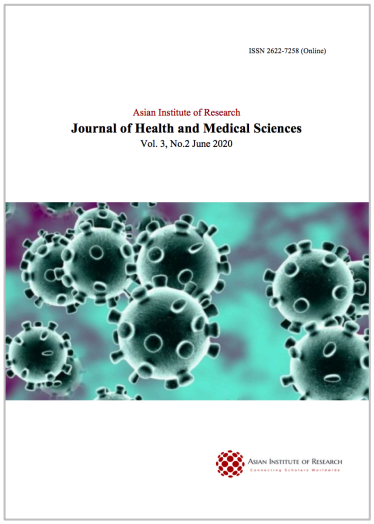

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Management of Septic Shock According to SSC 2016 in Post Laparotomy Exploration due to Gastric Perforation

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Abstract
According to International Guidelines for Management of Sepsis and Septic Shock 2016, sepsis was defined as life threatening organ dysfunction caused by a dysregulated host response to infection. Sepsis and septic shock are major healthcare problems and the incidence increased by year. Septic Shock was defined as subset of sepsis in which underlying circulatory and cellular metabolism abnormalities are profound enough to substantially increase mortality and can be identified with persisting hypotension requiring vasopressors to maintain MAP>65mmHg and having serum lactate level > 2 mmo/L despite adequate volume resuscitation. Intraabdominal infection was reported as contributor to a high mortality rate for infection case in intensive care units. We reported a case of a patient with sepsis and septic shock caused by intraabdominal infection post laparotomy exploration ec gastric perforation. The patient was monitored prospectively, received antibiotics, hemodynamic support and mechanical ventilation support while being treated in the ICU. On the sixth day, the patient was transferred to ward.

Keywords: Sepsis, Shock, Septic, Intraabdominal, Infection

Introduction

Sepsis was defined as life threatening organ dysfunction due to dysregulation or disproportion of immune response to infection, a major health problem and reported incidence continue to increase.[1] Several studies reported sepsis as the leading cause of death in critically ill patients throughout the world, in spite of its uncertain incidence. Septic shock is defined as subset of sepsis in which underlying failure in notably circulatory and cellular metabolism which may significantly increase mortality. Septic shock is characterized by persisting hypotension requiring vasopressors to maintain MAP≥65mmHg and having serum lactate level > 2 mmo/L despite adequate volume resuscitation with mortality reaching 40%.[1]

Sepsis is the main cause of death in the Intensive Care Unit (ICU), with almost 15% diagnosed sepsis and two-thirds of these fall in septic shock. Sometimes patients treated in the ICU also have accompanying diseases which aggravate their condition and organ failure which increases mortality. A study stated 60% of 305 patients with severe sepsis experienced lung infection followed by 39% due to abdominal infection. In an observation

conducted by the Complicated IAI Observational World (CIAOW) in 2014 stated that the source of infection were intraabdominal infection, as much as 14.3%, ranks third, after appendix 34.6% and cholecystitis 14.8%, as for mortality due to Intraabdominal Infection (IAI) reached 10.7%. Etiology of IAI mostly includes gram-negative *Escheria coli* bacteria and gram-positive *Enterococus faecalis*.[2]

Management of sepsis based on International Guideline for Management of Surviving Sepsis Campaign (SSC) 2016 includes crystalloid fluid resuscitation for at least 30 mL/kg iv in the first three hours to overcome hypoperfusion caused by sepsis. Additional fluid can be administered after reevaluation of hemodynamic status, whether pulse, blood pressure, arterial oxygen saturation, breathing frequency, temperature, urine output, etc., with invasive or non-invasive devices as available. Assess cardiac function, predict fluid responsiveness, maintain MAP 65 mm Hg with vasopressors, normalize lactate, take microbiological culture samples, and give antibiotics immediately after diagnosis of sepsis within the first 1 hour.[3]

Patients who experienced sepsis after intraabdominal infection should get their source of infection controlled, treated in the ICU and get correct antibiotics to avoid complication towards better improvement.

