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Determining the Required Level of Care for Patients with Acute Bacterial Meningitis: Case Reports and Literature Review

G. Makarevičius*
N. Giedraitienė**
A. Klimašauskienė**

**Faculty of Medicine, Vilnius University*

***Center for Neurology, Vilnius University*

Summary. Bacterial meningitis remains a disease associated with high mortality. Thus, in some hospitals admission of most patients presenting with bacterial meningitis to the intensive care unit (ICU) was a standard procedure. However, ICUs require advanced technologies and highly specialized personnel. Since both economic and human resources are scarce, countries are attempting to develop the most accurate ICU admission criteria that can minimize over- and undertriage. The guidelines designed so far mainly suggest admitting patients to ICU based on their neurological status. However, since neurological condition is not the only factor contributing to the outcomes of bacterial meningitis, over- and undertriage cannot always be avoided. In this article, we present two cases of bacterial meningitis: an elderly man who was denied ICU care since his consciousness was only mildly altered, and a woman who was admitted to ICU because she was diagnosed with meningococcus meningitis. We will also review some literature regarding prognostic factors for bacterial meningitis in an attempt to distinguish valuable criteria for ICU admission.

Keywords: bacterial meningitis, intensive care unit, admission criteria, prognostic factors.

INTRODUCTION

As of today, bacterial meningitis remains a disease associated with high mortality [1]. It is for this reason that bacterial meningitis is considered a medical emergency, and in some previous articles it was recommended that patients with confirmed bacterial meningitis and altered mental state should be better observed in the intensive care unit (ICU) [2, 3]. Thus, in some hospitals admission of most patients presenting with bacterial meningitis to ICU was a standard procedure [4, 5]. Even today, there are countries in which it is still recommended to treat most bacterial meningitis cases in ICU, at least in the initial stage of the disease [6]. ICUs, on the other hand, place a significant financial strain on the health care system. Furthermore, highly skilled employees are required to maintain a properly operating ICU. Both economic and human resources are scarce [7–9]. Considering these facts, it is crucial for health care systems around the world to utilize ICU beds as cost effective as possible. Adopting ICU admission criteria that identify patients who are most likely to benefit from ICU care is one strategy to make the best use of critical care resources. Some European guideline committees have already offered recommendations for ICU admission (Table).

However, listed countries (Table) have not reached a consensus on ICU admission criteria. For example, there is no agreement on the level of consciousness that is significant enough to require transfer to ICU. The United Kingdom joint specialist societies recommends that Glasgow Coma Scale (GCS) score should be 12 or less or there should be a drop of GCS more than 2 points for a person to require ICU care [10], whereas the Swedish Society of Infectious Diseases recommends that GCS score should be 11 or less [11], and the French Infectious Diseases Society recommends admitting to ICU when GCS score is 8 or less [12]. As opposed to these recommendations, Association

Address:
Gytis Makarevičius
Faculty of Medicine, Vilnius University
M. K. Čiurlionio St. 21, LT-03101 Vilnius
Email: gytis.makarevicius@mf.stud.vu.lt

Table. **ICU admission recommendations in some European countries** [6, 10–12]

Criteria	Country			
	United Kingdom	**France**	**Sweden**	**Germany**
Rash	Rapidly evolving rash	Extensive purpura	No recommendation	All cases of bacterial meningitis should be treated in ICU in the initial stage of the disease
Glasgow Coma Scale score	12 (or a drop of >2 points)	8	11	
Necessity of specific organ support (hemodynamic instability, septic shock, respiratory failure, etc.)	+	+	+	
Epileptic seizures	Uncontrolled seizures	Status epilepticus	If present	
Focal neurological signs	No recommendation	If present	If progressing	
Signs of brainstem involvement: bradycardia, tachycardia, respiratory rate abnormalities	No recommendation	+	No recommendation	
Lumbar fluid pressure	No recommendation	No recommendation	>40 cmH_2O strengthens the indication	
Consciousness state	No recommendation	No recommendation	Severe psychomotor anxiety/agitation/confusion or rapidly declining level of consciousness	

