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Effects of introducing a rapid response team in a university teaching hospital – preliminary analysis

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Dear Editor,

rapid response teams (RRTs) were introduced into hospitals at the beginning of the 90ties of the 20th century, first in Australia and North America and then in Western Europe. The rapid response systems have different names in different countries; nevertheless, their major objective is to identify patients at risk of rapid health deterioration/sudden cardiac arrest (SCA) and to implement appropriate therapy as promptly as possible [1]. In Poland, there is a shortage of hospital beds in intensive care units (ICUs) and medical intensive care units (MICUs), even though the regulation concerning medical standards in anaesthesiology and intensive care states that the number of ICU beds should constitute at least 2% of the total number of beds [2]. According to the findings of meta-analyses available in literature, the incidence of SCA has significantly decreased after the introduction of RRTs [3, 4]. The data regarding RRT interventions and their effectiveness under Polish conditions are sparse. Therefore, the study was designed to analyse RRT interventions performed at the university-affiliated teaching hospital and to assess the effects of RRT introduction.

Seventy-one RRT interventions carried out at the university-affiliated teaching hospital between 1.10.2018 and 30.01.2019 were retrospectively analysed. Based on the RRT intervention records, causes of calls, procedures applied during interventions, pharmacotherapy used, and recommendations for further treatment and management were analysed. The total number of intra-hospital transfers to ICU, the number of hospital SCAs as well as mortality rates prior to and following the introduction of RRT were determined. The same period of the previous year was considered a reference point. Moreover, analysis included selected laboratory results of patients on RRT calling, i.e. white blood cell (WBC) count, platelet count, concentrations of C-reactive protein (CRP), glucose, sodium, potassium, chlorides, creatinine, total bilirubin, and lactates. The laboratory results were obtained from the medical information technology system. Since the study was retrospective and observational, no consent of the Bioethics Committee was required.

The group of 53 patients treated by RRT consisted of 54% of females and 46% of males; the median age was 64 (IQR 58–76) years. The average number of RRT calls was 0.58/day, 4.06/week, 17.75/month. One-time interventions constituted 75% of all calls.

In the majority of RRT interventions, there were several causes of calls: assessment of respiratory efficiency – 37, assessment of circulatory efficiency – 20, qualification for ICU treatment – 14, sudden neurological change – 12, sudden dyspnoea – 10, respiratory rate < 8 or > 28–30 min^{-1} – 9, peripheral saturation < 90% – 8, staff concern – 8, heart rate < 40 or > 140 min^{-1} – 7 times and some others. The causes of RRT calls were presented in Figure 1.

The laboratory findings were presented in Table 1. The patients the RRT was called for were characterised by elevated WBC counts, concentrations of CPR and lactates.

The procedures performed during RRT interventions and the pharmaco-

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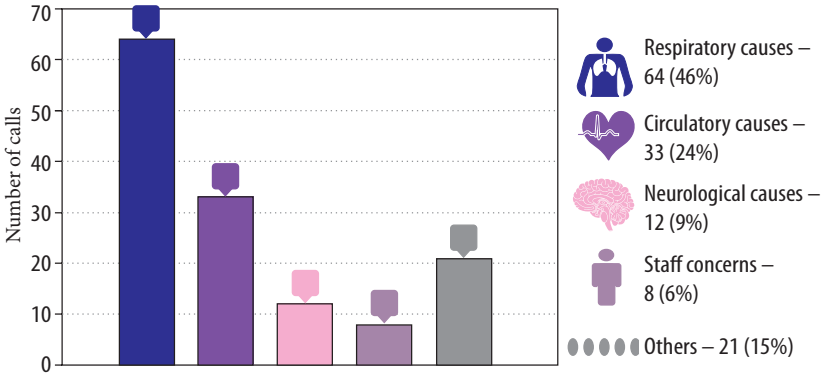

FIGURE 1. Causes of calls for rapid response team intervention

TABLE 1. Results of selected laboratory tests of patients treated by the rapid response team

Parameter	Median (IQR)
Leukocytes (G L^{-1})	**12.2 (9.2–16.7)**
Blood platelets (G L^{-1})	204 (136–296)
CRP (mg L^{-1})	**130.6 (49.3–198.2)**
Glucose (mg dL^{-1})	127.5 (103.0–178.7)
Sodium (mmol L^{-1})	138.5 (134.7–141.7)
Potassium (mmol L^{-1})	4.17 (3.7–4.7)
Chlorides (mmol L^{-1})	102.5 (100.3–105.5)
Creatinine (mg dL^{-1})	1.1 (0.8–1.6)
Total bilirubin (mg dL^{-1})	0.9 (0.5-1.9)
Lactates (mmol L^{-1})	**2.3 (1.8–2.9)**

IQR – interquartile range

logical treatment applied were listed in Table 2. Arterial blood gas analysis and endotracheal intubation were the most frequently performed procedures, which results from the most common cause of calling, i.e. assessment of respiratory efficiency (Figure 1).

