Original Research Article

Impact of institutional educational program on compliance of implementation of surviving sepsis campaign guidelines, total ICU and hospital mortality

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ABSTRACT

Background: To determine whether educational program based on the surviving sepsis campaign (SSC) guidelines affects the compliance of implementation of SSC guidelines, total ICU and hospital mortality.

Methods: A prospective observational study conducted in adult patients with severe sepsis or septic shock admitted to 11 bedded adult medical and surgical ICU of Bhopal Memorial Hospital and Research Centre, Bhopal, Madhya Pradesh, India. In pre-education period all patients in ICU were daily screened according to severe sepsis screening tool and followed up daily during their entire period of ICU stay. Outcome measures were compliance of implementation of SSC guidelines, total ICU and hospital mortality noted. Education program of resident doctors of the ICU, emergency department, medical and surgical units was carried out. Post-education period data noted similar to the pre-education period. Comparative statistics applied by using Chi-square test and paired Student t-test.

Results: Compliance to all resuscitative measures in SSC guideline both 3 hour and 6 hour bundles significantly improved after education program (P-value 0.014). In pre-education period 33.3% patients were treated with complete implementation of SSC Guidelines Bundles compared to 63.6% in post-education period. Total ICU mortality and hospital mortality did not change significantly after education program during study period. Total ICU mortality during pre-education period was 29.52% as compared to 25.45% in post-education period (P-value 0.44) while total hospital mortality in pre-education period was 5.18% as compared to 5.62% in post-education period (P-value 0.07).

Conclusions: The Institutional educational program has significant impact on increasing compliance to both 3 hour and 6 hour bundles in SSC guideline but failed to show any significant impact on decreasing overall total ICU and hospital mortality.

Keywords: Educational program, Sepsis, Septic Shock, SSC Guidelines

INTRODUCTION

Sepsis is a major health-care problem across the world accounting for an average 1 in 5 admissions to intensive care unit.[1] Worldwide, the prevalence of sepsis is 29.5% while ICU mortality rates is 25·8% and hospital mortality is 35·3%.[2] In Indian Intensive care set up, the prevalence of severe sepsis and septic shock is 28% while ICU mortality is 34%.[3]

Early diagnosis and treatment is mainstay in management of sepsis. Early identification of infection can lead to earlier application of source-control measures and antimicrobial treatment. The speed and appropriateness

of the therapy administered in the initial hours after onset of severe sepsis are likely to influence the outcome.[4]

Surviving sepsis campaign (SSC) guidelines.[5-7] was introduced globally in 2004 and was updated in 2008 and 2012, with a vision to improve the outcome of patients with Sepsis and septic shock. These were put together as bundles of evidence based guidelines with specific targets to be achieved within specified time frames.

Due to lack of education and awareness about sepsis and its management in hospital personnel, current SSC guidelines are followed variably in ICU, ED, and Medical and Surgical wards leading to longer duration of hospital stay and higher mortality.

Education programs are capable of improving knowledge of treatment guidelines and creating a positive attitude among hospital staff members. The expanding body of research makes it difficult for any physician to be aware of every applicable guideline and critically apply it to daily practice.

Considering importance of education about guidelines, in present study we would like to analyse effect of educational program for resident doctors in our institute on the compliance of implementation of SSC guidelines with its effect on ICU mortality and hospital mortality.

METHODS

Design and setting

A prospective observational study with "before and after" study design was conducted in adult patients with severe sepsis or septic shock admitted to 11 bedded adult intensive care unit.

Study period

Pre-education study was conducted from August 2013 to November 2013. Institutional education program was carried out in January 2014 (during which no patient data were collected). Post-education study was conducted from February 2014 to May 2014.

Total 66 patients were included in present study- 33 in each period.

Pre-education period

All the in-patients of ICU (means those admitted to ICU with any diagnosis from emergency department, wards and already present in ICU) were daily screened and followed up during their entire period of ICU stay daily for any new symptoms and signs suggestive of severe sepsis/ septic shock. Patients who initially fulfilled SIRS criteria but subsequently appeared not to be in severe

sepsis/septic shock were excluded from the study. If all the criteria in the management were completed according to SSC guidelines bundles i.e. 3 hour and 6 hour bundle within its time frame then it was labelled as "compliant". If any step was missed or not completed within its time frame then it was labelled as "non-compliant". Compliance was measured in total patients of severe sepsis and septic shock those present only in ICU during study period. Total ICU mortality and total hospital mortality during pre-education period was noted.