ICU – intensive care unit

of Scientific Medical Societies (AWMF) in Germany recommends that most patients with bacterial meningitis be treated in ICU in the initial phase of the disease, regardless of GCS score [6]. Initial phase of the disease is considered to be the first week of the disease as AWMF considers the first week of bacterial meningitis to be most critical. Although the guideline committee did not give any data to back up its claims, there is some evidence that most bacterial meningitis cases deteriorate within the first week of infection [13, 14]. However, it is worth noting that the German guideline has not been updated in over 5 years. In 2018, the validity of the guideline was extended to December 30, 2020 by the guideline committee. Thus, at the time of writing this article, there was no valid German guideline on bacterial meningitis. The expected date for the next guideline update is December 31, 2021. There are disagreements on other criteria as well. For example, the presence of focal neurological sign is a significant criterion in the French guidelines, while in the Swedish guidelines, it is significant only if these signs are progressing, and in UK guideline, the presence of focal neurological sign is not a criterion to admit to ICU. Epileptic seizures are also a disputable criterion, as French and UK guidelines recommend admitting the patient to ICU if there is status epilepticus, while the Swedish guidelines suggest admitting the patient if epileptic seizures are present. There are also some additional varying ICU admission criteria provided by different guidelines: rapidly evolving rash (UK); extensive purpura and signs of brainstem involvement: bradycardia, tachycardia, and respiratory rate abnormalities (France); severe psychomotor anxiety/ agitation/ confusion, rapidly declining level of consciousness (Sweden). At this moment, there are no studies that would evaluate the prognosis of patients who were monitored in ICU vs general ward [12]. Thus, the guidelines are based on expert opinion and on studies evaluating different bacterial meningitis prognostic factors of poor outcome. Moreover, the guidelines focus mainly on the patient's neurological condition and mental status on admission, which, as we will show, are not the only factors associated with poor outcome and the possible need for intensive care. Therefore, the most accurate ICU admission criteria need to be identified that can minimize over- and undertriage. It is also necessary to determine what kind of monitoring is needed for patients in case they are not admitted to ICU. Here we report a case of an elderly man who was diagnosed with bacterial meningitis but was denied admission to ICU since his condition was considered relatively good and therefore ICU monitoring was considered unnecessary. Another case concerns a woman who was admitted to ICU because she was diagnosed with meningococcus meningitis. We will also review some literature on factors associated with poor outcomes in acute bacterial meningitis that can help clinicians determine the degree of care needed.

CASE REPORTS

Case No. 1

An 82-year-old male was admitted to the emergency department of Vilnius University Hospital Santaros Klinikos with complaints of fever (38.9 C), nausea, vomiting, and weakness in the right leg. The exact time of the onset of

limb weakness was unknown since the patient did not get out of bed due to his condition. He was last seen walking at 8 am on the day of admission. His previous medical history included hypertension, yet he did not use any medication.

On admission, he was febrile (39.7 C), blood pressure (BP) 140/80 mm Hg, and heart rate (HR) 80 beats per min (bpm). His level of consciousness was mildly altered – Glasgow Coma Scale score was 13 (E4V3M6). Neurological examination revealed right leg paresis (Medical Research Council (MRC) grade 1/5), neck rigidity, and positive Kernig sign. Dysmetria was noted in the finger-to-nose test, the patient was unable to perform the heel-to-knee test.

Medical history revealed that the patient was referred to our emergency department with suspected cerebral ischemia a week before. Computed tomography (CT) of the head at that time did not reveal any pathology and laboratory screenings showed mild neutropenia, mild lymphopenia, mild thrombocytopenia, and moderately decreased kidney function (eGFR 44 mL/min/1.73 m^2). Chronic cerebral ischemia with the vestibulo-ataxic syndrome was diagnosed and the patient was transferred to his local hospital for further treatment.

Laboratory screenings on admission showed mild anaemia (114 g/L), mild hypokalaemia (3.7 mmol/L), mild hyperglycaemia (8.74 mmol/L), impaired renal function (eGFR 78 mL/min/1.73 m^2), normal levels of inflammatory markers (serum C-reactive protein (CRP) was 0.98 mg/L and procalcitonin was 0.03 μg/L), and normal values of white blood cells with elevated neutrophil percentage (7.85×10^9/L and 83.2%, respectively). A head CT was performed to rule out any space-occupying lesion that might contraindicate lumbar puncture. It did not show any pathology. Lumbar puncture was then performed, which revealed pathological changes in cerebrospinal fluid (CSF) with an increased leukocytes count (1677 leukocytes/μL) with 85.6% polymorphonuclear leukocytes and 14.4% monomorphonuclear leukocytes, and elevated protein level (0.767 g/L). Glucose level was normal (3.57 mmol/L). However, CSF/blood glucose ratio was low (0.40).

