patient with a recent onset of headache, fever, neck stiffness, or impaired mental status would encourage most clinicians to consider the possibility of meningitis [8, 9]. In the presented patient, the symptoms were very non-specific. Only a small fever was present for approximately one week. He was transported to hospital due to a loss of consciousness. On admission, a standard head CT showed cerebral oedema. At the same time, the patient became periodically agitated and failed to establish logical contact with medical personnel. It was decided to perform a lumbar puncture and perform latex test with cerebral spinal fluid (CSF).

Meningococcus meningitis is a severe life-threatening infectious disease that occurs mostly in children and young adults [9, 10, 11]. The first and largest peak of inflammation affects children, especially children up to two years of age, which is associated with the immaturity of the immune system and disappearance of maternal antibodies. Children under five years of age are insufficiently resistant to *N. meningitidis* polysaccharide antigens. Another peak of maturity occurs in adolescents and young adults (15–24. years of life), which is associated with carriage and lifestyle [1, 6]. Patients with congenital immunoglobulin deficiencies, complement deficiency, HIV/AIDS, asplenia, and under eculizuma, are more at risk of meningococcus infection [9, 11, 12, 13]. It is well known that the action of glucocorticosteroids, including prednisolone, includes i.a. inhibition of the body's immune response, to which mesalazine may also contribute. The fact that a patient is taking prednisolone and mesalazine for ulcerative colitis may make him more susceptible to infection with *Neisseria meningitis*. Although, *N. meningitidis* acquisition does not always cause disease, it often results in asymptomatic colonization of the upper respiratory tract mucosa, a phenomenon known as carriage [11, 14].

According to data from the National Institute of Public Health – National Institute of Hygiene in 2020, in Poland the highest incidence was recorded among children under the age of four (1.20 per 100 thousand), and the incidence in this group is about 41.1% of all meningococcal meningitis and/or meningococcal etiology brain inflammation. In turn, in the age group of the described patient (25 – 44 years), only five cases of meningococcal meningitis (0.04 out of 100 thousand) were recorded. A total of 831 cases of meningitis and/or encephalitis were reported, of which 56 cases were meningococcal meningitis and/or brain inflammation (incidence 0.15 per 100,000), which indicates the rarity of *N. meningitidis* infection in Poland [15]. Male gender may have been an additional risk factor in the presented patient because men have a higher incidence rate of meningococcal meningitis than women in both urban and rural areas [15]. Moreover, male gender is associated with increased susceptibility to systemic inflammatory response syndrome (SIRS) and sepsis [16].

The infection is most commonly caused by direct contact with an infected person through aerosols and oral or nasal secretions [9, 14, 17]. In about 10% of people around the world, meningococci occur in the nasopharyngeal cavity, without causing any symptoms [6, 11]. *N. meningitidis* infection can occur in a variety of clinical manifestations – from mild fever to fulminant septic shock associated with extensive thrombosis, and cardiovascular insufficiency. This pathogenic bacteria can lead to meningococcal meningitis and sepsis, which is referred to as invasive meningococcal disease (IMD) [11, 17]. The presented features depend on the age of patients, including meningitis occurring more often in young people, while in adults it is more common with septicaemia.

Although most cases of meningococcal meningitis are sporadic, epidemics continue to take place among others in Africa. The infection of the nervous system occurs through the bloodstream, breaking the blood-brain barrier, and then spreads to the meninges. Infection *N. meningitidis* may also be a localized infection in the form of pneumonia, arthritis, urethritis, epiglottitis, osteomyelitis, pericarditis,

and conjunctivitis. However, these forms of infections are much less common [12, 13, 17].

