Incidence and Outcome of Systemic Inflammatory Response Syndrome Among Post-Operative Patients of Elective Surgery Under General Anaesthesia

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ABSTRACT

Introduction: Signs and symptoms of Systemic Inflammatory Response Syndrome are frequently observed in post-operative and surgery wards. Inflammation and infection after major operations may lead to organ dysfunction and failure. When Systemic Inflammatory Response Syndrome progresses to multiple organ failure, the mortality is significantly high, depending on the number of failed organs. This study emphasizes to focus on Systemic Inflammatory Response Syndrome and sepsis in postoperative patients, so that timely care to such patients leads to decreased hospital stay. Financial to the patient can also be reduced.

Materials and Methods: This is a prospective observational study. Patients in surgical and post-operative wards were categorized as having systemic inflammatory response syndrome, if following two or more criteria were present: pulse rate: >90 beats/min, respiratory rate: >20 breaths/min, temperature: > 38°C or < 36°C, total leucocytes count: > 12,000/µL or < 4,000/µL. Patients with Systemic Inflammatory Response Syndrome were compared with outcomes of surgery like length of hospital stay and mortality with other similar patients.

Results: There were 120 post-operative cases of elective surgeries under general anaesthesia with 42 males and 78 females. Eighteen (15%) had Systemic Inflammatory Response Syndrome. No mortality was recorded due to the syndrome. Among total patients with the inflammatory syndrome, 61.11% were males compared to 38.89% females. Duration of the surgery was significantly associated with the syndrome, as 66.67% of those who developed Systemic Inflammatory Response Syndrome had undergone surgery for more than an hour.

Conclusion: Incidence of Systemic Inflammatory Response Syndrome among elective post-operative patients was greater in males and it increased with the total duration of the surgery.

Keywords: Postoperative, SIRS, morbidity, organ failure

INTRODUCTION

It is known that major problem after surgery is inflammation and infections which may sometimes lead to organ dysfunction and failure. Mortality may become high up to 30-80 % if Systemic Inflammatory Response Syndrome (SIRS) progresses to multiple organ failure.[1] Preoperative clinical parameters like high heart rate, low albumin levels are significantly associated with developing SIRS during post-operative period.[2] Outcome of SIRS depends on nature of surgeries like abdominal, neurosurgery,

emergency and elective surgery. Approximately 20% of post-operative patients of intracerebral hemorrhage develop SIRS.[3] There have been many studies on SIRS and Quick Sequential Organ Failure Assessment (qSOFA), and they have concluded that SIRS patients included almost all qSOFA patients.[4] This study was conducted among elective surgery cases under general anaesthesia; with the aim to find out the incidence rate of SIRS among elective post-operative patients. This study aims to help in timely diagnosis and decreasing SIRS in post-operative ward.

MATERIALS AND METHODS

It was a prospective observational study. This study was conducted at Pokhara Academy of Health Sciences, Western Regional Hospital, Pokhara, Kaski, Nepal. Ethical clearance was obtained from Institutional Review Committee of Pokhara Academy of Health Sciences. Duration of study was six months from June 2022 to December,2022. Total of 120 consecutive cases from the start of study period were included for this study. We included only major elective surgeries performed under general anaesthesia. Major elective surgeries performed under spinal anaesthesia were excluded. SIRS was diagnosed if two or more of the following variables were present among post-operative patients.

Temperature: > 38°C or < 36°C

Pulse rate (PR): >90 beats/min

Respiratory rate (RR): >20 breaths/min

Total leucocytes count (TLC): > 12,000/µL or < 4,000/µL

Temperature, pulse rate, and respiratory rate were recorded manually. TLC test was done on admission and alternate day after surgery till patients were discharged from hospital. All surgeries were performed under general anesthesia. Any untoward incident like fall in blood pressure , asystole , wheeze on chest auscultation, excessive bleeding during the period of surgery and duration of surgery were recorded. Data were entered into excel and then statistical analysis was performed by STATA 15. Descriptive analysis was done and the relationship of outcome variable with other covariates, Chi square test and Fisher's exact test were done.