As these findings suggested bacterial meningoencephalitis, the patient was started on intravenous antibiotics (Ceftriaxone 2 g every 12 hours and Ampicillin 2 g every 4 hours), mannitol. A single intravenous injection of dexamethasone was also performed. ICU team was consulted to decide on the hospitalization ward. As the patient lacked criteria for intensive care (only mildly altered mental state (GCS=13), hemodynamically stable), he was referred to a neurological ward for further treatment.

The next day, the Ear, nose, and throat (ENT) exam and chest X-ray were performed to identify the source of infection. However, they were both unremarkable. CSF culture and CSF polymerase chain reaction (PCR) tests for *Neisseria meningitidis*, *Haemophilus influenzae*, *Streptococcus pneumoniae*, *Listeria monocytogenes*, *Streptococcus beta-haemolyticus* group B, *Escherichia coli K1* were negative. Borrelia IgM antibodies were also negative. Since the causative pathogen was not identified, the initial antibiotic therapy regimen was not modified.

On the morning of day 3 of hospitalization, the patient's health rapidly deteriorated. He lost consciousness and stopped breathing. The cardiac arrest team was called and cardiopulmonary resuscitation (CPR) was performed successfully. The patient was transferred to ICU for further treatment. However, his condition remained critical and on the evening of day 6 of hospitalization, the patient died. The cause of death was multiple organ dysfunction syndrome (MODS).

Case No. 2

A 53-year-old woman was referred to the emergency department of the Infectious Diseases Centre of Vilnius University Hospital Santaros Klinikos with the history of one-day fever (39 C), severe headache (6–8 points as defined by Visual Analogue Scale (VAS)), nausea, and drowsiness. The patient had no history of chronic diseases or operations.

On admission, she was febrile (38.4 C), BP 160/96 mm Hg, and HR 130 bpm. The patient had tachypnoea (26 breaths per minute), SpO_2 was 92% (breathing ambient air). Her level of consciousness was normal. Medical examination revealed fine petechial rash on the chest, neck rigidity, and positive Kernig sign. Dysmetria was noted in the heel-to-knee test. Since these findings suggested bacterial meningitis, the patient was referred to the observation ward to await CT of the head and laboratory screening results.

Laboratory screenings showed high levels of inflammatory markers (CRP was 187.48 mg/L and procalcitonin was 5.008 μg/L) and high value of white blood cells (WBC) with elevated neutrophil percentage (18.89×10^9/L and 89.8%, respectively). The patient also had hypokalaemia (3.31 mmol/L), hyperglycaemia (9.13 mmol/L), coagulopathy (activated partial thromboplastin time (aPTT) was 32.9 seconds, international normalized ratio (INR) was 1.32, and prothrombin activity (PT% activity) was 55%), and elevated D-dimers (1305 μg/L).

While in the observation ward, the patient developed a petechial rash on her hands and became somnolent (Glasgow Coma Scale =14). Meningococcal meningitis was suspected, a blood culture sample was taken, and the patient was started on intravenous Ceftriaxone 2 g every 12 hours (1 hour and 45 minutes after hospitalization) and was referred to the intensive care unit of the emergency department (ED-ICU). A head CT was performed there. It did not show any pathology. After that, a lumbar puncture was performed, which revealed pathological changes in CSF with an increased leukocytes count (16734 leucocyte/μL) with 94.8% polymorphonuclear leukocytes and 5.2% monomorphonuclear, elevated protein level (5.942 g/L), and extremely low glucose level (0.12 mmol/L). Gram stain was negative in CSF. Since the

patient remained stable and no new rash developed, she was referred to the neurology ward for further treatment. There the patient was additionally started on intravenous Ampicillin 2 g every 4 hours (until receiving PCR results of CSF), and intravenous Ceftriaxone was continued.

