Incidence of Post-Operative Sepsis and Role of Charlson Co-Morbidity Score for Predicting Postoperative Sepsis

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Received: 10 Jan. 2015; Accepted: 25 Jun. 2015

Abstract- Sepsis and septic shock are among mortality causes following major surgeries. The Charlson co-morbidity index consists of 19 weighted categories related to chronic health which measures the burden of co-morbidity. The goal of this study was to determine the incidence of postoperative sepsis in patients underwent gynecological and gastrointestinal cancer surgeries and predictive role of Charlson index for this situation. Two hundred and twenty-two patients who underwent gynecological and gastrointestinal cancer surgeries were evaluated. Sixty-four (28.6%) patients developed SIRS postoperatively. Forty-four (19.7%) patients developed sepsis postoperatively. Mean age, duration of hospitalization and surgery, the Charlson score were significantly higher in patients who developed sepsis than other cases. Blood transfusion and Charlson score were independent predictors of sepsis occurrence. Charlson co-morbidity index is a predictive factor for developing postoperative sepsis.

Acta Med Iran, 2016;54(5):318-322.

Keywords: Sepsis; Post operative; Iran

Introduction

Sepsis and septic shock are among mortality causes following major surgeries (1).

Effects of anesthetic drugs, hormonal changes related to stress, rate of peri-surgical bleeding, transfusion, occurrence of ischemia–reperfusion, and duration of surgery are among post-surgical immune suppression factors (2).

Prophylactic therapies are widely used before procedures which have helped physicians to control post-operative sepsis and septic shock (3).

Factors like age, sex, underlying illness and co-morbidities, emergent surgeries, the degree of bleeding during surgery, and transfusion of allogeneic blood play a critical role in developing post-operative shock (4-9). Systemic inflammatory response syndrome (SIRS), sepsis, severe sepsis, and septic shock are clinical features with increasing mortality from SIRS to septic shock (10). Early identification of patients at risk of developing post-operative sepsis could help applying strategies to reduce post-operative sepsis. The Charlson co-morbidity index consists of 19 weighted categories related to chronic health which measures the burden of co-morbidity (11).

Higher levels of chronic co-morbidities are associated with higher risk of developing complications. So, application of this tool before major surgeries will help the physicians to identify high-risk cases and consider proper prophylactic therapies and strategies.

The goal of this study was to determine the incidence of postoperative sepsis in patients underwent gynecological and gastrointestinal cancer surgeries and predictive role of Charlson index for this situation.

Materials and Methods

In this study which conducted between September 2012 and September 2013 in Imam hospital (affiliated hospital of Tehran university of medical sciences), 250 patients who were a candidate for genitourinary or gastrointestinal cancer surgery were enrolled. Inclusion criteria were age more than 18 and candidate for surgery due to cancer of genitourinary or gastrointestinal tracts. Exclusion criteria were: age under 18, emergency surgery, evidence of sepsis prior to the surgery.

During the study period, a trained surgery resident recorded patient's data.

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She calculated The Charlson co-morbidity score (CCS) for each patient preoperatively. Demographic characteristics (age,sex), duration of surgery, prophylactic antibiotic, everyday vital sign, laboratory findings, ICU (Intensive care unit) admission, units of blood transfusion and length of stay were recorded.

All cases followed up to 6 days after surgery. Temperature, respiratory rate, pulse rate and white blood cell counts recorded for all patients for 6 consecutive days by a trained nurse.

Systemic inflammatory response syndrome (SIRS) was sought from the observation charts and laboratory results daily. SIRS, sepsis, and septic shock were defined as per the American College of Chest Physicians/Society of Critical Care Medicine Consensus Conference criteria (12).

If the SIRS criteria were met, case notes, laboratory results, radiographs, computed tomography scan were re-evaluated to find the source.

Chest" was considered as the source of sepsis if there were one or more of purulent sputum, worsening hypoxemia, new infiltrates on chest radiograph or positive sputum culture.

"Abdomen" was considered as the source of sepsis if there was an imaging modality demonstrating an intra-abdominal collection, or growth of pathogenic bacteria in any specimen of intra-abdominal drain fluid.

"Urinary tract" was considered as the site of infection if there was the positive growth of a pathogen in a mid-stream specimen or catheter specimen of urine.

If blood culture was positive but microbiological culture from another site was negative or imaging results were negative, according to organism cultured from blood, type of surgery and clinical signs, the sepsis was attributed to the most likely source of primary infection.

Surgical site infection considered if surgical site culture was positive.

All data were analyzed using SPSS software version 18.0 (SPSS Inc., Chicago, IL, USA).

Student's *t*-test and Fisher's exact tests were used to compare continuous and categorical variables.

P-value less than 0.05 was considered as significant.