RESULTS

The highest number (43.33%) of surgeries during the study period was done on the people of age group 40 years to 60 years(Table 1). Percent of females undergoing surgeries was almost double the percent of males undergoing surgeries. Total leucocyte count (TLC) showed that percentage of people having the TLC below the normal range(<4000/µL) was almost negligible (0.83%) as compared to the percent (37.5%) of people having TLC above the normal range(> 12,000/µL). Incidence of SIRS was observed in 15% of the patients during post-operative period.

Table1: Description of variables (N=120)

Variables	Category	Frequency (n)	Percentage (%)
Age(years)	20-40	31	25.83
	40-60	52	43.33
	less than 20	11	9.17
	more than 60	26	26.67
Sex	Female	78	65
	Male	42	35
Pulse rate	<90 Beats/min.	97	80.83
	>90Beats/min.	23	19.17
Respiratory rate	<20 per min.	113	94.17
	>20 per min.	7	5.83
Temperature	36-38 °C	105	87.5
	<36 °C	1	0.83
	>38 °C	14	1.67
Total leucocyte count	4000-12000/µL	74	61.76
	<4000/µL	1	0.83
	>12000/µL	45	37.5
Hospital stay	3-5 days	57	47.5
	6-8 days	9	7.5
	>8 days	2	1.67
	Upto 2 days	52	43.33
Duration	<1 hour	88	73.33
	>1 hour	32	26.67
SIRS	NO	102	85
	YES	18	15

We accepted the relationship to be significant if we found the p-value<0.05. In this study in Table 2, we did not find significant association of age of the patients with the outcome variable SIRS (p-value 0.284)

Table2: Relationships of independent variable and outcome variable (N=120)

Variable	Categories	SIRS		P-Value
		NO (n=102)	YES (n=18)	
Age (years)	20-40	28 (27.45)	3 (16.67)	0.284
	40-60	43 (42.16)	9 (50)	
	< 20	11 (10.78)	0	
	> 60	20 (19.61)	6 (33.33)	
Sex	Female	71 (69.61)	7 (38.89)	0.012
	Male	31 (30.39)	11 (61.11)	
pulse rate	<=90 Beats/minute	95 (93.14)	2 (11.11)	<0.001
	> 90 Beats/minute	7 (6.87)	16 (88.89)	
Respiratory rate	< 20/ minute	101 (99.02)	12 (66.67)	<0.001
	> 20/ minute	1 (0.98)	6 (33.33)	
Temperature	36-38 °C	97 (95.10)	8 (44.44)	< 0.001
	<36 °C	0	1 (5.56)	
	>38 °C	5 (4.9)	9 (50.0)	
Total leucocyte count	4000-12000/µL	67 (65.69)	7 (38.89)	0.017
	<4000/µL	0	1 (5.56)	
	>12000/µL	35 (34.31)	10 (55.56)	
Duration of surgery	< 1 hour	82 (80.39)	6 (33.33)	<0.001
	> 1 hour	20 (19.61)	12 (66.67)	
Hospital stay	>2 days	53(51.96)	15(83.33)	<0.001
	<2 days	49(48.03)	3(16.66)	

We observed that duration of surgery and total leucocyte count had significant association with SIRS with p-value <0.001 and 0.017 respectively. We found that majority (88.89%) of the patients who diagnosed with SIRS had pulse rate more 90 beats per minute.

