Cardiac surgery and sepsis in postoperative period – our experience

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ABSTRACT

The occurrence of sepsis after cardiac surgery is a rare event; however, its occurrence showed catastrophic clinical outcomes. The high morbidity and mortality revealed the need to improve treatment, aiming at patients' better clinical outcome.

Patients that develop sepsis, regardless of the infectious focus and the subjacent disease, present high morbidity and mortality, which vary from 17% to 65%. The main predictors of infections in the postoperative period are: body mass index ≥40kg/m², haemodialysis in the preoperative period, pre-op cardiogenic shock, age ≥80 years, pre-op treatment with immunosuppressive agents, diabetes mellitus, ECC time ≥200 minutes, mechanical circulatory support, three or more revascularized vessels.

From January 2015 to December 2015, we studied 675 adult patients who underwent cardiac surgery. Prophylactic antibiotic therapy was prescribed and given according to our protocol, from the induction of anaesthesia to the first postoperative day.
Sepsis in the postoperative period was defined as evidence on infection associated with two or more criteria of systemic inflammatory response syndrome: body temperature >38°C or <36°C, leukocytes >12,000 cells/mm³, positive blood cultures, respiratory rate >20/min, heart rate >100/min.

Key words: sepsis, postoperative period, cardiac surgery

INTRODUCTION

Cardiac surgery in most cases is a clean surgery with a low rate of infectious complications. When these do happen, they contribute to patients' unfavourable outcome. Infectious complications after clean cardiac surgery occur in up to 3.5% of patients and the main ones are: mediastinitis, infection at the site of the removal of the saphenous vein graft, endocarditis, sternal infection, chest surgical wound infection, sepsis, pulmonary infections, vascular access site infections, urinary tract infections, gastrointestinal tract infections, etc. Sepsis after cardiac surgery has been described as a low-prevalence infectious complication with tragic consequences. Patients who develop sepsis, regardless of the infectious focus present with high morbidity and mortality, which vary from 17% to 65%. (1)

Cardiac surgery postoperative infections contribute to the increase of the morbidity and mortality, hospital and ICU stay duration and cost. In spite of the increasing information on sepsis, there are no recent relevant publications that standardize the diagnosis and treatment in the context of the in-hospital postoperative period of patients submitted to cardiac surgery.
The main predictors of infections in postoperative period are: body mass index ≥40kg/m², haemodialysis in the preoperative period, pre-op cardiogenic shock, age ≥80 years, pre-op treatment with immunosuppressive agents, diabetes mellitus, ECC time ≥200 minutes, mechanical circulatory support, 3 or more revascularized vessels. (2)

MATERIALS AND METHODS

From January 2015 to December 2015, we studied 675 adult patients who underwent cardiac surgery. Prophylactic antibiotic therapy was prescribed and given according to our protocol, from the induction of anaesthesia up to the first postoperative day.
Sepsis in the postoperative period was defined as evidence of infection associated with two or more criteria of systemic inflammatory response syndrome: body temperature >38°C or <36°C, leukocytes >12,000 cells/mm³, positive blood cultures, respiratory rate >20/min, heart rate >100/min.
The assessed pre-, intra- and postoperative characteristics of the patients with sepsis were: age, sex, number of days spent in the ICU, cardiopulmonary bypass time, mechanical ventilation time, positive haemocultures, post-op acute renal failure. (Table 1)

RESULTS

Of the 675 cardiac surgery patients submitted to cardiac surgery during the analysed period, 48 (7.1%) developed sepsis during the in-hospital post-op period; 12 of them presented with severe sepsis and one of them developed septic shock, thus requiring high vasoactive support. Also, 12 patients were on mechanical cardiac support (LVAD, RVAD, BiVAD), of which two developed severe sepsis. Long in-hospital stay before surgery in the latter subset of patients, as well as low cardiac output syndrome are probable contributors to infection in the post-op period. In light of that acknowledgment, the real number of sep-

tic patients in the group of post-op cardiac patients is 36 (5.3%).
There was a predominance of male patients with sepsis during the post-op period when compared to female patients (67% vs. 33%); the patients' mean age was 66 (63±14) years. Renal replacement therapy was required in 22 (45%) patients. The mean value of mechanical ventilation period was 12 days, and ICU stay was 19.5 days. All of them had a long period of ECC (197.5 minutes), which is an independent predictor of getting an infection in the post-op period.
Isolated microorganisms from haemocultures of septic patients are shown in Table 2. All of them received antibiotic therapy according to antibiogram. Of all 48 septic patients 12 (25%) of them died during ICU stay.

Table 1. Septic patients in Zagreb University Clinical Hospital Centre cardio surgical ICU according to mechanical organ support management in 2015, with demographics.

SEX	No.	AGE (years)	ICU stay (days)	ECC1 (minutes)	MCS2		Mechanical ventilation (days)	RRT3 (No.)
					pts	days		
M	32	61±15 (65)	22.10±15. 10 (19. 50)	199. 31±103. 31 (208. 00)*	11	8. 46±5. 41 (6. 60)	14. 57±13. 07 (12. 00)	16
F	16	68±8 (70)	29. 31±22. 41 (22. 00)	180. 81±75. 12 (172. 50)	1	8±0 (8)	16. 93±16. 62 (12. 50)	6
Σ	48	63±14	24. 50±18. 20 (19. 50)	193. 14±95. 25 (197. 50)	12	8. 42±5. 18 (6. 80)	15. 35±14. 39 (12. 00)	22

1 ECC, ExtraCorporeal Circulation
2 MCS, Mechanical Cardiac Support
3 RRT, Renal Replacement Therapy
* a single patient with HM III was excluded (HM III for 45 days), however, bridging time on MCS was included

Table 2. Isolated microorganisms from haemocultures of septic patients in Zagreb University Clinical Hospital Centre cardio surgical ICU in 2015.