Results

Twenty-seven patients were excluded. Finally, 223 patients evaluated. The mean age of patients and mean duration of hospitalization were 49.8±9.9 years and 12.7±7.4 days. One hundred and twenty-two were male (54.7%), and 101 (45.3%) were female. Total colectomy, sub-total gastrectomy were the most common surgical procedures. The mean duration of surgery was 3 hours. One hundred and thirty-five (60.5%) received allogeneic blood intra-operatively, and median CHARLSON score was 3 (range 0-7).

The most common prophylaxis antibiotics were a combination of ciprofloxacin+ metronidazole (Table 1).

Table 1. Prophylactic antibiotics applied to patients

	Number (%)
Cephazoline	14(6.2%)
Cephazoline+Metronidazole	15(6.7%)
Cephteriaxone+ Metronidazole	26(11.7%)
Ciprofloxacin	2(0.9%)
Ciprofloxacin+ Metronidazole	166(74.5%)

Sixty-four (28.6%) patients developed SIRS postoperatively. Forty-four (19.7%) patients developed sepsis postoperatively.

The source of sepsis was urinary tract (6 patients), chest (2 cases), and abdomen (15 cases). In 15 patients, positive culture of surgical site recorded.

Thirty-five out of 44 patients who developed sepsis admitted to critical care unit ($P<0.001$), and 29 (65.9%) received allogeneic blood intraoperatively ($P=0.005$).

There was no significant difference between two sex groups in cases developed sepsis (23 male and 21 female, $P=0.2$). Nine patients (20%) who developed sepsis died.

Mean age, duration of hospitalization and surgery were significantly higher in patients who developed sepsis than other cases (Table 2). Blood transfusion and CHARLSON score were independent predictors of developing post operative sepsis (Table 3).

Table 2. Mean age, duration of hospitalization, surgery and vital sign in patients with and without sepsis

	SIRS	Mean	Std. deviation	*P*.value
AGE	YES	53.7895	8.55873	0.007
	NO	49.0117	10.05631	
Duration of hospitalization(day)	YES	22.8000	12.23530	<0.001
	NO	10.4463	2.47458	
Duration of surgery (min)	YES	195.4167	50.64407	<0.001
	NO	151.5515	42.21524	
CHARLSON	YES	4.1026	1.09532	<0.001
	NO	2.7045	1.32802	
PR1	YES	100.7750	2.75948	<0.001
	NO	95.6978	5.91766	
RR2	YES	19.1000	2.71558	<0.001
	NO	16.7747	2.15397	
RR3	YES	18.6000	2.75309	<0.001
	NO	17.0604	12.37453	
RR4	YES	18.7000	3.16390	<0.001
	NO	15.7747	1.96624	
RR5	YES	19.2500	3.46965	<0.001
	NO	15.6429	1.81733	
PR6	YES	100.1351	5.13789	0.002
	NO	90.0000	4.00000	
RR1	YES	19.4750	2.68889	<0.001
	NO	17.3901	2.61033	
RR2	YES	19.1000	2.71558	<0.001
	NO	16.7747	2.15397	
RR3	YES	18.6000	2.75309	0.4
	NO	17.0604	12.37453	
RR4	YES	18.7000	3.16390	<0.001
	NO	15.7747	1.96624	
RR5	YES	19.2500	3.46965	<0.001
	NO	15.6429	1.81733	
RR6	YES	19.3784	3.49087	0.1
	NO	16.0000	1.00000	
T1	YES	38.0500	.15852	0.001
	NO	37.9258	.23160	
T2	YES	37.9875	.12848	<0.001
	NO	37.6011	.31395	
T3	YES	37.9025	.25165	<0.001
	NO	37.2687	.29350	
T4	YES	45.4000	47.46841	0.01
	NO	37.1049	.27336	
T5	YES	38.0750	.29936	<0.001
	NO	37.0324	.24696	
T6	YES	38.0811	.20526	<0.001
	NO	37.2250	.38622	
WBC1	YES	12830.0000	2237.92486	<0.001
	NO	10367.1429	2258.93427	
WBC2	YES	12440.0000	2342.12264	<0.001
	NO	9393.9560	1490.12097	
WBC3	YES	11685.0000	2256.79032	<0.001
	NO	8778.5714	1100.74417	
WBC4	YES	11667.5000	2392.65838	<0.001
	NO	8529.6703	1010.22338	
WBC5	YES	12005.0000	2685.66470	<0.001
	NO	8344.5055	914.67322	
WBC6	YES	12275.6757	2699.11564	<0.001
	NO	6451.5000	4353.26035	

PR: pulse rate
RR: Respiratory rate
T: temperature
WBC: White blood cells

Table 3. Logistic regression analysis considering sepsis as dependent and other variables as independent factors

	OR(95% CI)	*P*.VALUE
Sex (male/female)	0.8(0.3-1.8)	0.6
Blood transfusion	3.4(1.2-9.7)	0.02
CHARLSON score	0.3(0.2-0.5)	<0.001
Age	0.9 (0.9-1)	0.1

Discussion

The result of the current study showed that postoperative sepsis occurred in 19% of cases who underwent GI cancer surgery while 28% developed SIRS postoperatively. This rate was lower than the rate reported by Hampshire *et al*., .

