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Review article

Outcome of adult patients attended by rapid response teams: A systematic review of the literature[☆]

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ABSTRACT

Background: An abundance of studies have investigated the impact of rapid response teams (RRTs) on in-hospital cardiac arrest rates. However, existing RRT data appear highly variable in terms of both study quality and reported uses of limitations of care, patient survival and patient long-term outcome.

Methods: A systematic electronic literature search (January, 1990–March, 2016) of the PubMed and Cochrane databases was performed. Bibliographies of articles included in the full-text review were searched for additional studies. A predefined RRT cohort quality score (range 0–17) was used to evaluate studies independently by two reviewers.

Results: Twenty-nine studies with a total of 157,383 RRT activations were included in this review. The quality of data reporting related to RRT patients was assessed as modest, with a median quality score of 8 (range 2–11). Data from the included studies indicate that a median 8.1% of RRT reviews result in limitations of medical treatment (range 2.1–25%) and 23% (8.2–56%) result in a transfer to intensive care. A median of 29% (6.9–35%) of patients transferred to intensive care died during that admission. The median hospital mortality of patients reviewed by RRT is 26% (12–60%), and the median 30-day mortality rate is 29% (8–39%). Data on long-term survival is minimal. No data on functional outcomes was identified.

Conclusions: Patients reviewed by rapid response teams have a high and variable mortality rate, and limitations of care are commonly used. Data on the long-term outcomes of RRT are lacking and needed.

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Introduction

Rapid response teams (RRTs) and medical emergency teams (METs) form the efferent limb of rapid response systems providing clinical assessment and, if needed, intensive care interventions and timely transfers to a higher level of care for deteriorating ward patients.¹ European resuscitation guidelines have acknowledged the rapid response system as an essential element of in-hospital resuscitation,² and recent systematic reviews and meta-analyses have reported significant reductions in in-hospital cardiac arrests and hospital mortality after the introduction of rapid response systems.^{3–5}

Most studies on RRTs either focus on hospital-wide mortality rates and reductions in the incidence of in-hospital cardiac

arrests (IHCA),^{3–5} or outcomes in specific sub-cohorts of patients reviewed by RRT (e.g., RRT patients treated with non-invasive ventilation⁶ and outpatients reviewed by RRT⁷). Information about the long-term outcomes of patients reviewed by RRTs is limited, and the data appear variable, despite the publication of the Utstein-style statement in 2007 by the International Liaison Committee on Resuscitation (ILCOR) for uniform reporting on RRTs.⁸

The aim of this study was to systematically review the current literature on the outcomes of patients reviewed by RRTs. To this end, we specifically aimed to focus on the implementation of limitations of medical treatment (LOMT), transfers to intensive care units (ICUs), ICU mortality, hospital mortality, 30-day mortality and 180-day mortality rates of RRT patients.

Methods

This systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.⁹ The checklist and flow diagram were used,

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and PRISMA-Protocols was further applied to the reporting of this systematic review study protocol.¹⁰

Search protocol and eligibility criteria

A literature search was conducted on the 1st of March, 2016 using the PubMed and Cochrane Database of Systematic Reviews (January, 1990–March, 2016). The following key words were utilised: ‘medical emergency team’ OR ‘rapid response team’ AND ‘outcome’ OR ‘survival’ OR ‘implementation’. Complete data on the electronic searches are presented in Appendix A. Bibliographies of the articles selected for full text review were hand searched for potentially eligible studies.

Paediatric studies and non-English studies were excluded. Studies reporting only outcomes of minor sub-cohorts of patients reviewed by RRTs were also excluded. Due to the known heterogeneity in the RRT literature,^{3–5} before–after trials and randomised controlled trials (RCTs) on RRTs were included if a satisfactory amount of data on RRT reviews and the outcomes of RRT patients was reported.

Study selection

TT conducted the initial electronic searches, screened the records for duplicates and selected articles for full text analysis based on the titles and/or abstracts. Based on full texts, TT and JT further excluded articles not meeting the inclusion criteria and independently reviewed the remaining articles. JT conducted the search of the bibliographies of all articles that were included for full text review, evaluated new articles meeting the inclusion criteria and presented these articles to TT for independent review.

