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Research Article

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Clinical Observational Study of the Rapid Response System in General Ward in China

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Abstract

Rapid Response Systems (RRS) had emerged as an approach to identify hospitalized patients who are at high risk of clinical deterioration. We performed a retrospective observational study and included inpatients from May, 2016 to December, 2019. This study aimed to observe and analyze the effect of introducing RRS in general wards, and discuss the main problems occurring in hospital in China. The critical rapid response team was called to 312 cases in 44 months. The top three reasons for calling them were unconsciousness (29.79%), respiratory distress (19.17%), and hypotension (18.60%). The effective call rate was 91.99%, and only 68.27% of cases were transferred to the ICU. The top three advanced life supports used for patients transferred to ICU were mechanical ventilation (89.67%), blood purification (85.92%), and vasoactive drugs application (82.16%). After the introduction of the RRS, the rate of unplanned admissions to the ICU increased, but the incidence of cardiac arrest decreased significantly. The RRS can improve the safety of inpatients in general wards, but the criteria for calling the rapid response team, and scoring tool used, are worthy of further discussion.

Keywords: Cardiac Arrest, NEWS Score, qSOFA, Rapid Response System, Unplanned ICU Admission

Introduction

Sudden deterioration of clinical signs and even sudden death of patients often occur in general wards. To identify and respond rapidly to serious adverse events (SAEs), many countries have set up rapid response teams and systems with names such as RRS, clinical emergency response systems, medical emergency teams, or critical care outreach teams [1]. The original purpose of the RRS is to decrease in-hospital mortality, principally through the prevention of cardiac arrest [2].Given that RRS are complex intervention, differences in design and implementation may account for why RRS were associated with improved outcomes in some studies but not others. All the Meta-analyses have not demonstrated a reduction in all-cause mortality, but, RRS may achieve a better In-Hospital Cardiac Arrest (IHCA) outcomes [3]. RRS activation is usually triggered by several factors, such as unstable vital signs, unconsciousness, and direct calls from attending physicians, nurses, and family members [4, 5].

Our hospital, Zhengzhou Central Hospital, is a comprehensive hospital in Henan Province. We established Critical Rapid Outreach Teams (CROT) in January 2016. This study retrospectively analyzes data about cases where the CROT was called. It discusses problems in the deployment of these teams, and possible solutions.

Methods

Ethical Approval

The study protocol was reviewed and approved by the ethics committee of the Zhengzhou Central Hospital (202154). The study population was patients in general wards for whom a CROT had been called.

Study Protocol

All data were obtained from a 3122-bed hospital in Zhengzhou, Henan Province, about patients from 2012 to 2019.

We established CROT in January 2016, drawing on experience of critical care outreach teams in the UK and rapid response teams in the US. In our study, the CROT provided a service for any inpatients who required its help. A daily patrol to detect early warning signs was carried out among critically ill patients in general wards. Patients with national early warning score (NEWS) score of ≥ 7 were recommended to be transferred to the intensive care unit (ICU) for further monitoring and treatment. Secondly, when acute adverse events occurred in non-critical care departments, the CROT was called to provide help. After completion of an intervention, the doctor concerned was required to complete the response sheet.

Criteria for calling the CROT were: (1) respiratory system: respiratory frequency < 8 times/min or > 30 times/min, blood ox-

ygen saturation (SpO2) < 90% and oxygen intake ≥ 6L/min; (2) nervous system: coma, sudden change of consciousness, seizure; (3) circulatory system: systolic blood pressure < 90mmHg or 20% lower than the basic rate, heart rate > 140 times/min or < 40 times/min; (4) kidney: oliguria or absence of urine for more than one day.

Data Collection

Baseline patient data, including the age and gender distribution, diagnosis, comorbidities, admissions to the ICU, and whether they had a cardiac arrest, were abstracted from the electronic medical record system. Data related to CROT activity, including reasons for calling the CROT, CROT arrival time, intensive care unit admission, and patient outcomes, were abstracted from the records of the medical department.

We analyzed unplanned intensive care admissions and the incidence of CA among inpatients on general wards between the control group (patients from May 2012 to November 2015, before the CROT was established) and the CROT group (patients from May 2016 to November 2019).

Statistical Methods

All statistical analyses used IBM SPSS version 22 (IBM Corp., Armonk, NY, USA). Data are shown as mean values (with standard deviation, SD). Categorical data are shown as counts (%). Descriptive statistics were generated and between-group comparisons were analyzed using Student's t test (for normally distributed values), the Mann–Whitney test (for non-normally distributed values), and χ^2 (for categorical values). The level of significance was set at $\alpha = 0.05$, with a two-tailed test.

Results

After the introduction of the CROT, the rate of unplanned ICU admissions increased (4.68% vs 5.64%, P = 0.012), and the incidence of CA among inpatients in general wards decreased significantly (0.44‰ vs 0.33‰, P = 0.027) (Table 1).

Table 1: Effect of the Introduction of the CROT

Variables	CA Rate(‰)	Unplanned ICU transfer rate(%)
control	101/231260(0.44‰)	249/5322(4.68%)
CROT	147/447488(0.33‰)	587/10416(5.64%)
P	0.027	0.011

Abbreviations: CA: cardiac arrest; CROT: critical rapid out-reach team; ICU: intensive care unit.

