

Impact of RUSH protocol in post-cardiac surgery patients in ICU: A prospective study

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Abstract

RUSH (Rapid Ultrasound in Shock) Protocol is an easily learned and quickly performed shock ultrasound protocol, involving a 3-part bedside physiologic assessment of cardiovascular system simplified as “the pump,” “the tank,” and “the pipes.” Data was collected including demographics, admission diagnosis, surgery, triggers (indications) for RUSH protocol, hemodynamic parameters, time from ICU admission to applying RUSH protocol in hours, conclusion of RUSH protocol and interventions applied. Most common trigger (indication) for RUSH protocol was hypotension (87%), followed by drop in urine output (15%), peripheral signs of shock (13%), drop in haematocrit (11%), altered mental state (4%). More than one trigger were present in 35% of patients, most of which were CABG patients (68%).

Keywords: Rapid ultrasound in shock, post-cardiac surgery, hypotension

Introduction

RUSH (Rapid Ultrasound in Shock) Protocol is an easily learned and quickly performed shock ultrasound protocol, involving a 3-part bedside physiologic assessment of cardiovascular system simplified as “the pump,” “the tank,” and “the pipes.” It has been designed to quickly assess at bedside reversible causes of shock and improves accurate diagnosis in undifferentiated hypotension in Emergency Department ^[1, 2]. This results in applying necessary intervention measures thereby preventing morbidity and mortality. Similar principles can also be applied in post cardiac surgical patients for diagnosis and timely intervention to prevent mortality and morbidity. We did a similar study in post cardiac surgical patients in order to appreciate the feasibility of RUSH protocol and apply appropriate interventional measures in ICU ^[3, 4].

Aim

To apply the principles of RUSH protocol and assess the feasibility in diagnosing undifferentiated shock in post cardiac surgical patients in ICU.

Objectives

1. To determine the trigger for applying RUSH protocol.
2. To evaluate the cause of shock in post cardiac surgical patients.
3. To assess the type of intervention utilized.

Methodology

This is a Prospective, Observational, Longitudinal study, conducted on 54 post-cardiac surgery patients in ICU.

Inclusion criteria

1. Age above 18 years.
2. Any sex.
3. Any post cardiac surgical patient with signs of shock.

Exclusion criteria

- Poor Echo window.

After fulfilling abovementioned inclusion/ exclusion criteria, patients were subjected to RUSH protocol for evaluation of shock in post- operative period. Appropriate diagnosis of undifferentiated shock was done and timely intervention measures were applied. Data was collected including demographics, admission diagnosis, surgery, triggers (indications) for RUSH protocol, hemodynamic parameters, time from ICU admission to applying RUSH protocol in hours, conclusion of RUSH protocol and interventions applied.

Appropriate statistical analysis software was utilized. Type of surgery, postoperative time duration, trigger (indication) and time duration of trigger for RUSH protocol were correlated with conclusion of RUSH protocol and intervention done by appropriate statistical analysis.

Results and Discussion**Table 1: Age Groups**

	Number of cases	Percentage
20-30	2	4%
30-40	8	15%
40-50	6	11%
50-60	24	45%
60-70	9	17%
70-80	4	7%
Total	53	

Table 2: Gender

	Number of cases	Percentage
Male	37	69%
Female	17	31%
Total	54	

Table 3: Diagnosis

	Number of Cases	Percentage
IHD	37	69%
Valvular	15	27%
Aortic	1	2%
Septal Defect	1	2%
Total	54	

Table 4: Surgery

	Number of Cases	Percentage
CABG	37	69%
Valve	15	27%
Bentall	1	2%
Septal defect	1	2%
Total	54	

Table 5: Trigger for RUSH Study

	Number of Cases	Percentage
Hypotension	47	87%
Drop in U/O	8	15%
Peripheral Signs of shock	7	13%
Altered Mental Status	2	4%
Drop in CI	5	9%
Drop in HCT	6	11%
Breathlessness	2	4%

Table 6: Time gap between ICU admission and trigger for study

Hours	Number of Cases	Percentage
0-6	26	50%
6-12	5	9%
12-24	5	9%
24-36	2	4%
36-48	7	13%
48-72	0	
>72 hrs.	3	6%
Delayed Presentation	4	7%
Total	52	