The next day the patient remained stable, no new rash developed, her level of consciousness was normal, and heart and respiratory rate returned to normal (80 bpm and 16 bpm, respectively). CSF polymerase chain reaction (PCR) test was performed. It was positive for *Neisseria meningitidis*. Ampicillin was withdrawn. Since meningococcus meningitis was confirmed, ICU team was consulted, and the patient was transferred to ICU. The patient was treated in ICU for additional 3 days. Since her condition remained stable, inflammatory markers and white blood cell count decreased (CRP was 52.7 mg/L and WBC count was 6.87×10^9/L), she was referred to the neurological ward and was treated there for additional 7 days. On day 11 of hospitalization, her CSF findings normalised (leukocytes count was 64 leucocyte/μL with 8% polymorphonuclear leukocytes and 92% monomorphonuclear leukocytes, protein level was 0.393 g/L, and glucose was 2.92 mmol/L). The patient was discharged on the 12th day of hospitalisation, she did not have any neurological deficit.

DISCUSSION

These case reports highlight several important issues. First, what criteria should be used to admit patients with bacterial meningitis to ICU? Second, what kind of monitoring is needed for the patient in case of non-admission to ICU? As stated in "ICU admission, discharge, and triage guidelines" by the Society of Critical Care Medicine (SCCM), ICU should be reserved for those patients who can benefit from ICU care [9]. However, it is not always possible to determine who fits this criterion when an important decision on what level of care is most appropriate is being made [15]. As a result, research is needed to identify particular characteristics at the time of admission that are linked to the requirement for intensive care later on. However, to this day scientific data in this field are still scarce [12, 16]. This might be the reason why previously mentioned guidelines base their ICU admission criteria on the articles that evaluate the prognosis of patients with bacterial meningitis depending on factors on admission, mainly neurological condition. For example, the criteria of the United Kingdom joint specialist societies are justified by Flores-Cordero et al, 2003 [5]. In this study, which evaluated 64 episodes of community-acquired bacterial meningitis in patients who were admitted to ICU, it was found that of 21 cases of patients with mildly altered mental status (GCS 15–13) none were fatal. It was discovered that altered mental state (GCS <10) on ICU admission, age >50, focal neurological deficit and/or seizures, and Acute Physiology and Chronic Health Evaluation (APACHE) II >13 were associated with poor outcome. However, after multivariate analysis, only APACHE II was still an independent factor in adverse clinical outcomes. Moreover, the sample size of the study was rather small to assuredly recommend drastic changes to the usual ICU referral policy. As a result, Flores-Cordero et al, 2003 recommended that most patients with acute bacterial meningitis, especially the elderly and/or patients with altered mental state and/or neurological deficits were seen suitable to be monitored in ICU. This recommendation contradicts the criteria of the United Kingdom joint specialist societies, even though the criteria are justified by this article. Similar to the British guideline, admission to ICU by the Swedish Society of Infectious Diseases was based largely on articles that evaluated the outcomes of bacterial meningitis and associated risk factors [17, 18]. For example, the study of Schutte et al, 1998 found that 88% of people with meningitis and GCS >12 had a good clinical outcome (no or mild neurological deficit). However, the case fatality rate in group GCS >12 was quite high (9.3%), also cases of meningitis of different aetiology (viral, bacterial, fungal) were included, which could lead to some misrepresentation. Lastly, there are also ICU admission criteria of the French Infectious Diseases Society. But these criteria are based on the fact that they are suggested in the literature, and reference articles provided by the guideline committee have no information about ICU admission criteria for adults and only investigate the sensitivity of various diagnostic signs of meningitis [19–21]. To sum up, ICU admission criteria for patients with bacterial meningitis in some European countries are based on articles that investigate only the factors of poor prognosis of bacterial meningitis. This can lead to some misjudgement and may be the reason for a lack of consensus among guideline committees on the ICU admission criteria. Thus, it is entirely possible that usage of only these guidelines can result in mis-triage.

It is also worth noting that ICU admission criteria mainly consist of parameters of neurological condition (state of consciousness, focal neurological signs, and seizures). The severity of neurological state is seen as the most important factor for poor prognosis; therefore, ICU care is recommended for the patients whose neurological condition is severe enough. However, there are several unanswered questions regarding such decision. First, we know of several articles that provide information on outcomes of patients depending on their initial neurological status and do not draw irrefutable conclusions [2, 5, 16, 18, 22–26]. For example, several of these studies attempted to define the level of consciousness, as measured using GCS, associated with poor outcome, and came to different conclusions [5, 16, 18, 22]. Flores-Cordero et al 2003 found that GC 10, age >50, neurological deficit and/or seizures, and APACHE II >13 are associated with poor outcome (Glasgow Outcome Scale (GOS) 1–3); however, after multivariate analysis, only APACHE II >13 remained an independent risk factor. Thus, it was recommended that patients with acute bacterial meningitis, especially the elderly and/or patients with altered mental state and/or neu-