From May 2016 to December 2019, the CROT was called in 312 cases involving 278 patients, of whom 163 were men and 115 women. Their mean age was 54.98 ± 18.23 years. The mean time before CROT arrival was 2.17 ± 0.83 min. The most com-mon reason for calling the CROT was unconsciousness (157 cases, 29.79%) (Table 2). For 287 cases (91.99%), the call for the CROT was considered correct, and seven calls (2.24%) were considered overactivation. Nine patients (2.89%) did not want to be resuscitated, and 11 showed no signs of life and were not resuscitated (Table 3). After the intervention, 213 (68.27%) pa-tients were transferred to the ICU for further treatment (Table 4).

Table 2: Reasons for Calling the CROT

Reasons for CROT activation(N=527)	n	%
Unconsciousness	157	29.79
Airway obstruction/respiratory arrest	19	3.60
Respiratory distress	101	19.17
Hypotension	98	18.60
Tachycardia	58	11.01
Symptomatic bradycardia	73	13.85
Other	21	3.99

Abbreviations: CROT: critical rapid outreach team.

Table 3: Relevance and Effect of Calling the CROT

Applicability of RRS activation(N=312)	n	%
Valid activation	287	91.99
No additional treatment required	7	2.24
Refusing to rescue	18	5.77

Abbreviations: CROT: critical rapid outreach team; RRS: rapid response system.

Table 4: Outcomes of Calling the CROT

Outcomes of CROT activation (N=312)	n	%
Continued treatment in the original department	72	23.08
Failed to rescue and died	21	6.73
Admitted to medical unit	213	68.27
Other	6	1.92

Abbreviations: CROT: critical rapid outreach team.

For the patients transferred to ICU, organ function support was generally required. The top three interventions used were mechanical ventilation (89.67%), blood purification (85.92%), and use of vasoactive drugs (82.16%). After treatment, 144 cases (67.61%) improved, 51 patients (23.94%) died in the ICU, and 18 cases (8.45%) were discharged after treatment (Table 5).

Table 5: Additional Intervention Required for Patients Transferred to ICU [n (%)]

Organ support(N=213)	n	%
Mechanical ventilation	191	89.67
Utilization of vasoactive drugs	175	82.16
Continuous blood purification therapy	183	85.92
Application of the ventricular assist device	16	7.51
Mild hypothermic neuroprotection	46	21.60

Abbreviations: ICU: intensive care unit.

Discussion

In recent years, in China the hospitals are getting bigger and bigger, and the number of medical staffs is not matching it. RRS have been widely used as a reliable mechanism for recognition and response to clinical deterioration, and to reduce the rate of unplanned ICU admission and cardiac arrest in hospitals [6-9]. However, we found that introducing the RRS resulted in an increase in unplanned ICU transfer rates. This may have occurred for several reasons. First, it could be because more deteriorating patients were appropriately identified and transferred to the ICU by the CROT. It is also possible that more critically ill patients were admitted. However, further analysis of the data in the three years since the establishment of CROT showed that this figure decreased year by year. This might be because of the increasing maturity of CROT management.

Second, 91.99% of the calls were justified and effective, which was consistent with previous reports of RRS [10]. The rate of overactivation calls was 2.24%. However, resuscitation was not attempted in 5.77% of cases. These cases occurred infrequently, but are still a waste of medical resources. Further training and simulation exercises may be required throughout the hospital to enable callers to master the activation standards. At the same time, it also suggests that we need to pay attention to do not to resuscitation [11].

In principle, most patients for whom a rapid response team is called should be moved to the ICU or higher medical institutions [12]. Gorka found that about 40% of calls resulted in a transfer to a higher-level unit [13]. Our transfer rate to the ICU was 68.27%. Retrospective analysis of clinical data showed that the patients who refused to be transferred were aged > 75 years with multiple diseases, and had a poor long-term prognosis. The person who called the CROT may not have realized that the patient or family did not want ICU admission. However, age and complications are risk factors for adverse events, and early warning is therefore important for these patients. NEWS score is recognized as a good early-warning tool in most hospitals. However, it does not include physiological indicators such as age.

Third, we were surprised by the outcomes of patients transferred to ICU. The rate of use of vasoactive drugs, mechanical ventilation, and blood purification treatment exceeded 80%, and the mortality rate of ICU patients during hospitalization was 23.94%. Further analysis showed that 171 patients (80.28%) were transferred to ICU because of severe infection. SIRS diagnostic criteria and qSOFA score can often identify patients with severe infections [14]. Gershkovich used this as a tool among hematologic tumor patients to decide when to call a rapid response team, and found it had good sensitivity and specificity [15]. Dedicated sepsis rapid response teams have also been reported [16].Thus, the new scoring tools were worthy being recommended, such as SOFA score, APACHEII score and so on.

Overall, the RRS was very useful for people in general wards, but it had some limitations.

Conclusion

There is a weak link in medical safety concerning inpatients who experience acute adverse events while on general wards. RRS have been set up to help those patients. However, to analyze the operational effect of these teams, it is necessary to examine the standard required to call the rapid response team and the way in which it operates. In our case, more data are needed for this purpose.

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