They evaluated 101 patients who underwent elective major surgery and reported postoperative sepsis in 27% and SIRS in 58% (1). In another study, Mokart *et al*., evaluated 93 cases who underwent major oncological surgery and investigated that 19 patients (20.4%) developed a severe sepsis after surgery (13). seven (36%) of the septic patients died. Nine patients (20%) who developed sepsis died in our study. In current study sex was not an independent predictor of postoperative sepsis while in Mokart (13) male gender was an independent predictor (OR 4.7, 95% CI between 1.5 and 15.5, $P<0.01$). Offner *et al*., reported postoperative sepsis rate as 40% (14). These different rates could be due different inclusion and exclusion criteria and different settings in different studies.

We found that Charlson score was significantly different in cases with and without SIRS development. This finding is compatible with Mokart *et al*., findings and against Hampshire *et al*., findings (1,13). It has been reported that Charlson score equal or more than 6 is predictive of developing postoperative severe sepsis. As the results show, the Charlson score was significantly different between SIRS-positive and negative cases. In this score, for instance, metastatic cancer is heavily weighted which could strongly contribute to development of postoperative sepsis.

Charlson score is a simple, objective scoring system which consists of 19 weighted categories related to chronic health that measures the burden of co-morbidity (11).

It could be used easily and completely in a short time, but it has some disadvantages.

First, it does not include all co-morbidities. Second, some co-morbidities included in the score are not directly related to developing SIRS (15).

In the current study, mean age of patients who developed SIRS was significantly higher than the mean age of cases who did not develop SIRS. In Mokart *et al.,* and Hampshire *et al*., studies, age was not significantly different between septic and not septic groups (1,13).

People older than 65 years old are more likely to have chronic conditions which could contribute to developing SIRS and sepsis. We also investigated that mean duration of hospitalization and meant duration of surgery were significantly higher in SIRS group which is compatible with Hampshire *et al*., findings (1).

This study had some limitations. First, it conducted in a referral hospital. Second, all cases who underwent all types of surgery were not included.

Multicenter studies with larger sample sizes are recommended.

Charlson co-morbidity index is a predictive factor for developing postoperative sepsis.

References

1. Hampshire PA, Guha A, Strong A, et al. An evaluation of the Charlson co-morbidity score for predicting sepsis after elective major surgery. Indian J Crit Care Med 2011;15(1):30-6.
2. Desborough JP. The stress response to trauma and surgery. Br J Anesth 2000;85(1):109-17.
3. Lobo SM, Salgado PF, Castillo VnG, et al. Effects of maximizing oxygen delivery on morbidity and mortality in high-risk surgical patients. Crit Care Med 2000;28(10):3396-404.
4. Madbouly KM, Senagore AJ, Remzi FH, et al. Perioperative blood transfusions increase infectious complications after ileoanal pouch procedures (IPAA). Int J Colorectal Dis 2006;21(8):807-13.
5. Vamvakas E, Carven J, Hibberd P. Blood transfusion and infection after colorectal cancer surgery. Transfusion 1996;36(11-12):1000-8.
6. Torchia MG, Danzinger RG. Perioperative blood transfusion and albumin administration are independent risk factors for the development of postoperative infections after colorectal surgery. Can J Surg 2000;43(3):212-6.

7. Cullen DJ, Apolone G, Greenfield S, et al. ASA Physical Status and age predict morbidity after three surgical procedures. Ann Surg 1994;220(1):3-9.
8. Behrman SW, Zarzaur BL. Intra-abdominal sepsis following pancreatic resection: incidence, risk factors, diagnosis, microbiology, management, and outcome. Am Surg 2008;74(7):572-9.
9. Wichmann M, Inthorn D, Andress H-J, et al. Incidence and mortality of severe sepsis in surgical intensive care patients: the influence of patient gender on disease process and outcome. Intensive Care Med 2000;26(2):167-72.
10. Hotchkiss RS, Karl IE. The pathophysiology and treatment of sepsis. N Engl J Med 2003;348(2):138-50.
11. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. J Chronic Dis 1987;40(5):373-83.
12. Bone RC, Balk RA, Cerra FB, et al. Definitions for sepsis and organ failure and guidelines for the use of innovative therapies in sepsis. The ACCP/SCCM Consensus Conference Committee. American College of Chest Physicians/Society of Critical Care Medicine. Chest 1992;101(6):1644-55.
13. Mokart D, Leone M, Sannini A, et al. Predictive perioperative factors for developing severe sepsis after major surgery. Br J Anaesth 2005;95(6):776-81.
14. Offner PJ, Moore EE, Biffl WL. Male gender is a risk factor for major infections after surgery. Arch Surg 1999;134(9):935-40.
15. Bader MS. Staphylococcus aureus Bacteremia in Older Adults: Predictors of 7-Day Mortality and Infection With a Methicillin-Resistant Strain. Infect Control Hosp Epidemiol 2006;27(11):1219-25.