rological deficits should be monitored at ICU [5]. Dauchy et al, 2007 found that patients who had GCS 12 measured 6 hours after admission did not need vasopressors and/or mechanical ventilation (with 92% positive predictive value) unless they had focal neurological signs and/or comorbidities. This conclusion led to the recommendation to admit patients with acute bacterial meningitis with altered mental status (GCS <12) and/or neurological deficit and/or comorbidity to ICU. Fuentes-Antras et al, 2019 found that even higher GCS can be associated with adverse outcomes (GOS 4). GCS of 13 and less as well as reduced platelet count ($<150\times10^9$) on admission were associated with adverse outcomes in this study. Thus, it led to the conclusion that patients presenting with GCS 13 and/or reduced platelet count should be observed in ICU. As shown, there is no consensus about what level of consciousness should be considered relevant. Other articles also confirm that neurological signs other than the level of consciousness, such as the presence of focal neurological signs [2, 16, 26], seizures [2, 23, 27], and facial nerve paralysis [25] may be also associated with poor clinical outcome. Second, neurological condition on admission is not the only factor determining the clinical course of acute bacterial meningitis. Factors of poor outcome include older age [5, 23–26, 28–30], more specifically, age 40 years [24], age >50 years [5], age 60 years [28], age >65 years [29], age >70 years [26]; comorbidities [16, 23, 26, 28, 29]; reduced platelet count [24, 29, 31]; worse overall clinical condition as defined by Simplified Acute Physiology Score (SAPS) II [31] or APACHE II [5]; low CSF glucose levels [28, 32]; low CSF leukocyte count [25, 26, 33]; tachycardia [33], as well as factors showing severity of disease (evidence of shock, sepsis, and bacteraemia) [2, 24, 26, 28]. To emphasize the importance of other factors in addition to neurological condition to influence the outcome of patients with bacterial meningitis, Weisfelt et al, 2008 [33] are worth noting. In this study, factors of poor outcome (defined as GOS 4) within 1 hour of admission were evaluated. The researchers found that older age, tachycardia (>120 bpm), low GCS score, presence of cranial nerve palsies, low CSF leucocyte count (<1000 cells/mm^3), and detection of gram-positive cocci in CSF were independent risk factors. All these parameters were included in the newly designed risk score. Every risk parameter has a certain number of points. The possible score can range from 0 to 65. Neurological condition (GCS and cranial nerve palsy) accounts for 25 out of 65 possible points. Thus, the neurological condition was not seen as the single most important determinant. A nomogram was designed to attribute the score to estimated risk (0 points were associated with 3.2% risk of unfavorable outcome and 65 points were associated with 96%). The authors argue that this risk score can help physicians decide on the care needed (general ward or ICU) [33]. However, a cut-off value to monitor patients in ICU was not suggested. Nevertheless, the proposed risk score emphasizes that other risk factors together with neurological condition may be important in determining the risk of poor outcome of acute bacterial meningitis. As this review shows, neurological condition is not the only factor that determines the clinical course of acute bacterial meningitis. Because other factors such as age, comorbidities, and clinical condition on admission can gravely affect prognosis, ICU admission criteria which focuses on neurological condition alone may not always be accurate enough. Besides, the researchers disagree about the severity of neurological condition associated with adverse clinical outcomes. It is worth noting that most of the studies mentioned (except Dauchy et al, 2007) evaluate risk factors associated with poor outcome. However, poor outcome was defined in different way: GOS less than 5, less than 4, or death, depending on the study. Moreover, disability at discharge is not necessarily related to the need for intensive care while in hospital and vice versa. Thus, it is not always possible to determine ICU admission criteria from these articles. Therefore, more studies are needed to design accurate ICU admission criteria for patients with bacterial meningitis.