Case Report

A 68 year old woman from a private hospital presented to the emergency department of Hasan Sadikin General Hospital Bandung with generalized abdominal tenderness and difficulties to defecate since two days prior admission, it was accompanied with epigastric pain two weeks prior admission aggravated by pressure but without vomiting. She admitted taking medicine and herbs for back pains and a year history of uncontrolled hypertension, with highest systolic blood pressure 160 mmHg but unknown diastolic pressure.

In the emergency department, the patient was conscious but with severe general condition; blood pressure was measured 115/70 mmHg, heart rate 118x/min, respiratory rate 34x/min, no additional lung sound was found in physical examination, body temperature of 37.7^{o}C, *Numeric Rating Scale* (NRS) 4-5, oxygen saturation (SpO_2) 99% with O_2 in *non-rebreathing simple mask* (NRM) 10 lpm. Laboratory investigation shown hemoglobin (Hb) 13.1 g/dL, leukocyte count 11.820/µL, hematocrit (Ht) 39.5%, thrombocyte 261.000/µL, prothrombin time (PT) 15.5, INR 1.42, *activated partial tromboplastin time* (aPTT) 34.4, free blood glucose (FBG) 111 mg/dL, SGOT 26, SGPT 17, albumin 2.05, ureum (Ur) 108.1 mg/dL, creatinine (Cr) 1.65 mg/dL, lactate 3.0 mmol/L, pH 7.451, pCO_2 32.5 mmHg, pO_2 145.7 mmHg, HCO3 22.9 mmol/L, BE 0.1 mmol/L, SaO2 99.11%, blood gas analysis (BGA) mixed vein SaO2 68.2%. Chest radiology result from previous hospital was bilateral pneumoperitoneum, cardiomegaly with aorta atherosclerosis without pneumonia. Electrocardiogram showed infrequent unifocal VES (Figure 1).

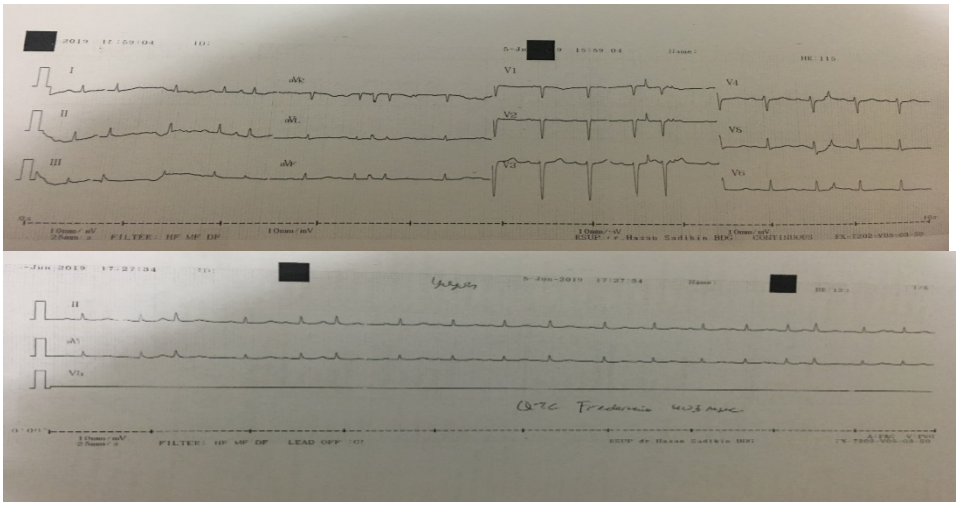

Figure 1 Electrocardiogram in emergency department
Source: private documentation

Patient was priorly diagnosed as diffuse peritonitis due to Suspected Hollow Viscus Perforation; Suspected Gastric Perforation; Hypertensive Heart Disease; Stage I Acute Kidney Injury, was given 1800 cc NaCl 0.9% intravenous fluid in the first 6 hours and continued by 1800 cc for 18 hours; combination of intravenous antibiotics including ceftriaxone two grams every 24 hours and metronidazole 500 mg every eight hours, also planned to have laparotomy exploration.

