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A case of successful treatment
of severe catheter-related gram-negative sepsis
in the young child

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The child having serious catheter-related gram-negative sepsis has been treated in the Department of anesthesiology and intensive therapy (DAIT) of the regional children's clinical hospital (RCCH) of Ivano-Frankivsk. From the anamnesis, it is known that infusion therapy through peripheral venous catheter in the projection of the left crook of the arm had been being conducted for three days. At admission, the child's condition is severe due to endogenous intoxication, type II respiratory distress by lower obstructive-constrictive type on the background of pneumonia, anemic, hypoproteinemic and dyselectrolytemic syndroms, and coagulopathy. Given the signs of increasing respiratory distress, hemorrhagic, anemic syndromes, and cerebral deficit, indurative edema of upper-left extremity with the transition to the neck tracheal intubation with respiratory support using artificial lung ventilation was carried out. Because of progression of upper extremity edema, interference with blood flow, we had to do a fasciotomy and necrectomy. Due to the development of organ dysfunction, two sessions of hyperbaric oxygenation were initiated on the seventh day. On the tenth day because of the progression of purulent endobronchitis an intermediate tracheostomy was held. To regress purulent expectoratory component therapeutic bronchoscopy was performed six times. Correction of anemic, hypoalbuminemic syndromes and coagulopathy were provided by the transfusion of washed red blood cells, fresh frozen plasma, 10% solution of albumin. With immunosupportive purpose, intravenous human immunoglobulin was administered (three times 5 ml/kg). On the 17th day of treatment at DAIT the respirator was removed. Tracheostomy decannulation was held on the 24th day. On the 26th day the child was transferred for further treatment to Combustiology Department of regional clinical hospital in Ivano-Frankivsk, where the child was discharged due to satisfactory condition on the 38th day of total stay in hospital.

Key words: sepsis, pneumonia, children.

Introduction

Sepsis is a complication caused by a generalized (systemic) inflammation due to infection of different nature (bacterial, viral, fungal), which leads to the development of immune distress. Stages of immune distress (SIRS, CARS, MARS), unfortunately, do not have a clear clinical differentiation. The question of when the stage of immunotoxicity and systemic inflammation response syndrome will transform in the mixed antagonist response syndrome and ends in immune paralysis, remains open. More successfully characterizes this critical condition the term «persistent inflammation, immunosuppression and catabolism syndrome — PICS». Persistent inflammation, immunosuppression and catabolism syndrome (PICS) is characterized by constant leukocytosis with a lymphopenia, hypoalbuminemia, impaired regulation of adaptive immunity and inflammatory genes [4].

In the beginning of the XXIst century, sepsis remains one of the most urgent problems of medicine [1,2]. Every year an increase in morbidity without reducing mortality is observed [3]. Severe sepsis is characterized by the occurrence of organ damage with subsequent transformation into mutually confounding scenario, a manifestation of endotoxemia and disorders in the circulatory system: drop in blood pressure, microcirculation, and microperfusion [5,8]. Among the main mechanisms of damage particular attention should be paid to the formation of hemodynamic corridor of critical condition, i.e. the interval marked by the onset of the sepsis sympathetic hypotension and subsequent development of refractory septic shock. In this case, if one applies adequate comprehensive therapy he will achieve hemodynamic compensatory plateau and provide conditions to prevent the development of shock.

The immediate cause of death of patients with sepsis is septic shock and multisystemic violations. In the era of advanced technologies, the mortality rate in severe sepsis

is around 45–50% and varies in different subgroups, depending on the premorbid pathology, physical status and existing triggers: from 30–40% to 75–80% [6,9]. The total cost of treating septic patients in the United States is \$30.3 billion [7].

Unfortunately, official statistical data on disease and mortality due to sepsis in Ukraine are not available. There is no Registry of patients who survive their episode of sepsis, as well as multidisciplinary national Consensus on sepsis. All these factors lead to a lack of unified guidelines of sepsis and septic shock treatment in children and adults in Ukraine.

Materials and methods

Here is the case of the treatment of severe catheter-related sepsis in a young child who was treated in DAIT of RCCH of Ivano-Frankivsk in 2016.

Results and Discussion

Study results and discussion. *Child V., 2 years old*, moved to DAIT of RCCH of Ivano-Frankivsk from the Surgery Department, which he had been admitted to for treatment from the district center. Admission complaints of a progressive edema of the left upper extremity. Induration of tissues in cubital area (the place of catheterization of peripheral cubital vein) emerged after the conducted infusion therapy via the peripheral venous catheter. The swelling extends to shoulder and neck to the left. Upon inspection of the vascular surgeon — the vascular permeability is good; blood flow to the distal areas of the limb is preserved. A serious condition is due to respiratory disorders, endogenous intoxication. Unproductive cough, increase of temperature up to 38.8°C, shortness of breath, oral cyanosis, SaO₂ without oxygen 90%. Over the lungs breathing is harsh, fine moist rales are heard. Heart sounds are rhythmic, muted; there is apical systolic murmur. In the Complete Blood Count deficient