Microorganism	Number of patients with positive haemoculture (expressed as a percentage of total septic patients)
P. aeruginosa	10 (20. 8%)
St. maltophilia	11 (22. 9%)
A. baumanii	4 (8. 3%)
CNS*	18 (37. 5%)
Enterobacter spp.	5 (10. 4%)
K. pneumoniae**	3 (6. 2%)
MRSA	1 (2%)
E. coli	1 (2%)
A. flavus	1 (2%)
***	15 (31. 2%)

* coagulase negative staphylococcus
** a single case of K. pneumoniae ESBL
*** number of patients with 2 or more isolated microorganisms from haemocultures (mentioned above)
CNS, central nervous system
ESBL, Extended spectrum beta-lactamase
MRSA, methicillin-resistant Staphylococcus aureus

DISCUSSION

The infectious complications after clean cardiac surgery occur in up to 3.5% of patients. Cardiac surgery postoperative infections contribute to an increase of the morbidity and mortality, hospital and ICU stay duration and costs. (3)
In our investigation sepsis occured in 5.3% of the patients, which is a little bit higher than in the literature. The reason could be hospital admission at one or two weeks before surgery, and that needs to be changed.
Toumpoulis et al. studied 3,720 patients submitted to cardiac surgery, with the objective of identifying risk factors for sepsis and endocarditis. The prevalence of sepsis in the post-op period was 1.2%; however, the in-hospital mortality was >70% and there was an increase in cost and time of hospitalisation associated with the occur-

rence of sepsis. (4)

Michalopoulos et al. evaluated 2,615 patients submitted to cardiac surgery and verified a low prevalence of sepsis (2%). During sepsis, the patients presented the following picture: hypoxemia (41%), fever (39%), metabolic acidosis (36%), acute renal failure (36%), tachycardia (33%), arterial hypotension (28%) and mental confusion (22%). (5)

Fowler et al. analysed 331,429 patients submitted to myocardial revascularization surgery between January 2002 and December 2003, with the objective of developing an infection risk score. The prevalence of major infections was 3.5%: septicaemia in 1.2% of the patients, infection at the site of the removal of the saphenous vein graft in 1.1%, mediastinitis in 0.9% and multiple-site infection in 0.2%. The mortality of patients with infection was higher when compared to those without infection (17% vs. 3%, p <0.001). (2)

In the present study, the temporal onset of complications, that is, the occurrence of adverse events after the onset of sepsis, suggests that the patients with this disease are more vulnerable and thus present such high rates of complications. This lends to belief that the patient with sepsis has a higher chance of presenting with acute renal failure, heart failure, etc.

The current treatment of severe sepsis is based on the following procedures: aggressive and early (first 6h) volemic resuscitation (colloid or crystalloid), early antibiotic therapy (preferably within the first hour of septic shock), maintenance of haemoglobin >8g/L, administration of blood derivatives, adequate mechanical ventilation (when necessary), sedation, analgesia, no neuromuscular blockers (whenever possible), strict glycaemia control (blood glucose <10mmol/L), renal replacement therapy (there is an equivalence between the classic and the new modalities), corticosteroid administration when there is an inadequate response of BP to fluid therapy and vasopressors, recombinant activated protein C if APACHE score is ≥25 or when there is multiple organ failure, administration of sodium bicarbonate to patients with hypoperfusion induced by lactic acidosis with pH ≤7.15 and prophylaxis for deep venous thrombosis and stress ulcer. (6)

The objectives in the first 6 hours of volemic resuscitation are: central venous pressure between 8 and 12mmHg, mean BP ≥65mmHg, urinary output ≥0.5 ml/kg/hour and central venous oxygen saturation (ScvO2) ≥70%. In cases where the administration of fluids does not reach the target ScvO2, a red blood cell transfusion must be considered (if the haematocrit is <30%) as well as the intravenous infusion of dobutamine. (7) The implementation of this treatment contributes to decreased morbidity and mortality of severe sepsis in several clinical situations. They should also be adopted for patients submitted to cardiac surgery that develop severe sepsis.

In spite of its low prevalence, sepsis that occurs in the cardiac surgery post-operative period significantly contributes to patients' high morbidity and mortality. Therefore, the current recommendations for the treatment of severe sepsis represent a strategy that is potentially capable of improving the outcome of such patients and needs to be evaluated concerning the sepsis that occurs after cardiac surgery.

The present study has some limitations: the study was carried out in a single centre and modifications in sepsis diagnosis and treatment were verified during the assessed period.

CONCLUSION

Sepsis has always been a rare complication in the postoperative period of cardiac surgery. However, when observed, the result is catastrophic: 79% of the patients who presented such complication died during the hospitalisation phase. Cardiac surgery, in most cases, is a clean surgery with a low rate of infectious complications; however, when these do happen, they contribute to patients' unfavourable outcome.

Recently, recommendations that standardise the diagnosis and treatment of this disease have been published, aiming at improving the clinical evolution of patients. In spite of the increasing information on sepsis, there is not a relevant number of recent publications that standardise the diagnosis and treatment in the context of the in-hospital postoperative period of patients submitted to cardiac surgery.

The therapeutic measures recommended by the international guidelines for the treatment of sepsis must be applied to patients that present with sepsis after cardiac surgery, as they are potentially capable of reducing morbidity and mortality.

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