Clinical Observation Research on the Application of Rapid Response System in General Wards

Yan Wang (wangyan0201@163.com)
Zhengzhou Central Hospital https://orcid.org/0000-0002-4863-6695

Haiyan Wu
Zhengzhou Central Hospital

Chang Liu
Zhengzhou Central Hospital

Suping Ran
Zhengzhou Central Hospital

Baoyu Wang
Zhengzhou Central Hospital

Research

Keywords: rapid response system, general wards, ICU, Observation Research

DOI: https://doi.org/10.21203/rs.3.rs-157783/v1

Abstract

Objective Observe and analyze the effect of the criticall rapid response system in general wards.

Methods Analyze the data of CROT cases initiated in 2016-2019, and statistically analyze the reasons for the initiation, on-site treatment, the outcomes of patients, and the number of organ function support of patients transferred to ICU.

Results A total of 312 cases were initiated in 43 months. The top three reasons for initiation were: unconsciousness (29.79%), respiratory distress (19.17%), and hypotension (18.60%). The effective call rate was 91.99%, and only 68.27% were transferred to ICU. Mechanical ventilation (89.67%), blood purification (85.92%), and vasoactive drugs (82.16%) were applied in ICU.

Conclusions The critical rapid response system can guarantee the safety of inpatients in general wards, but the activatiaon characteristics are worthy of further discussion.

Introduction

Recent years, due to the continuous expansion of hospitals and the mismatch of the number of medical staff, the refinement of specialties, and the increasingly complex spectrum of diseases, sudden deterioration of clinical signs and even sudden deaths often occur in general wards. In order to early identify and respond to serious adverse events(SAEs), many countries at home and abroad set up different rapid response systems(RRS), or clinical emergency response systems(CERS), medical emergency teams(MET), critical care outreach teams(CCOT) and so on[1].

Our hospital, the Zhengzhou Central Hospital is a comprehensive hospital with 2200 beds in Henan province. We established Critical Rapid Outreach Teams (CROT) since January 2016 to improve the outcomes of patients with SAEs. This study retrospectively analyzed the case data of starting CROT, and discussed its existing problems and possible solutions.

Methods

Ethical approval

The study protocol was reviewed and approved by the ethics committee of the Zhengzhou Central Hospital. The study population was derived from activated CROT patients in general wards.

Study design

Based on CCOT in the UK and RRT in the US,we established CROT.

The study was conducted from the May 2016 to the November 2019 in a 3122-bed Hospital in Zhengzhou of Henan Province.

The RRS comprises four key elements: an afferent limb (identification of patient deterioration by the ward staff and triggering of a response), the efferent limb (CROT), and the feedback and administrative components.In the study, the CROT serviced for the all inpatients. Firstly,daily patrol and early warning were conducted for the critically ill patients in the general ward. Patients with NEWS scoring≥7 score and consistent with the ICU admission were recommended to be transferred to ICU for further monitoring and treatment.Secondly, when acute adverse events occured in patients in non-critical departments, CROT was called for active rescue treatment. After completion of the intervention,the doctor was required to complete the SAE response sheet.

CROT activated criterias were: (1) respiratory system: respiratory frequency < 8 times /min or > 30 times /min, blood oxygen saturation (SpO 2) < 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 value, heart rate > 140 times /min or < 40 times /min;(4) Kidney: Oliguria or absence of urine for more than one day.

Statistical methods

were performed using IBM SPSS version 25 (IBM Corp., Armonk, NY,USA). Descriptive statistics were generated and analyzed. we analyzed the age and gender distribution of patients, activation reasons, CROT arrival time, and patient outcomes.

Results

From May 2016 to December 2019, CROT activation occurred 312 cases involving 278 patients, including 163 males and 115 females;mean age±standard deviation (54.98±18.23 years).The mean time from CROT call to the patient site was (2.17±0.83) min. Overall, the main cause was unconsciousness in 157(29.79%) (Table 1). A total of 287 cases required CROT really(91.99%). 7 calls (2.24%) were deemed to be over-activation.9 patients (2.89%)refused to be resuscitated. 11 cases showed no signs of life and no need for rescue(Table 2). After the intervention,213 68.27%) patients were transferred to ICU units for further treatment (Table 3.)

For ICU patients, organ function support is required, mechanical ventilation, blood purification, and utilization rate of vasoactive drugs are all over 80%.After treatment, 144 cases (67.61%) were improved, 51 cases (23.94%) died in ICU, and 18 cases (8.45%) were discharged automatically after abandoning treatment(Tbale 4).

Table 1.Reasons for CROT activation

.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

Table 2. Applicability of RRS activation

Applicability of RRS activation（N=312）	n	%
Valid activation	287	91.99
No additional treatment required	7	2.24
Refusing to rescue	9	2.89
Patients with no signs of life	11	3.53

Table 3. Outcomes of CROT activation

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

Table 4. Organ support of 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

Discussion

RRS has been widely used as a reliable mechanism for recognition and response to clinical deterioration, and to reduce the rate of unplanned ICU admission in hospital[2-4]. However, not all the calls were correct. In this study, it was found that 91.99% of the calls were effective and there was a certain waste of resources, which was consistent with Yang's report[5].