Рис.1. Хворий при госпіталізації у ВАІТ



Рис.2. Протезування дихальної системи штучною вентиляцією легень



Рис. 3. Стан після фасціотомії



Рис.4. Період реконвалесценції

anemia of moderate severity (Hb-90 g/L) is diagnosed, $E_r - 2.9 \times 10^{12}$, leukocytosis ($L - 14.9 \times 10^9$), aneosinophilia (0%), a shift to the left ($p - 17\%$), ESR - 6 mm/h, Ht - 0.34. In biochemical analysis: hypoproteinemia (total protein - 35.7 g/L); urea - 3,6 mmol/L, creatinine - 68 mmol/L, potassium - 3,06 mmol/L, sodium - 129,7 mmol/L, ALT level - 58 U/L, ACT - 75 U/L; blood sugar - 5.6 mmol/L. While assessing the coagulation parameters the signs of hypocoagulation were revealed: prothrombin index - 70.6%, prothrombin time - 15 sec, international normalized ratio - 1.29, activated partially thrombin time - 100 sec, fibrinogen - 1.92 g/L. Procalcitonin ≥ 12.9 ng/mL, D-dimer - 9000 ngFEU/ml.

Having taken into account the above data, the diagnosis was made: severe sepsis, septicopyemic form, acute course. Necrotic phlegmon of the left upper extremity. Community-acquired bilateral bronchial pneumonia complicated by the left-sided paracostal pleuritis, respiratory failure (type II), severity IV, acute. Deficiency anemia of complex genesis of moderate severity (Fig.1).

Detoxification therapy began (intravenous rehydration therapy), empirical antibiotic therapy, hyperbaric oxygen therapy, hepatoprotectors, disaggregants, syndromic correction.

On the second day of stay at the DAIT of RCCH the child's condition continued to deteriorate due to the growing phenomena of respiratory distress, hemorrhagic, anemic syndromes, cerebral deficit.

For health reasons tracheal intubation was conducted, as well as artificial pulmonary ventilation by the apparatus «Carina» in the mode SIMV with the following settings: $FiO_2 - 50\%$, R - 24 per minute, PEEP-3 mm wc, PIP - 15 mm wc, I:E=1:2 (Fig. 2).

For the correction of anemic and hypoproteinemic syndrom, transfusion of washed red blood cells, fresh frozen plasma was carried out. Due to the progression of suppurative pulmonary component in the setting of the artificial ventilation on the third day of stay in the DAIT sanitation bronchoscopy (diffusion endobronchitis) and medium tracheotomy were conducted. The child was examined by pediatric surgeon, vascular surgeon, pulmonologist, combustiologist. Necrectomy of the affected limb was conducted three times (Fig.3).

According to the antibiogram (10^4 Pseudomonas aeruginosa) and antibiotic susceptibility, on the 10th day of stay the antibiotic treatment was enhanced for health reasons: vancomycin, colomycin, braxon. With immunosupportive purpose the transfusion of human immunoglobulin in the dose of 5 ml/kg was conducted three times.

Over time, the child's condition gradually stabilized. On the 17th day of treatment at DAIT the respirator was removed. In the Complete Blood Count anemia (Hb - 94 g/L), leukocytosis ($L - 5.7 \times 10^9$), aneosinophilia, normalization of leukogram (bands/stabs - 7%, segmented neutrophils - 52%, lymphs - 34%, mono's - 7%), ESR - 4 mm/h, Ht - 0.32 were observed. In biochemical analysis

hypoproteinemia (51.4 g/L) was diagnosed. While assessing the coagulation parameters the tendency towards normalization was observed: prothrombin index – 86.4%, prothrombin time – 16.4 sec, international normalized ratio – 1.5, activated partially thrombin time – 29 sec, fibrinogen – 2.88 g/L.

Tracheostomy decannulation was held on the 24th day. On the 26th day the child was transferred for further treatment to Combustiology Department of regional clinical hospital in Ivano-Frankivsk, then to inpatient department where due to satisfactory condition the child was discharged on the 38th day of total stay in hospital.

Objectively by the central nervous system – post-hypoxic encephalopathy. Auscultatory – in the lungs vesicular breathing, symmetrical. Cardiovascular system – hemodynamics is stable, heart sounds are rhythmic, sonorous, systolic murmur at the apex. On palpation of the abdomen – liver protrudes from under the edge of costal arc on 1.5 cm, the edge is smooth and elastic. The spleen is not palpable. The child has a keen appetite. Asthenovegetative syndrome

has decreased. Bowel and bladder habits are not broken. In the region of the shoulder and scapular area scar tissue with pronounced cosmetic defect has formed after autoder-moplasty (Fig. 4).

Conclusions

The positive effect of intensive therapy in this child was achieved thanks to:

1. Timely admission to a specialized department.
2. Timely fasciotomy and necrectomy.
3. Effective antimicrobial therapy, which was administered on the principle of empirical, oriented in the mode of de-escalation.
4. Immunosupportive therapy.
5. The use of methods of nonspecific detoxification, hyperbaric oxygenation, that reduce the signs of syndrome of endogenous intoxication.
6. The use of infusion-transfusion rehydration therapy.
7. Timely respiratory therapy (ALV), which allowed to adequately maintain respiratory functions of the lungs.

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