RRT cohort outcome quality score

Despite the fact that many RRT studies are of before–after design or RCTs, the data gathered on RRT cohorts themselves are always of observational design, either prospective or retrospective. Because an applicable tool for quality and bias assessment for studies in this review was difficult to find, the authors of this article generated a quality score using the Utstein-style ILCOR statement recommendations as a basis (Table 1).⁸ This ‘RRT cohort quality score’ (range 0–17) does not necessarily reflect the overall quality of the study (the main objective in such studies is often not the docu-

Table 1
RRT cohort quality score.

Evaluation criteria	Score (0–17)
Study type	2
Prospective observational (2)	
Retrospective observational (1)	
RRT definition/staffing reported	1
General RRT–patient profile outlined	1
RRT activation criteria reported	1
The reason for RRT activation reported	1
Time intervals reported (1 point each)	2
Afferent limb failure	
Time from call to RRT arrival	
Outcome data reported (1 point each)	7
ICU transfers/RRT activations reported	
ICU mortality of RRT patients transferred to ICU	
Total hospital mortality of RRT patients transferred to ICU	
Hospital mortality of RRT patients left on ward	
Total hospital mortality of RRT patients	
30-day mortality of RRT patients	
180-day mortality of RRT patients	
Neurological outcome of RRT patients discharged alive	1
Quality of life of RRT patients discharged alive	1

RRT, rapid response team; ICU, intensive care unit.

mentation of general RRT patient characteristics and outcomes; see above); it evaluates the quality (methodology, factors associated with internal and external validity) related to the documentation of RRT activity and patients reviewed by RRT.

Data collection

TT and JT independently extracted all relevant data from the included articles, including the data on main outcomes, and utilized the developed score for quality assessment using Microsoft Excel 2011[®]. In cases of disagreement between TT and JT, MS provided an independent third review to provide consensus.

Assessment of bias in included studies

The developed ‘RRT cohort quality score’ assessed several factors that are possible sources of bias in the included studies (Table 1). Key sources of bias are also addressed verbally in the results section.

Definitions

A rapid response team (RRT) was defined as any external response unit (physician led or not) providing assessment for a deteriorating patient in a hospital. Liaison nurse activity (providing scheduled visits for patients) was not considered a RRT intervention,¹¹ and these types of visits were excluded from the extracted data if identified. ‘RRT activations’ refers to the number of times the team was activated, and ‘RRT patients’ to the number of different patients seen by RRT. Limitations of medical treatment (LOMT) included all ‘do-not-resuscitate’ orders and ‘no intensive care’/‘do not intubate’ orders. Using the extracted data, LOMTs and ICU transfers were adjusted to the number of RRT activations, and hospital-, 30-day and 180-day mortality rates to the number of patients reviewed by the RRT. The Utstein-style ILCOR statement recommendations were used as a basis for the general definitions.⁸

Statistics

Data are presented as numbers and/or percentages as appropriate. Meta-analysis was not conducted due to (1) the observational methodology used in RRT cohort documentation and (2) the heterogeneity among the included studies. However, medians with quartiles and ranges were calculated for the quantitative outcome data in order to present some general conclusions from the included studies combined with a pooled data presentation. Intra-class correlation coefficient (ICC) with a 95% confidence interval was used to test inter-rater agreement in the RRT patient outcome quality score. SPSS version 20 for Windows (SPSS Inc., Chicago, IL, USA) was used.

Results

Study selection

A total of 377 articles were initially identified by the described search strategy. Fig. 1 presents the PRISMA flowchart; 29 studies were assessed as eligible for this systematic review.^{12–40} Twelve of the included studies were found directly through electronic searches and 17 studies were identified through the hand search.

Study characteristics

Table 2 presents the general characteristics of the included studies. Data on the RRT cohort were prospectively collected in 17 studies.^{12,14,16–18,20,22,24–26,28–30,32,36,38,39} Four studies

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