Institutional education program

It included education of resident doctors of the ICU, emergency department, medical and surgical units in the form of power point presentation, posters, and flow charts emphasizing on the definitions, early detection of signs and symptoms, diagnosis and the treatments of severe sepsis and septic shock according to SSC guidelines. All the resident doctors were provided SSC guidelines implementation kit which contained posters, pocket guides, bundle cards. Duration of education program was one month.

Post-education period

Total 33 patients included. All the data collection methods were kept similar to that of pre-education period. Compliance to SSCG bundles, total ICU and hospital mortality were noted similar to the pre-education period.

Data analysis

Comparative statistics was applied to determine the effect of the educational program on compliance with sepsis bundles and effect on ICU and hospital mortality by using Chi-square test and paired Student t-test.

RESULTS

In present study, total ICU admissions in pre-education period were 308 while in post-education period were 243 patients. The consecutive patients were not studied because patients in pre-education period and post-education period are different as both periods are separated by education period of 1 month.

Age and gender distribution in both periods was found to be statistically insignificant denoting that both study periods were comparable. Mean age in pre-education period was 55.12 years (SD±16.63) while in post-education period was 59.91 years (SD±11.09) having male predominance in both periods. Mean APACHE II score in pre-education period was 25.21 (SD±4.96) while in post-education period was 26.52 (SD±4.87) showing statistical insignificance (p-value 0.283). This means severity of diseases in both study periods was comparable (Table 1).

Table 1: Distribution of age, gender, apache II, admission source between groups.

	Pre-education	Post-education	P-value
Age (mean±SD)	55.12±16.63	59.90±11.09	0.174
Gender F/M	11/22	12/21	0.796
APACHE II (Mean±SD)	25.21±4.96	26.5±4.87	0.286
Admission source (ED/ward)	18/15	24/9	0.125
Percent of patients with severe sepsis/septic shock	60.6% / 39.4%	63.6% / 36.4%	0.800

Table 2: Distribution of various parameters within 6 hours in pre and post education groups.

	Pre-education		Post-education		P-value
	Yes	No	Yes	No	
CVP measurement	11 (33.33%)	22 (66.70%)	23 (69.70%)	10 (30.30%)	0.003
Serum lactate measurement	11 (33.30%)	22 (66.70%)	21 (63.60%)	12 (36.40%)	0.014
Scvo2 measurement	11 (33.30%)	22 (66.70%)	21 (63.60%)	12 (36.40%)	0.014
Vasopressor administration	33 (100%)	-	33 (100%)	-	-
Crystalloid administration	13 (39.40%)	20 (60.60%)	26 (78.80%)	7 (21.20%)	0.001
Antibiotics administration	21 (63.60%)	12 (36.40%)	30 (90.90%)	3 (9.10%)	0.008
Blood cultures	15 (45.50%)	18 (54.50%)	30 (90.90%)	3 (9.10%)	<0.0001
Compliance with the entire 3-hr bundle	11 (33.3%)	22 (66.7%)	21 (63.6%)	12 (36.4%)	0.014
Compliance with the entire 6-hr bundle	11 (33.3%)	22 (66.7%)	21 (63.6%)	12 (36.4%)	0.014
Total overall compliance	11 (33.3%)	22 (66.7%)	21 (63.6%)	12 (36.4%)	0.014

Sources of admission of severe sepsis and septic shock patients to ICU from emergency department in pre-education period were 54.5% versus 72.7% in post-education period while admissions to ICU from wards in pre-education period were 45.5% versus 27.3% in post-education period (P-value 0.125). This suggest that source of admission of included patients to ICU was comparable in both periods.

Percentage of patients with severe sepsis was 60.6% in pre-education period and 63.6% in post-education period compared to Septic shock 39.4% in pre-education period and 36.4% in post-education period (P-value 0.80). We also found that number of patients with severe sepsis (62.1%) were more than septic shock (37.9%) in both of the study periods.

Table 3: Distribution of length of ICU stay in pre and post education groups.

	Group	N	Mean	Std. Deviation	T-value	P-value
Length of ICU stay	Pre test	33	8.03	5.955	1.527	0.132
	Post test	33	10.24	5.81		

Table 4: Distribution of outcomes in pre and post education groups.

		Outcome		Total	Chi square	P-value
		Death	Discharged			
Group	Preeducation	31	2	33	3.216	0.073
		93.9%	6.1%	100.0%		
	Posteducation	26	7	33		
		78.8%	21.2%	100.0%		
Total		57	9	66		
		86.4%	13.6%	100.0%		

Most common suspected source of sepsis in our ICU was found to be respiratory system (53%), followed by urinary system (24%), abdominal system (18%), and blood stream (4%). But distribution of suspected source

of sepsis shows no statistically significant difference (P-value 0.256) between two periods. Measurement of serum lactate levels within 3 hours of development of severe sepsis and septic shock had been significantly improved after education program from 33.3% to 63.6% with p-value of 0.014.