Table 7: CVP – Correlating With Hypovolemia

	Number of cases	Percentage
Yes	20	71%
No	8	29%
Total	28	

Table 8: CI – Correlating With Dysfunction

	Number of Cases	Percentage
Yes	15	100%
No	0	
Total	15	

Table 9: Fall in HCT Correlating with -

	Number of cases	Percentage
Bleeding	2	
Caridac tamponade	4	

Table 10: RUSH Protocol Conclusion

	Number of Cases	Percentage
Hypovolemia	28	53%
Cardiac Temponade	4	7%
LV Dysfunction	15	28%
RV Dysfunction	1	2%
Biventricular Dysfunction	4	8%
Chocked Valve	1	2%
Total	53	

Table 11: Intervention according to RUSH Protocol

	Number of Cases	Percentage
Fluid resuscitation	25	46%
Inotropic support	18	33%
Re-exploration	4	7%
Fluid restriction with ionodilators	3	6%
Blood tranfusion	3	6%
Thrombolysis	1	2%
IABP	2	4%

Table 12: Correlation between Surgery & RUSH study conclusion

	CABG	Valve
Hypovolemia	22 (41%)	6
Cardiac tamponade	3 (6%)	1
LV Dysfunction	13 (24%)	2
RV Dysfunction	0	1
Biventricular Dysfunction	2 (4%)	2

Table 13: Cause of Hypotension Depending on post op duration

	Hypovolemia	Cardiac Tamponade	LV Dysfunction	RV Dysfunction	Biventricular Dysfunction
0-6	22 (69%)		5 (42%)		
6-12	2 (7%)	2 (40%)		1 (100%)	
12-24			5 (42%)		
24-36					2 (67%)
36-72	5 (16%)	2 (40%)			1 (33%)
>72		1 (20%)	2 (16%)		0
Total	32	5	12	1	3

Total number patients admitted to ICU during our study period were 77. Total numbers of patients included in the study were 54. Incidence of shock during study period in our postoperative ICU was 70%. The mean age was 52.26 years, 69% were males, and 69% (37 / 54) had undergone CABG, 27% (15 / 54) valve surgeries. Out of 37 patients who underwent CABG, 22 were done off pump and 15 on pump.

Most common trigger (indication) for RUSH protocol was hypotension (87%), followed by drop in urine output (15%), peripheral signs of shock (13%), drop in haematocrit (11%), altered mental state (4%). More than one trigger were present in 35% of patients, most of which were CABG patients (68%).

Majority patients (50%) had shock during immediate postoperative period 0-6 hours, followed by 13% of patients during 36-48 hours, 9% each during 6-12 hours and 12-24 hours respectively.

In our group of patients, according to RUSH protocol the most common cause of shock during postoperative period was hypovolemia (53%), followed by LV dysfunction (28%), biventricular dysfunction (8%), cardiac tamponade (7%). In CABG patient's hypovolemia (41%) was most common cause of shock, followed by LV dysfunction (24%), cardiac tamponade (6%). In valve surgeries, hypovolemia remained most common cause of shock, followed by ventricular dysfunction^[5, 6].

Hypovolemia was predominant cause of shock during 0-6 hours, cardiac tamponade during 6-12 hours, while LV dysfunction was predominant cause during 12-24 hours. Hypotension was predominant cause of shock in CABG –off pump patients whereas LV dysfunction was predominant cause of shock in CABG –on pump patients.

CVP as an index of hypovolemia correlated with IVC diameter in 71% of patients and decrease in cardiac index correlated with ventricular dysfunction in all patients^[7, 8].

Fluid resuscitation (46%) was the most common intervention done, followed by inotropic support (33%), re-exploration (7%), IABP (4%).

Conclusion

RUSH Protocol is an easily learned and quickly performed shock ultrasound protocol which enables bedside quick assessment of reversible causes of shock and improves accurate diagnosis of undifferentiated shock in post-cardiac surgery patients, allowing appropriate intervention.

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