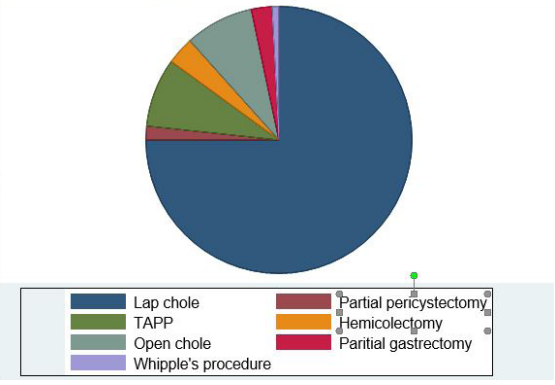

Figure 1: Different surgeries performed

We recorded the surgeries performed during the study and found that seven types of surgeries were performed as displayed in figure1. Laparoscopic cholecystectomy was on 75% of the patients whereas least number of surgeries performed was whipple procedure which was done on only one (0.83%) patient. Patients of Trans Abdominal Pre Peritoneal (TAPP) mesh repair and open cholecystectomy was equal in number 10 (8.33%).

DISCUSSION

The major problem after surgery is inflammation and infections which may sometimes lead to organ dysfunction and failure. Mortality may be high up to 30-80 % if SIRS progresses to multiple organ failure.[1] Preoperative clinical parameters like high heart rate, low albumin levels are significantly associated with developing SIRS during post-operative period.[2] In this study we included only elective surgical cases under general anaesthesia .

Acute phase reaction of the body is a complex series of reactions that begin in response to infection, physical trauma which is characterized by elevated body temperature, leukocytosis and changes in the body metabolism.[5] In post-surgical patients leukocytosis is common, which is due to increased release of cortisol after the body's response to stress of surgery.[6,7]

Out of total 120 cases included , 42 were males and

78 were females. Overall incidence of systemic inflammatory response syndrome was 15%. However studies show that almost half of patients hospitalized on the wards developed SIRS at least once during their hospital stay.[8,9] Our findings were only 15% which suggest that SIRS is lower among elective surgery patients.

Out of 120 cases, 45 patients (37.5%) had TLC more than 12000. Out of total SIRS patients 10 patients (55.55%) had increased TLC which is similar to other studies.[10-12]

Incidence of SIRS among females and males are 7(38.88%) and 11 (61.11%) respectively. In this study incidence of SIRS is less among females which is similar in other studies performed at different health facilities.[13] Reasons behind less incidence of SIRS among females may be due to active immune system - both cellular and humoral immunity reactions during SIRS.[14-16] Studies have shown that females have high level of estrogen which favours lower inflammatory response.[7,17] There were no patients with SIRS among below 20 years age group which may be due to presence of active cellular and humoral immunity among teenagers.

In this study the most frequent positive findings among SIRS-positive patients were increased pulse rate 16(88.88%) and change in TLC 17(94.44%). There are different studies showing different parameters to be frequent in SIRS patients. In one study the most frequent positive criterion among SIRS-positive patients was increased respiratory rate followed by change in leukocyte count.[18] Hospital stay more than two days was observed in 15(83.33%) among SIRS patients which is only 53(51.96%) among non SIRS patients. Most of the SIRS patients were discharged within 8 days without progressing to sepsis , MODS and mortality which may be due to timely intervention and proper selection of cases only among elective surgery.

CONCLUSION

Incidence of SIRS among elective post-operative patients was greater in males and increases with the increasing time taken for surgery. SIRS increases hospital stay. We need large scale studies for further verification of outcome of SIRS after elective surgeries.