Significant improvement in obtaining blood cultures prior to administration of broad spectrum antibiotics within 3 hour bundle period occurred after education program (45.5% in pre-education period to 90.9% in post-education period with a p-value of <0.0001).

Table 5: Distribution of compliance status in pre and post education groups.

		Status		Total	Chi square	P-value
		Compliance	Non-compliance			
Group	Pre-education	11	22	33	6.066	0.014
		33.3%	66.7%	100.0%		
	Post-education	21	12	33		
		63.6%	36.4%	100.0%		
Total		32	34	66		
		48.5%	51.5%	100.0%		

Table 6: ICU and hospital mortality in pre and post education groups.

Mortality	Group	Mean (%)	SD	T-value	P-value
ICU	Pre	29.52	7.45	0.8327	0.4369
	Post	25.45	6.34		
Hospital	Pre	5.18	0.20	2.1626	0.0738
	Post	5.62	0.35		

Significant increase in compliance to administration of broad spectrum antibiotics within one hour of admission had been noted after education of resident doctors, increasing from 63.6% in pre-education period to 90.9% in post-education period (P-value 0.008)

Compliance to administration of crystalloids (30 ml/kg) within 3 hour bundle period significantly improved after education. In pre-education period only 39.4% of patient received crystalloids as compared to 78.8% in post-education period (P-value 0.001).

In present study, all patients in both study periods received vasopressor suggesting full compliance to application of vasopressors within 6 hour bundle period. Compliance to measurement of CVP within 6 hrs bundle period had been improved significantly from 33.3% to 69.7% in post-education period. (P-value 0.003) Compliance to measurement of Scvo2 within 6 hours bundle period was increased in post-education period from 33.3% to 63.6% (P-value 0.014).

There was significant improvement in re-measurement of *S. lactate* after all resuscitative measures in management of severe sepsis/ septic shock within 6 hours bundle period from pre-education period 33.3% to 63.6% in post-education period occurred (P-value 0.014). In present study, compliance to all resuscitative measures in SSC Guidelines both 3 hour and 6 hour bundles had

significantly improved after education program (P-value 0.014). In pre-education period 33.3% patients were treated with complete implementation of SSC guidelines bundles compared to 63.6% in post-education period.

The final outcome was measured in terms of death or discharge from ICU. In pre-education period, 93.9% of patients with severe sepsis/ septic shock died while 6.1% of patients were discharged compared to post-education period in which 78.8% of patients with severe sepsis/ septic shock died while 21.2% of patients were discharged from ICU. These results when compared by using chi-square test, showed statistical insignificance. (P-value 0.073) This suggests that education program did not have significant impact in decreasing ICU mortality in patients with severe sepsis/ septic shock.

In present study, mean duration of ICU stay in patients with severe sepsis and septic shock in pre-education period was found to be 8.03 days while 10.24 days in post-education periods. When this data was compared by using paired Student t-test, it was statistically insignificant suggesting both periods were similar in terms of ICU length of stay. Total ICU mortality in our hospital, during pre-education period was 29.52% as compared to 25.45% in post-education period (P-value 0.44). Total hospital mortality in our hospital, in pre-education period was 5.18% as compared to 5.62% in post-education period (P-value 0.07). This shows that

ICU mortality and hospital mortality did not change significantly after institutional education program.

DISCUSSION

In present study, compliance to all resuscitative measures in SSC Guidelines both 3 hour and 6 hour bundles had improved significantly after education program from 33.3% to 63.6% but decrease in total ICU mortality from 29.52% to 25.45% and total hospital mortality from 5.18% to 5.62% was not statistically significant.

In 2005, Massimo Girardis et al concluded that the compliance to all 9 interventions in SSCG increased from 8% to 35% (P<0.01) after an in-hospital sepsis program with a lower risk of in-hospital mortality (23% vs. 68% and 27% vs. 68%, P<0.01).[8] Ferrer et al compliance to all resuscitative measures in SSC guidelines both 3 hour and 6 hour bundles had improved significantly after implementation of education program from 5.3% to 10.0% (P-value 0.001) with insignificant decrease in hospital mortality from 44.0% to 39.7% in post intervention period (P-value 0.04).[9] Also ICU mortality decreased insignificantly from 36.9% to 32.4% (P=-value 0.03).