In terms of clinical symptoms, meningococcal meningitis is basically no different from other bacterial meningitis. Meningococcal meningitis often begins with a flu-like illness, with symptoms such as fever, muscle pain, and weakness, only later appear the symptoms typical of meningitis [8, 10, 13]. The incubation period varies from one to 14 days, although it usually takes less than two days [10]. The clinical pattern also varies depending on the age of the patient [6, 11]. In infants, the symptoms are quite unspecific – there is irritability, drowsiness, slowness, desperate crying, absent facial expression, and seizures, which can complicate the task and delay the establishment of a proper diagnosis by a paediatrician. In older children and adults there are already typical symptoms for bacterial meningitis, such as fever, headache, muscle pain, photophobia, vomiting, meningism such as neck stiffness, Kernig's sign, Brudzinski's sign, as well as consciousness disorders [1, 8, 12, 14, 18]. Older patients have a lower incidence of neck stiffness and consciousness disorders than younger patients. The rapid onset and progression of symptoms over hours is typical and can be helpful in distinguishing this condition from self-limiting viral infections – the first symptoms usually begin from 15 – 22 hours before admission to hospital. It is also worth noting that the classic triad of fever, neck stiffness, and altered consciousness in meningococcal meningitis occurs in only 44% of patients, which can make a correct diagnosis difficult [12, 18]. Instead, at least two of the four features (headache, fever, neck stiffness, or altered mental state) will be present in 95% of patients with bacterial meningitis and should prompt urgent evaluation of this condition [8, 12]. Some patients may also develop a purplish petechial rash on the lower limbs which is a classic sign of meningococcal septicemia, occurring in 40% – 80% of cases. A macular rash, which helps in diagnosis, may appear early, but often develops with the deterioration of the patient's condition. The rash can develop into purpura fulmians (Waterhouse-Friderichsen syndrome, WFS), a skin manifestation of disseminated intravascular coagulation. Painful, well-delimited, purple skin blisters and a bloodshed state in the adrenal glands develop. The petechiae and purpura may occur anywhere on the body, therefore their presence, together with fever and signs of sepsis should automatically suggest IMD and prompt the initiation of immediate parenteral antimicrobial therapy. These cases are often associated with septic shock and necrosis of the skin, ischemia, or infarction of fingers or limbs, which usually require amputation [8, 11, 12, 13, 14, 17, 18].

Owing to the use of antibiotics, mortality in meningococcal disease is significantly reduced from 70 – 85% up to 10 – 15% [8, 13]. The medicament of choice for the empiric treatment of meningococcal meningitis is a third-generation cephalosporin, such as ceftriaxone or cefotaxime. Once *N. meningitidis* has been isolated from a sterile fluid, appropriate treatment regimens include intravenous penicillin G, ceftriaxone, or cefotaxime [11]. The recommended duration of treatment is 7 – 10 days, although recent studies have shown that sterilization of the CSF can occur in only 3 – 4 days [19]. Initial adult therapy should include the administration of a third-generation cephalosporin in conjunction with vancomycin [1]. For minimum inhibitory concentration (MIC) <0.1 mcg/ml, the presented patient was treated with penicillin, although MIC of 0.1 to 1 mcg/dl, third-generation cephalosporin is preferred [1]. Even if the bacterium is penicillin-susceptible, ceftriaxone is often used due to cost and efficacy [13]. For patients who are unable to tolerate beta-lactam or during epidemics, chloramphenicol and meropenem are the treatment of choice for meningococcal meningitides [1, 13, 18]. Steroids are commonly used in the treatment of meningococcal meningitis [1]. However, dexamethasone has a limited effect on the outcome of invasive meningococcal disease. Dexamethasone had some effect only during the days of administration in cases with clinical forms of sepsis with meningitis [20]. Patients who have signs of shock should be treated with appropriate fluid and vasopressors [13]. Despite continued progress in diagnostic methods and treatment strategies, mortality remains very high, up to 50% in untreated meningococcal meningitis [18]. As many as 10% of surviving patients develop permanent ICM consequences, which include: min. loss of limbs, bone and joint damage, skin complications in the form of scars, deafness, brain damage, and kidney failure [1, 10, 11].

To sum up, despite the unusual course of the disease, the diagnosis of meningitis by *N. meningitidis* was quickly established in the presented patient, thanks to the latex test with CSF, which enabled the implementation of immediate antibiotic therapy. At the time of admission to the ICU, the patient's condition deteriorated, tire symptoms appeared together with increased awareness disorders. The patient required mechanical ventilation and treatment with norepinephrine infusion. The patient's condition improved significantly thanks to the immediate activation of intravenous antibiotic therapy. After four days of treatment, tire symptoms disappeared. It should also be emphasized that despite the severe clinical course, with persistent awareness disorders and haemodynamic disorders, the current brain oedema in CT, the patient was discharged in good condition, without any obvious signs of focal CNS damage. There were also no complications typical of meningococcal meningitis. Although the invasive form of infection *N. meningitidis* in the light of the above data is relatively rare in Poland, it is necessary to include this pathogen in the diagnosis and therapy of bacterial meningitis in adult patients.

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