During RRT interventions, the following procedures were most commonly recommended – continuation of mechanical ventilation in patients mechanically ventilated – 32 (45%), additional laboratory tests – 24 (34%), arterial blood gasometry – 22 (31%), monitoring of vital functions – 20 (28%), specialist consultation – 18 (25%), blood culture – 12 (17%), bronchial tree suction – 12 (17%), 24-hour fluid balance – 12 (17%), chest X-ray – 9 (13%), additional imaging exams – 7 (10%), urine culture – 6 (8%), monitoring of diuresis – 6 (8%), and 12-lead ECG – 3 times (4%).

Once the RRT were introduced, the number of intra-hospital transfers of patients to ICU, of hospital SCA and hospital mortality rates were found to decrease (Table 3).

Analysis of RRT interventions and evaluation of their effectiveness have been recently studied only in foreign centres, where the RRT counterparts (of different names) have been functioning for a long time [5–10]. Since RRTs were introduced in Poland only in 2018, the reports assessing their effectiveness in Poland are lacking.

The analysis mentioned above demonstrated that RRT was most frequently called to assess respiratory efficiency (Figure 1), which is consistent with the observations of some authors who found that the major cause of calls was respiratory disorders [5] and that the main procedure carried out was endotracheal intubation [6]. According to some other authors, however, the most common causes of calls included concerns about the patient condition [6], general bad condition of patients [7], rapid neurological changes [8–10]. The most common pharmacotherapy, as disclosed by the analysis, was a change or continuation of the hitherto applied antibiotic therapy, administration of vasopressors and fluid therapy, which is also in agreement with the study findings reported by other authors [5, 6]. Furthermore, our analysis revealed reduced numbers of hospital SCA after the introduction of RRT. Likewise, the reports from foreign centres have also demonstrated reduced numbers of hospital SCA as well as unexpected deaths after the introduction of RRTs [11, 12]. A few papers available in literature have not shown the effects of RRTs on a reduction in numbers of hospital SCA [4] or that their reduction was not statistically significant [10]. Moreover, the implementation of RRTs according to the concept of *ICU without walls*, which aims at intensification of treatment in the department that admitted the patient (outside ICU), without need for ICU admission, reduced the number of intra-hospital transfers of patients to ICU by 29.2% (Table 3). Similar effects were observed in another centre [13]. Some selected laboratory results of patients on the day of calling RRT should also be mentioned as they suggest the ongoing inflammatory process and microcirculation disturbances, which, in turn, allows to suspect that the patients presented the symptoms of sepsis. Sepsis is considered one of the main diagnoses established by RRTs [14]. The study by Cross *et al*. is noteworthy; the authors conducted a three-month retrospective study assessing the percentage of RRT calls associated with systemic inflammatory response syndrome (SIRS) and sepsis [15]. They have demonstrated that among 358 RRT calls two or more SIRS criteria were present in 277 (77.4%) cases while among these 277 cases with SIRS criteria, 159 (57.4%) patients fulfilled the criteria of sepsis 24 hours prior to and 12 hours after the call. The above observations disclosing the occurrence of SIRS or sepsis symptoms in patients, the RRTs were called for, contributed to the formation and introduction of special RRTs specializing in early diagnosis and treatment of sepsis [16].

Our analysis has some limitations; RRT consultations were carried out by various teams of specialists and intervention documentation was filled non-uniformly. Moreover, the only laboratory parameter

used for concluding about microcirculation disorders in patients, the RRT was called for, was the concentration of lactates; its interpretation, however, should be dealt with caution [17]. The reduced number of intra-hospital ICU transfers that was observed might have resulted from other factors than improved treatment in the departments that patients were admitted to. Furthermore, during the period studied, reduced hospital mortality rates could have been affected by many other factors.

In conclusion, the most common cause of RRT calls was the assessment of respiratory efficiency. The laboratory results of patients for whom RRT was called often suggested developing sepsis/septic shock. The introduction of RRT enabled the intensification of treatment in the departments patients were admitted to, which contributed to the reduction in the number of ICU transfers. It is advisable to further develop the skills regarding assessment of respiratory efficiency and diagnosis of sepsis among hospital personnel.

TABLE 2. Procedures and pharmacotherapy used during rapid response team interventions

Procedures performed	Number (%)
Arterial blood gas test	19 (27)
Endotracheal intubation	15 (21)
Modification of ventilation parameters	15 (21)
Bronchail tree suction	11 (15)
Face mask	10 (14)
Central venous cannulation	9 (13)
Alveolar recruitment	5 (7)
Ambu bag	3 (4)
Extubation	3 (4)
Nasal catheter	2 (3)
Pharmacotherapy used	
Modification of antibiotic therapy	20 (28)
Inotropes/vasopressors	17 (24)
Fluid therapy	13 (18)
Mucolytics	12 (17)
Continuation of antibiotic therapy	10 (14)
Anticoagulants	7 (10)
Diuretics	6 (8)
Opioids	5 (7)
Nonsteroidal antiinflammatory drugs	4 (6)
Antiarrhythmics	3 (4)

TABLE 3. Effects of introducing a rapid response team

	In-hospital SCA (*n*)	Transfer to Anaesthesia and Intensive Care Unit (*n*)	Deaths/1,000 hospitalisations (*n*)
Before RRT introduction (1.10.2017 – 30.01.2018)	14	106	17.7
After RRT introduction (1.10.2018 – 30.01.2019)	11	75	16.2

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