When the patients had a SAE, it meets the CROT standard and calls immediately.These team members can respond and provide appropriate and timely rescue treatment, transport patients to ICU or higher medical institutions[6].The most activations were due to patients with organ dysfunction, need for

advanced life support, and need to be transferred to ICU and organ function support. However, in this study, the transfer rate to ICU was only 68.27%. Retrospective analysis of clinical data showed that most of the patients who refused to be transferred to ICU were aged > 75 years with multiple diseases, and the long-term prognosis was difficult to assess.Second, Most of the callers are on duty and patrol medical staff, and they are often non-bed doctors and responsible nurses, who fail to fully know the treatment intention of their families. It also suggests that age and complications are risk factors for adverse events.Therefore, early warning is very necessary for such patients. NEWS score is currently recognized as a good early-warning tool. However, NEWS does not include physiological indicators such as age.

The rate of call RRS transfer to ICU has been widely reported, but the prognosis of patients transferred to ICU is rarely studied. In this study, the utilization rate of vasoactive drugs, mechanical ventilation and blood purification treatment exceeded 80%, and the mortality rate of ICU patients during hospitalization was 23.94%. Faced with such a high mortality rate, further analysis revealed that 80.28% (171 cases) of patients were transferred to ICU because of severe infection.SIRS diagnostic criteria and qSOFA score can assess the stratification of risk for severe infection[7]. Gershkovich [8]has used this as a hematologic tumor patient calling RRS tool with good sensitivity and specificity. Therefore, based on the application of NEWS scoring, the introduction of a new scoring tool is worth further discussion.

Conclusion

It is a weak link of medical safety to rescue inpatients with acute adverse events in general wards, so it is necessary to construct a rapid response system.However, to analyze the operation effect, the activation standard and operation mode are worthy of deliberation, for which more data are needed to explore and study.

Declarations

Ethics approval and consent to participate

The study protocol was reviewed and approved by the ethics committee of the Zhengzhou Central Hospital.

Acknowledgements

We thank all researchers, patients, and surrogates involved in the individual trials.

Authors' contributions

Yan Wang conceived of the study, participated in the design, collected the data,performed statistical analyses and drafted the manuscript. Haiyan Wu participated in the design, collected the data, performed statistical analyses.Chang Liu participated in the design and helped to revise the manuscript critically for

important intellectual content. Suping Ran collected the clinical data. Baoyu Wang revised the manuscript. All authors read and approved the final manuscript.

Funding

Joint Construction of Medical Science and Technology Research Plan of Henan Province in 2018 (2018020796)

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Availability of supporting data

All data generated or analyzed during this study were collected from clinical case data.

References

1. Study Investigators T, Concord Medical Emergency Team 2 Study I: **Outcomes following changing from a two-tiered to a three-tiered hospital rapid response system**. *Aust Health Rev* 2019, **43**(2):178-187.
2. Felner K, Smith RL: **Rapid-response teams**. *N Engl J Med* 2011, **365**(14):1355-1356; author reply 1356-1357.
3. Jaderling G, Bell M, Martling CR, Ekbom A, Bottai M, Konrad D: **ICU admittance by a rapid response team versus conventional admittance, characteristics, and outcome**. *Crit Care Med* 2013, **41**(3):725-731.
4. Kawaguchi R, Nakada TA, Oshima T, Abe R, Matsumura Y, Oda S: **Reduction of unexpected serious adverse events after introducing medical emergency team**. *Acute Med Surg* 2015, **2**(4):244-249.
5. Yang M, Zhang L, Wang Y, Zhan Y, Zhang X, Jin J: **Improving rapid response system performance in a Chinese Joint Commission International Hospital**. *J Int Med Res* 2019, **47**(7):2961-2969.
6. Jacques T, Harrison GA, McLaws ML: **Attitudes towards and evaluation of medical emergency teams: a survey of trainees in intensive care medicine**. *Anaesth Intensive Care* 2008, **36**(1):90-95.
7. Singer M, Deutschman CS, Seymour CW, Shankar-Hari M, Annane D, Bauer M, Bellomo R, Bernard GR, Chiche JD, Coopersmith CM *et al*: **The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3)**. *JAMA* 2016, **315**(8):801-810.
8. Gershkovich B, Fernando SM, Herritt B, Castellucci LA, Rochwerg B, Munshi L, Mehta S, Seely AJE, McIsaac DI, Tran A *et al*: **Outcomes of hospitalized hematologic oncology patients receiving rapid response system activation for acute deterioration**. *Crit Care* 2019, **23**(1):286.