After being consulted to Anesthesiology Department, consciousness was decreased to 14, blood pressure 90/72 mmHg, heart rate 120x/min, respiratory rate 24x/min, temperature 37.8^{o}C, NRS 5-6, SpO2 99% with NRM 10 lpm. Crystalloid Ringer Lactate solution was given for 2000 cc and started norepinephrine from 0.05µg/kg/m. Central Venous Catheterization (CVC) was done in right subclavian vein before laparotomy. Pneumoperitoneum and 70 cc intraabdominal greenish fluid were identified during laparotomy.

Surgery was done with general anesthesia. Perforation in pre-pyloric area with diameter of 1 cm was fixed by primary suture, omental patch and done biopsy. During operation, patient received 900 cc of crystalloid solution with average blood loss of 150 cc and urine output 200cc. Hemodynamic status during the two hour surgery using norepinephrine 0,05-0,2µg/kg/m had an average systolic pressure 90-140 mmHg, diastolic 60-78 mmHg and heart rate 78-130x/min. After surgery, patient was transferred to *Intensive Care Unit* (ICU).

In the ICU, patient was under sedation with blood pressure 95/54 mmHg, heart rate 67x/min using norepinephrine 0,05µ/kg/m , SpO2 97-99%, ET no. 7.0 connected to SIMV mode ventilator with PS 16, PEEP 5, fiO2 70%, peak pressure 26-28 TV 320-370 cc. Hemodynamic monitoring, signs of blood loss, urine production, fluid balance was monitored, sample was taken for bulyon culture. Antibiotics were changed to combination of meropenem 1 gram and metronidazole 500 mg every eight hours intravenously, with morphine 10µ/kg/hr iv and paracetamol 1 gram every 6 hours.

On the first day in ICU, patient was stable with E2M2Vt under sedation. Systolic blood pressure (SBP) shown 95-127 mmHg, diastolic blood pressure (DBP) 54-72 mmHg, heart rate (HR) 67-84x/min with norepinephrine 0,05 µ/kg/hour and temperature 36-36.5^{o}C; respiratory rate (RR) 16x/min with SIMV ventilator mode PS 12 PEEP 5 fiO2 70% and tidal volume 320-360 cc; urine production 0,4-0,5 cc/kg/hour, cumulative of 670 cc/4 hours with balance +1566 cc. NGT showed dark production with positive bowel sound, abdomen was not found distended. Meropenem and metronidazole antibiotics were continued. Post-operative laboratory result shown Hb 11.5 g/dl, Ht 35.2%, Leucocyte count 12240/mm^3, trombocyte 206000/mm^3, Ur 101.6, Cr 1.22, PT 16,8, INR 1.55, APTT 39.80, FBG 103, Na 140, K 4.3, Cl 114, Ca 4.29, Mg 1.6 and Albumin 1.68.

On the second day, consciousness was E4M6Vt, with SBP 105-152 mmHg, DBP 54-72 mmHg and MAP 71-98 mmHg, HR 70-84x/min with norepinephrine 0.05µg/kg/min, temperature 36-36.5^{o}C, RR of 16x/min, SpO2 96-98% with SIMV ventilator mode PS 16 PEEP 5 FiO2 70% and tidal volume 360-540 cc. NGT production was still dark without abdominal distention and positive bowel sound. Patient was given TPN Triofusin 500cc/24 hours and aminofluid 1000 cc/24 hour. Ventilator was set to PSIMV PEEP 5 FiO2 70% then weaning was done with PS to 9 and FiO2 to 50%. The patient received Ringer Lactate intravenous (iv) fluid 1000 cc/24 hour, meropenem iv, metronidazole iv, norepinephrine 0.05µg/kg/hour, 2 gr of magnesium iv, 2 gr of calcium gloconas iv, extra Digoxin 500 µg iv. Second day laboratory results showed SGOT 46, SGPT 23, total bilirubin (BT) 0.632, direct bilirubin (BD) 0.301, indirect bilirubin (BI) 0.331, lactate 2.1, mixed vein pH 7.278, pCO2 65.0, pO2 65.0, HCO3 21.2, BE -4.9, SaO2 88.0. Chest xray shown minimal right pleural effusion, cardiomegaly without lung edema, aorta atherosclerosis with no signs of pneumonia as in Figure 2.