The last problem in determining the level of care needed for patients with acute bacterial meningitis is to decide on the type and frequency of monitoring for those not admitted to ICU. Only French and Swedish guidelines on acute bacterial meningitis suggest some recommendations on this topic. The French Infectious Diseases Society recommends frequent (hourly) monitoring of hemodynamic parameters and consciousness for at least 24 hours after admission [12]. It is worth noting, that the American College of Critical Care Medicine recommends ICU (or level 3) care for patients who need hourly monitoring [9], therefore, its guidelines come to contradictory conclusions on what level of care could be achieved at different hospital units. Similarly, the Swedish Society of Infectious Diseases also suggests frequent evaluation of alertness, hemodynamic, and neurological and respiration status, however, time intervals are not specified [11]. Since there are no articles that evaluate what monitoring may be sufficient to detect deterioration in patients with bacterial meningitis early, the question what type and frequency of monitoring should be considered best practice remains open. Nevertheless, more careful monitoring of patients with bacterial meningitis who are not admitted to ICU may be appropriate, at least in the initial stage of the disease, to detect any possible deterioration.

ICU admission criteria can be of great help for a physician in deciding whether the person with bacterial meningitis needs a higher level of care. However, there is a great variation between the recommendations on when bacterial meningitis should be treated in ICU. In addition, data on this issue are still scarce. Thus, the designed criteria based on these scarce data may not always be reliable. Besides, some studies show that neurological condition is not the only factor associated with the outcome of acute bacterial meningitis. Thus, it might be reasonable to suggest that other risk factors (general clinical status, age, comorbidities, etc.) should be considered together with the proposed ICU admission criteria. People who have additional risk factors for poor outcome may need ICU care or additional monitoring (hemodynamic monitoring, consciousness

state monitoring) in the general ward even if they do not have criteria for ICU care.

Unlike other European countries discussed, Lithuania has no official guidelines on what criteria a patient with bacterial meningitis must meet to be admitted to ICU. The usual procedure is that the referral to the hospitalization ward is based upon the decision of the ICU intensivist. In general, patients with bacterial meningitis with altered mental state and/or respiratory failure and/or status epilepticus and/or hemodynamic instability, and/or sepsis are admitted to ICU, however, each case is decided individually.

The first patient described in our clinical report was denied ICU monitoring by the decision of the ICU intensivist since the patient's condition was not severe enough (only mildly altered mental state, hemodynamically stable). This decision is consistent with the recommendations of 2 out of 4 national guidelines. This patient would be recommended ICU care only by the French guidelines since he had a focal neurological sign and by the German guidelines since they suggest ICU care for patients with bacterial meningitis in the initial stage of the disease. However, the patient had factors shown in various studies to be associated with adverse clinical outcome: advanced age, focal neurological sign, and comorbidities (hypertension, chronic renal disease, chronic cerebral ischemia, and altered immune system). His risk of a poor outcome as defined by Weisfelt et al 2008 risk score was 13%. The risk factors presented may have contributed to the rapid deterioration of the patient's condition. It is likely that the patient's condition and consciousness may have deteriorated as a result of increasing intracranial pressure (ICP) caused by cerebral edema, which usually starts to worsen after a few hours to a couple of days after infection [14]. The deterioration was spotted in the morning, although it likely occurred during night-time hours and was not detected as it is not always possible to monitor patients in neurological ward every hour, especially at night. Treatment and monitoring in ICU might have helped to detect deterioration of consciousness earlier. This might have resulted in earlier adequate management of increased ICP and more favourable outcome.

The second patient described in our clinical report was transferred to ICU for monitoring because meningococcus meningitis (which requires isolation and intensive treatment) was confirmed. As shown, the patient's condition did not meet any of the criteria (described in the abovementioned guidelines) for ICU care, except the German AWMF. The patient did not require vasopressors or mechanical lung ventilation while in ICU. Yet, on admission, the second patient (as well as the first) had factors associated with adverse clinical outcome: older age, hypoglycorrhachia, and tachycardia. The patient's risk for a poor outcome as defined by Weisfelt et al 2008 risk score was 17%, thus even higher than that of the first patient. Yet, the clinical outcome of the second patient was much better than the outcome of the first one. Treatment and monitoring in ICU might have contributed to more favourable outcome in this case. In ICU laboratory screenings are performed at least once a day (more often if needed). In this case, blood gases and electrolyte panel were performed daily. Infusions and oxygen therapy were corrected depending on the results. This might have contributed to adequate oxygenation and eunatremia, which is a key factor in the prevention of cerebral edema [34]. Even if these measures had not been effective and the patient had worsened, deterioration would probably have been detected earlier and adequate timely care would have been provided. Even though the patient did not require vasopressors or mechanical lung ventilation over the course of the disease, the authors of this research believe that admitting the patient to the ICU was the proper thing to do.