In Asian set up, Phua J et al found that compliance rate for the resuscitation and management bundles were 7.6% and 3.5% respectively with overall hospital mortality 44.5% while ICU mortality was 36.7%.[10] A study by Rhodes A et al shows overall compliance with all the 3hr bundle metrics was 19% while with 6hr bundle metrics was 36%.[11] Rhodes A et al compliance with 3hr bundle metrics was associated with lower hospital mortality than noncompliance 20 vs. 31%, (p<0.001) while with 6hr bundle metrics was 22 vs. 32%, (p < 0.001).[11] Levy MM et al found overall lower mortality was observed in high (29.0%) versus low (38.6%) resuscitation bundle compliance sites (p<0.001) and between high (33.4%) and low (32.3%) management bundle compliance sites (p=0.039).[12] This analysis demonstrated that increased compliance with sepsis performance bundles was associated with a 25% relative risk reduction in mortality rate. In Taiwan, Chen et al study showed hospital mortality rate had decreased from 37.0% to 30.8% suggesting that nationwide education program had statistically significant impact on decreasing total hospital mortality rate.[13]

Lundberg et al and Ferrer et al found that the location within the hospital where the patient was diagnosed with sepsis influences outcomes.[9,14] Location was predominantly in the emergency department and the medical-surgical wards. Gao et al study shows respiratory system was the most common source of sepsis (50%) followed by intra-abdominal infection.[15] Ferrer et al main sources of sepsis were pneumonia and acute abdominal infections in both study periods.[9] Other less common sources were urinary tract infection, meningitis, and multiple infection sites.

Chen et al compliance to the measurement of serum lactate during initial resuscitation period increased from 4.8% to 12.7% after education program.[13] Similarly Ferrer et al showed improvement in measurement of serum lactate from 39% to 50.1 % after education program (p-value<0.001).[9] Chen et al showed significant improvement in obtaining blood cultures from 70.4% to 83.4% after education period (P-value<0.001).[13] Ferrer et al showed improvement in obtaining blood cultures from 54.4% to 62.4% in post-education period (P-value<0.001).[9] J Phua et al found that compliance of obtaining blood cultures was 62.5%.[10]

Kumar et al showed that with each hour delay in appropriate antibiotic therapy, there was a 7.6% decrease in survival in patients with severe sepsis.[16] Ferrer et al showed increase in compliance to administration of broad spectrum antibiotics within one hour of admission from 66.5% to 68.9% in post intervention period (P-value 0.24).[9] Chen et al also showed increase in application of broad spectrum antibiotics from pre-education period 45.9% to 57.3% in post-education period (P-value <0.001).[13] Phua J et al found that compliance to broad spectrum antibiotics was 63.9%.[10]

Ferrer et al study shows significant increase in administration of crystalloids after education from 40.9% to 46.7 (P-value 0.008).[9] Ferrer et al showed improvement in compliance to measurement of CVP within 6 hrs bundle period from 21.4% to 26.7% (P-value 0.007).[9] Chen et al showed insignificant improvement in compliance to measurement of CVP as initial resuscitative measure (38.6% to 38.1) (P-value 0.355).[13] Phua J et al found that compliance to measurement of CVP was 39.7%.[10] Ferrer et al improvement in compliance to measurement of Scvo2 was from 6.3% to 11.4% (P-value 0.001) after education program.[9]

In Ferrer et al study, mean duration of ICU stay was 16 days in pre-education period compared to 16.3 days in post-education period showing insignificant increase in duration of stay.[9] Phua J et al the median length of stay in the intensive care unit and hospital was 7 days and 18 days respectively in survivors and 6 days and 10 days respectively in non survivors.[10] Levy MM et al found that hospital and intensive care unit length of stay decreased 4% (P-value 0.012) for every 10% increase in site compliance with the resuscitation bundle.[12]

In present study, very high mortality during both study periods was possibly because patients with severe sepsis/septic shock usually admitted to ICU were usually transferred from ward, emergency department or other hospitals. We had started appropriate empirical antibiotics at the time of admission to ICU and sent blood culture for definitive diagnosis to microbiological laboratories. Afterword on confirmative diagnosis, we had started definitive antibiotics. Many of patients have high resistance pattern for many of antibiotics and required high end of antibiotics.

In present study, compared to other studies including the Asian study, high compliance rate to SSC guidelines with no decrease in mortality rate was seen. This may quite possibly have achieved due to less sample size and short duration of study. Also this was single centre intensive care setting study with limited numbers of ICU beds managed by limited numbers of resident doctors under guidance of senior consultant intensive care doctors. So application of guidelines possible after education programme by understanding importance of guidelines in managing patients with severe sepsis/septic shock.

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