On the third day, patient was stable with consciousness E4M6Vt, vital signs shown SBP 138-161 mmHg, DBP 56-72 mmHg, MAP 83-101, HR 60-102 x/min with norepihephrine 0.05µg/kg/hour. Ventilator weaning was done by changing mode to CPAP PS 15 PEEp 5 FiO2 50% and tidal volume 500-710 cc. Diuresis was found 0.8-1.2 cc/kg/hour with balance +256 cc and a cummulative of 1985 cc/24 hour. Nutrition and antibiotics were still as previous days, intravenous dexmedetomidine 0.2µg/kg/min and omeprazole 40 mg every 12 hours were added. NGT production was still dark without abdominal distention and positive bowel sound. Third day laboratory results showed Hb 9.5, Ht 29.9, leucocyte count 15170, thrombocyte count 185000, FBG 174, lactate 1.3, Ur 136, Cr 1.7, Na 139, K 4.9, Cl 117, Mg 2.7. Echohemodynamic examination was done and shown CO

5.2 L/min, CI 3.05 L/min/m^2 SV 42 cc/beat SVR 1046 dynes.sec.cm^{-5} LVOT Umax 1.17 m/s , LVOT Umin : 0.79 ml/s, Dist. Index 32 %, IVCmax 2.24 cm, IVCmin 1.94 cm, Dist. Index : 13%; fluid responsive, fine CO with support and suggestive additional fluid administration was seen.

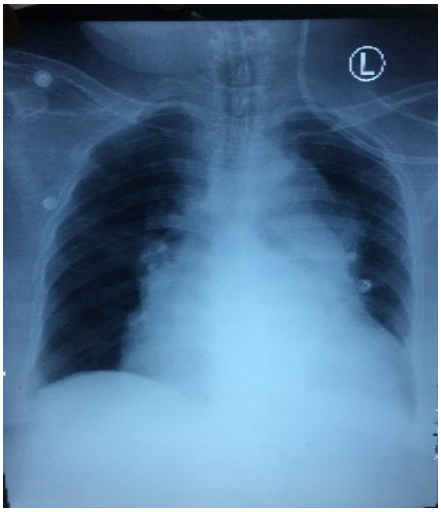

Figure 2 Chest x-ray result in the ICU
Source: private documentation

On the fourth day, patient was stable with E4M6Vt, vital signs were SBP 120-154 mmHg, DBP 60-70 mmHg, MAP 80-98 mmHg, HR 54-68x/min, RR 16-20x/min, SpO2 98-99%, Ventilator mode CPAP PS 1-15 PEEP 5 FiO2 50%, temperature 36.4-37.1 ^oC, diuresis 1-1.7 cc/kg/hour, balance -492 cc with a cumulative of 2476 cc/24 hour. Antibiotics and medications were still as previous days. Ventilator weaning was done with removing ventilator and connecting ETT to T-piece at 14.00 and extubation was done at 18.00. NGT had no retension, laboratory results showed FBG 143, Na 139, K 4.1, CL 111, Mg 2.4, Ca 4.99, pH 7.454, pCO2 39, pO2 129.7, HCO3 27.8, BE 4.1, SaO2 97.2. Sputum examination was done.

On the fifth day of treatment, amlodipine 10 mg, captopril 12.5 mg and perdipine iv 0.5µg/kg/min were given for the increasing blood pressure.

On the sixth day, laboratory results showed FBG 159, Na 139, K 4.0, Cl 105, Mg 1.9, Ca 4.83, patient was moved to *High Care Unit* (HCU). Patient was given RL solution 500 cc/24 hours, liquid diet with calory needs of 1500 to 2400 kkal. Urine production shown >0.5-1 cc/kg/hour with cumulative balance of -2778 cc.