These clinical cases emphasise that bacterial meningitis is a deceptive disease that can lead to a rapid deterioration in the patient's condition. The proposed risk stratification scores cannot always detect patients with the highest risks. In addition, ICU admission criteria proposed by some European countries cannot always distinguish patients with the highest need for ICU care and can lead to different clinical approaches that may affect patient outcomes. More accurate ICU admission criteria are needed, with a broader focus not only on neurological condition, but also on other risk factors. Until accurate ICU admission criteria are determined, the authors of this article suggest that it is safer to admit and monitor most patients with bacterial meningitis in ICU, at least in the initial stage (first week) of the disease. In our opinion, some overtriage is more tolerable than undertriage.

CONCLUSION

There is no doubt that patients with bacterial meningitis who are hemodynamically unstable, in septic shock, coma, requiring artificial ventilation, etc. should be urgently transferred from the emergency department to ICU and treated there. However, when it comes to patients with a seemingly good initial clinical condition, the decisions become not so clear. There are currently no scientific data to prove or disprove benefits for early ICU admission. However, as shown in these case reports, the clinical condition of a patient with bacterial meningitis can rapidly deteriorate. All cases of bacterial meningitis should be evaluated on a case-to-case basis and the patient's general clinical status, age, and comorbidities should be considered in conjunction with the traditional ICU admission criteria described in this article. In case of non-admission to ICU, it would be advisable to closely monitor hemodynamics and level of consciousness in patients with bacterial meningitis, especially if they have any prognostic factors of poor outcome shown in this article. Further prospective clinical studies are needed to develope more accurate ICU admission criteria with the highest predictive value for identifying patients who will require ICU care over the course of the disease.

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G. Makarevičius, N. Giedraitienė, A. Klimašauskienė

INTENSYVIOSIOS TERAPIJOS REIKALINGUMO ĮVERTINIMAS PACIENTAMS, SERGANTIEMS ŪMINIU BAKTERINIU MENINGITU: ATVEJŲ APRAŠYMAI IR LITERATŪROS APŽVALGA

Santrauka

Bakterinis meningitas vis dar išlieka svarbia mirštamumo priežastimi. Dėl to praeityje dauguma bakterinio meningito atvejų buvo perkeliami stebėti ir gydyti į reanimacijos ir intensyviosios terapijos skyrius (RITS). Deja, RITS išlaikyti reikalinga speciali įranga ir specialiai apmokytas personalas, o šie ištekliai yra riboti. Riboti ištekliai verčia šalis priimti tam tikrus RITS kriterijus, kuriais remiantis būtų galima identifikuoti asmenis, kuriems priežiūra RITS yra iš tikrųjų reikalinga. Siūlomi kriterijai pacientams, sergantiems bakteriniu meningitu, dažniausiai yra paremti paciento neurologinės būklės sunkumu. Neurologinė būklė yra ne vienintelis veiksnys, lemiantis bakteriniu meningitu sergančių asmenų klinikinę eigą ir išeitis, todėl, remiantis tik neurologine būkle, ne visada galima tiksliai nuspręsti, kokioje palatoje (RITS ar terapijos) pacientas turėtų būti gydomas. Šiame straipsnyje mes pristatome du bakterinio meningito atvejus: pirmasis atvejis – vyresnio amžiaus vyro, kurį buvo nuspręsta gydyti neurologijos skyriaus palatoje, nes jo sąmonės būklė buvo tik nežymiai sutrikusi, antrasis – moters, kurią buvo nuspręsta gydyti RITS, nes jai buvo diagnozuotas meningokokinis meningitas, kuriam reikalinga paciento izoliacija ir intensyvus gydymas. Taip pat apžvelgiame straipsnius, nagrinėjančius veiksnius, rodančius didesnę tikimybę, kad bakterinis meningitas turės prastesnes išeitis. Tikimės, kad tai padės tiksliau nustatyti, ar pacientams, sergantiems bakteriniu meningitu, reikalingas stebėjimas ir gydymas intensyviosios terapijos skyriuje.

Raktažodžiai: bakterinis meningitas, intensyviosios terapijos skyrius, priėmimo kriterijai, prognostiniai veiksniai.

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