REFERENCES

1. Singh S, Singh P, Singh G. Systemic inflammatory response syndrome outcome in surgical patients. The Indian journal of surgery. 2009;71(4):206-9.
2. Albabtain IT, Almohanna RS, Alkhuraiji AA, Alsalamah RK, Almasoud NA, AlBaqmi KH, et al. Risk factors for the systemic inflammatory response syndrome and sepsis following surgical management of acute intestinal obstruction. International journal of health sciences. 2021;15(6):28-33.
3. Boehme AK, Hays AN, Kicielinski KP, Arora K, Kapoor N, Lyerly MJ, et al. Systemic Inflammatory Response Syndrome and Outcomes in Intracerebral Hemorrhage. Neurocritical care. 2016;25(1):133-40.
4. Gando S, Shiraishi A, Abe T, Kushimoto S, Mayumi T, Fujishima S, et al. The SIRS criteria have better performance for predicting infection than qSOFA scores in the emergency department. Scientific reports. 2020;10(1):8095.
5. Singla DR, Garg DA, Maan DSS, Sharma DS. Systemic Inflammatory Response Syndrome (SIRS) Outcome in Surgical Patients at Tertiary Care Hospital. International Journal of Science and Research (IJSR) 2020;9(3):1554-7.
6. Fung YL, Fraser JF, Wood P, Minchinton RM, Silliman CC. The systemic inflammatory response syndrome induces functional changes and relative hyporesponsiveness in neutrophils. Journal of critical care. 2008;23(4):542-9.
7. Streat SJ, Plank LD, Hill GL. Overview of modern management of patients with critical injury and severe sepsis. World journal of surgery. 2000;24(6):655-63.
8. Churpek MM, Zadravecz FJ, Winslow C, Howell MD, Edelson DP. Incidence and Prognostic Value of the Systemic Inflammatory Response Syndrome and Organ Dysfunctions in Ward Patients. American journal of respiratory and critical care medicine. 2015;192(8):958-64.
9. Mi Q, Meng X, Meng L, Chen D, Fang S. Risk Factors for Systemic Inflammatory Response Syndrome Induced by Flexible Ureteroscope Combined with Holmium Laser Lithotripsy. BioMed research international. 2020;2020:6842479.

10. Kriplani A, Pandit S, Chawla A, de la Rosette J, Laguna P, Jayadeva Reddy S, et al. Neutrophil-lymphocyte ratio (NLR), platelet-lymphocyte ratio (PLR) and lymphocyte-monocyte ratio (LMR) in predicting systemic inflammatory response syndrome (SIRS) and sepsis after percutaneous nephrolithotomy (PNL). Urolithiasis. 2022;50(3):341-8.
11. Horeczko T, Green JP, Panacek EA. Epidemiology of the Systemic Inflammatory Response Syndrome (SIRS) in the emergency department. The western journal of emergency medicine. 2014;15(3):329-36.
12. Ye-Ting Z, Dao-Ming T. Systemic Inflammatory Response Syndrome (SIRS) and the Pattern and Risk of Sepsis Following Gastrointestinal Perforation. Medical science monitor : international medical journal of experimental and clinical research. 2018;24:3888-94.
13. Xu J, Tong L, Yao J, Guo Z, Lui KY, Hu X, et al. Association of Sex With Clinical Outcome in Critically Ill Sepsis Patients: A Retrospective Analysis of the Large Clinical Database MIMIC-III. Shock. 2019;52(2):146-51.
14. Klein SL, Flanagan KL. Sex differences in immune responses. Nature reviews Immunology. 2016;16(10):626-38.
15. Kosyreva AM, Dzhalilova DS, Makarova OV, Tsvetkov IS, Zolotova NA, Diatroptova MA, et al. Sex differences of inflammatory and immune response in pups of Wistar rats with SIRS. Scientific reports. 2020;10(1):15884.
16. Giefing-Kroll C, Berger P, Lepperdinger G, Grubeck-Loebenstein B. How sex and age affect immune responses, susceptibility to infections, and response to vaccination. Aging cell. 2015;14(3):309-21.
17. Smajic J, Tupkovic LR, Husic S, Avdagic SS, Hodzic S, Imamovic S. Systemic Inflammatory Response Syndrome in Surgical Patients. Medical archives. 2018;72(2):116-9.
18. Taniguchi LU, Pires EMC, Vieira JM, Jr., Azevedo LCP. Systemic inflammatory response syndrome criteria and the prediction of hospital mortality in critically ill patients: a retrospective cohort study. Revista Brasileira de terapia intensiva. 2017;29(3):317-24.