Discussion

The word sepsis derives from the Greek word “sepo” which means “I rot” and was first mentioned in the poems of Homer (18th century BC). In 1914, Hugo Schottmuller formally defined “*septicaemia*” as a disease caused by microbial blood stream invasion. Despite its definition, terms such as septicaemia, sepsis, toxemia and bacteremia were often overlapped.

Sepsis is now known as a condition involving early activation of pro-inflammatory and anti-inflammatory response in the body. Along with this condition, circulatory abnormalities such as decreased intravascular volume, peripheral vascular vasodilation, myocardial depression, and increased metabolism generate an imbalance between systemic oxygen delivery and oxygen demand which will lead to systemic tissue hypoxia. The pathophysiology of this condition starts with reactions to infection which will trigger neurohumoral response in the presence of pro-inflammatory and anti-inflammatory responses, starting with cellular activation of monocytes, macrophages and neutrophils that interact with endothelial cells. Subsequent bodily responses include mobilization of plasma contents as a result of cellular activation and endothelial disruption. Plasma contents include cytokines such as tumor necrosis factor, interleukin, caspase, protease, leukotriene, kinin, reactive oxygen species, nitric oxide, arachidonic acid, platelet activating factor, and eicosanoids.

Proinflammatory cytokines such as tumor necrosis factor α, interleukin-1β, and interleukin-6 will activate the coagulation chain and inhibit fibrinolysis. Activated Protein C (APC) is an important modulator of the coagulation and inflammatory chains that enhances the process of fibrinolysis and inhibits the process of thrombosis and inflammation. Activation of the complement and the coagulation chain help strengthen the process. The interaction dominantly occurs in vascular endothelium and as a result microvascular injury, thrombosis and capillary leakage will follow and leads to tissue ischemia. This endothelial disorder plays a role in the occurrence of organ dysfunction and global tissue hypoxia.

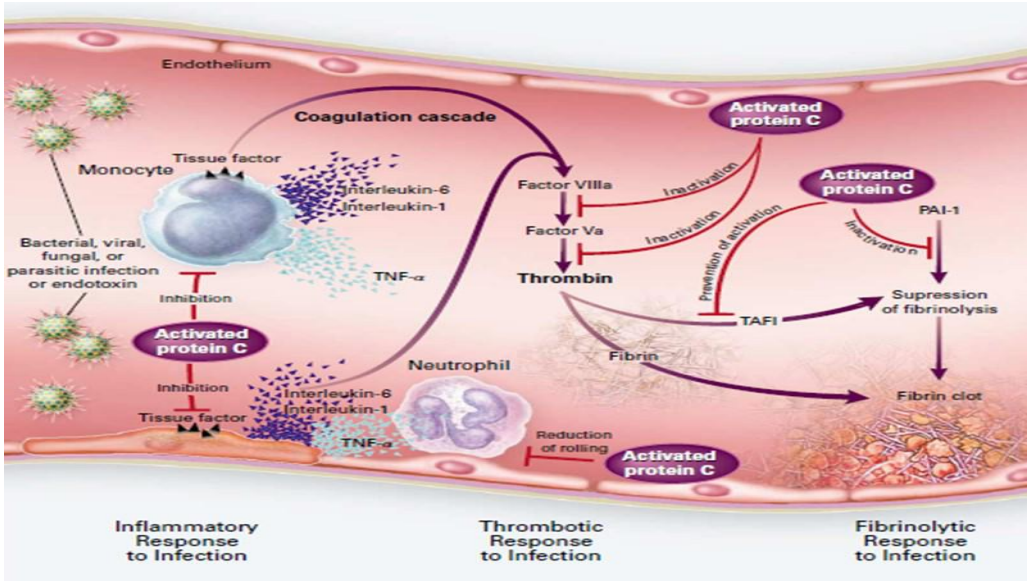

Figure 3 Coagulation Chain started with inflammatory response, thrombosis and fibrinolysis as response to infection.

Source: Bernard GR, Vincent JL, et al.[9]

According to a study in 2014 that explains the wide pathophysiology of sepsis, identification of sepsis with SIRS criteria is no longer appropriate because SIRS indirectly stated dysregulation of body response to infection.[4] An amount of patients were admitted to the hospital with SIRS criteria but ultimately without evidence of infection. Pathological condition in the state of sepsis affects almost every component of micro-circulating cells including endothelial, smooth muscle cells, leucocyte, erythrocyte and tissues. Microcirculation determine oxygen availability for each cell and tissues which ensures organ functions properly and if not corrected properly may cause respiratory distress in tissues and cells and leads to macro circulation dysfunction and finally results in one and multiple organ failure.

Management of sepsis based on *Surviving Sepsis Campaign* (SSC) guideline were implemented to sepsis bundles with revised consensus that issued *hour 1 bundle* with the aim of providing resuscitation and sepsis management as soon as possible, to prevent subsequent organ dysfunction, in the first hour after patient was identified as having organ dysfunction with Quick SOFA (qSOFA) criteria that includes 2 out of three following criterias: Respiratory rate ≥22 x/min, loss of consciousness and systolic blood pressure of ≤ 100 mmHg, make sure hour 1 bundle is carried out as the main priority that is to measure of lactate levels, re-measuring if previous lactate levels >2 mmol/L, blood culture examination before administration of antibiotics, administration of broad-spectrum antibiotics, administration of crystalloid fluids 30 cc/kg if there is hypotension or lactate levels ≥ 4 mmol/L, administer vasopressors if hypotension occurs either during or after fluid resuscitation, to maintain the MAP value ≥ 65 mmHg.[3] In this patient, before surgery was planned, qSOFA score was found ≥3 including loss of consciousness with glassglow coma scale from 15 to 14, respiratory rate 24x/min and decreasing SBP 90 mmHg. In accordance with one hour bundle, lactate levels were examined and showed 3.0 mmol/L, but in the next 2 hours no lactate examination was done, a study stated that using lactate levels as a guide in resuscitation, decreased mortality rates. She was then given 2000 cc intravenous Ringer Lactate crystalloid fluid for resuscitation, broad spectrum intravenous antibiotic Ceftriaxone 2 gram every 24 hours and Metronidazole 500

mg every eight hours, vasopressor norepinephrine was used starting 0.05μg/kg/min. Blood culture was obtained after surgery in the ICU.

Next management focused on controlling the source of infection where most sepsis diagnosis may need emergency operation for diagnostic and infection source control. Laparotomy exploration was done for suspected gastric perforation in this patient. Empirical antibiotics with adequate concentration in the first hour after diagnosis were given. Administration of antibiotic must be evaluated everyday to prevent antibiotic de-escalation. Use combination of antibiotics for septic shock patients, neutropeni patients and patients with multi drug resistant pathogen microbial infection. Duration of therapy may range from 7-10 days, longer usage may be given to delayed clinical response patients, *S. aureus* bacteremia, fungal infection, viral infection or immunological deficiency. Low procalcitonin levels may be used for guidance to stop antibiotic therapy in patients earlier with sepsis.

Abdominal sepsis is sepsis due to in intra-abdominal infections with or without peritoneal involvement, intra-abdominal infection is divided into Community Acquired IAI (CCA-IAI) and Health Care Acquired IAI (HC-IAI). Based on the extent of the infection, it is divided into Uncomplicated IAI, which is a one organ infection without damage of intra-abdominal organs and Complicated IAI, which is an infection that extends from the source of the infectious organ into the peritoneum through the perforated viscus.[6]

Guidelines issued by IDSA regarding diagnosis and management of intra-abdominal infections in 2010 recommend the administration of broad-spectrum empirical antibiotics to overcome the activity of gram-negative bacteria including meropenem, imipenem-cilastatin, doripenem, piperacillin-tazobactam, ciprofloxacin or levofloxacin in combination with metronidazole, or administration of ceftazidime, or cefepime in combination with metronidazole for high-risk community acquired IAI patients (late intervention> 24 hours, APACHE II score ≥15, extreme age, comorbid organ dysfunction, and low albumin).[7] In this patient, intravenous empirical antibiotic meropenem was given 1 gram every 8 hours and metronidazole 500 mg every 8 hours. Blood culture and sputum examination were also obtained but resulted no growth of microorganism.

Patient was treated in the ICU post operatively and given mechanical ventilation support with consideration of having major surgery, geriatrics with unstable cardiovascular condition, as previously seen VES unifocal infrequent + AF RVR on echocardiogram and received Digoxin during operation and on the first day of ICU hospitalization, as seen clinically, no lung problems was found but chest X-ray revealed minimal pleural effusion. Ventilator weaning gradually went well every day until patient was extubated. In accordance with the 2016 SSC recommendations, the use low tidal volume is reecommended in adult patients with respiratory failure induced by sepsis without ARDS, by giving tidal volume 4-6 cc/kg may offer good results, reduce the duration of mechanical ventilation usage, reduce the incidence of subsequent ARDS, and, in sepsis patients with abdominal surgery, the use of low tidal volume may reduce the incidence of respiratory failure and decrease the length of stay in the ICU.[1]

Enteral nutrition in the first 24-48 hours of treatments in the ICU was recommended as nutritional management in sepsis and septic shock patients.[1] Administration of only parenteral nutrition or combination of parenteral and enteral nutrition is not recommended in patients that are able to be given enteral nutrition. Parenteral nutrition is more invasive, increases the risk of infection, does not reduce mortality, and is high cost. [8] In this patient, on the first day of ICU treatment, parenteral nutrition is given directly without combination with enteral, because patient fasted until the 5th postoperative day.

During treatment at the ICU, hemodynamic monitoring, hemodynamic support, urine production and fluid balance monitoring, empirical antibiotics, mechanical ventilation, sedation, analgesia, with the aim of giving better tissue perfusion. On the fifth day of treatment at the ICU, the patient was transferred to the ward in a stable condition.

Conclusion

Septic shock is a part of sepsis based on circulatory and cellular metabolic failure that may increase mortality significantly. Early and adequate diagnosis of sepsis since patient was admitted to emergency department, accompanied by appropriate management of sepsis such as fluid resuscitation, hemodynamic support, source control surgery, specific antibiotic administration will improve patient's outcome and reduce morbidity as well as mortality.

References

Rhodes A, Evans LE, Alhazzani W, Levy MM, et al. (2016). Surviving Sepsis Campaign. International Guidelines for Management of Sepsis and Septic Shock. Critical Care Medicine, 43(4), 304-77

Sartelli M, Chichom-Mefire A, Labricciosa FM, et al. (2017). The Management of intra abdominal infections from a global perspective .WSES guidelines for management of intraabdominal infections. World Journal of Emergency Surgery,12-29

Levy MM, Evans LE, Rhodes A.(2018). The surviving Sepsis Campaign Bundle 2018 Update. Intensive Care Med, 44(6), 925-8

Singer M, Deutschman CS, et al. (2016). The third international consensus definitions for sepsis and septic shock (sepsis-3). JAMA, 315(8), 801-10

Seymour M, Liu VX, et al. (2016). Assesment of clinical criteria for sepsis: for the third international consensus definition for sepsis and septic shock (Sepsis-3). JAMA , 315(8),762-74

Leone M, Constantin J, Montravers T, Misset B. (2018). Guidelines for management of intra-abdominal infections, 34, 117–30

Solomkin JS, Mazasuki JE, Bradley JS, et al.(2010). Diagnosis and Management of Complicated Intra-abdominal Infection in Adults and Children. Guidelines by the Surgical Infection Society and the Infectious Diseases Society of America. Clinical Infectious Diseases, 50,133-64

Tatsumi H. (2019). Enteral Tolerance in critically ill patients. Journal of Intensive Care,7:30

Bernard GR, Vincent JL, Laterre PF, LaRosa S, Dhainaut JP, Rodriguez AL, et al. (2001). Efficacy and safety of recombinant human activated protein c for severe sepsis. N Eng J Med, 344 (10), 699-709