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Clinical paper

Medical emergencies in the imaging department of a university hospital: Event and imaging characteristics☆

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ABSTRACT

We aimed to describe the characteristics of medical emergencies that occurred in the medical imaging department (MID) of a university hospital in Melbourne, Australia.

A database of 'Respond Medical Emergency Team (MET)' and 'Respond Blue' calls was retrospectively examined for the period June 2003 to November 2010 in relation to events that occurred in the MID. The hospital medical imaging database was also examined in relation to these events and, where necessary, patients' notes were reviewed. Ethics approval was granted by the hospital ethics review board.

There were 124 medical emergency calls in the MID during the study period, 28% Respond Blue and 72% Respond MET. Of these 124 calls, 26% occurred outside of usual work hours and 12% involved cardiac arrest. The most common reasons for the emergency calls were seizures (14%) and altered conscious state (13%). Contrast anaphylaxis precipitated the emergency in 4% of cases.

In 83% of cases the emergency calls were for patients attending the MID for diagnostic imaging, the remainder being for a procedure. Of the scheduled imaging techniques, 45% were for computed tomography. The scheduled imaging was abandoned due to the emergency in 12% of cases. When performed, imaging informed patient management in 34% of cases in diagnostic imaging and in all cases in the context of image-guided procedures.

Medical emergency calls in the MID often occurred outside usual work hours and were attributed to a range of medical problems. The emergencies occurred in relation to all imaging techniques and imaging informed patient management in many cases.

1. Introduction

Medical emergency teams and emergency codes are an integral component of the care provided to ill patients and their implementation, although at times controversial, has been shown to reduce mortality and cardiac arrest rates.[1–9] The most common reasons for activation of emergency codes in the general hospital setting has been to shown to be a drop in Glascow Coma Score[10] (GCS) of two or more, a systolic blood pressure of less than 90 mmHg and a respiratory rate of greater than 30 per minute.[11]

The medical imaging department (MID) of a tertiary hospital services a broad spectrum of patients. Although many medical emergency calls are initiated for patients in the MID, to our knowledge the characteristics of these calls have not been described. This study aims to describe these events with respect to: the times of day at which they occur, the types of imaging requested, the reasons for the emergency calls and the findings of any imaging performed. This information may help to guide staff training, improve patient preparation/resuscitation prior to being transported to the medical imaging department and ultimately improve patient care.

2. Methods and materials

The study was conducted in Melbourne, Australia at a university-affiliated hospital with approximately 320 acute and 80 subacute beds. Each year there are approximately 40,000 admitted patient episodes and over 30,000 emergency department presentations. The MID consists of a general department encompassing computed tomography (CT), computed radiography, nuclear medicine, ultrasound, digital subtraction angiography (DSA) and fluoroscopy as well as a geographically separate magnetic resonance imaging (MRI) department. Approximately 110,000 imaging studies are performed at the hospital each year.

There are two types of medical emergency response codes at the hospital: a 'Respond MET' is available for inpatients displaying serious (but non-arrest) signs and symptoms and a 'Respond Blue' is

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Table 1
Characteristics of patients who were the subject of 'Respond MET' or 'Respond Blue' calls in the medical imaging department. *N* = 121.

Age in years, mean ± standard deviation	62 ± 13.7
Males	65 (54%)
Inpatients	104 (86%)

Values are number and (percentage), unless specified. MET = medical emergency team.

available to assist any patients suffering cardiac arrest, respiratory arrest or a threatened airway. Due to the relatively geographically remote location of the MRI department, 'Respond Blue' was the only medical emergency response available to patients in that area of the hospital.

Prospective data were gathered by intensive care staff in relation to all events for which a Respond MET or Respond Blue call was made. A log of these calls from the hospital paging system was used to ensure all events were captured and the medical director of intensive care oversaw data collection. We retrospectively examined this data in relation to all emergency calls that occurred in the MID and DSA suite (excluding cardiac catheterisation) from June 2003 to November 2010 and in our separate MRI department from July 2007 to November 2010. The medical imaging Picture Archive Communication System (PACS) database was used to identify the imaging techniques for which these patients had attended the MID and the findings of any imaging performed immediately before or after the medical emergency calls. Patients' notes were also reviewed as required.

Information in the Respond Blue and Respond MET database included the specific physiological defect for which each emergency call was initiated. When the underlying medical problem that precipitated the physiological derangement was known, such as contrast anaphylaxis, this was also recorded. When analysing the imaging performed immediately before or after each medical emergency call, a judgment was made as to whether the imaging informed the referring team of the immediate cause of the emergency code. For example, did the CT pulmonary angiogram demonstrate pulmonary embolus (PE) or consolidation as the cause of the hypoxia that had resulted in the initiation of the code? In cases where an emergency call was made in the setting of suspected PE or active haemorrhage, it was also determined whether therapeutic anticoagulation (defined by our institution's therapeutic guidelines), or fluid resuscitation respectively, were initiated prior to the patient arriving in the MID. Events that occurred in usual work hours were defined as those occurring between 08:00 h and 17:00 h, Monday to Friday, excluding public holidays. Ethics approval was granted by the hospital ethics review board.

Continuous data were summarised as mean and standard deviation (SD) if normally distributed or median and inter-quartile range if skewed. Categorical variables were reported as counts and proportions.

3. Results

A total of 124 emergency codes were called in the general MID, the DSA suite and MRI department, equating to, on average, 13.1 per year in the general MID, 1.7 per year in the DSA suite and 3.6 per year in the MRI department. These 124 emergency calls represented 2.26% of the 4778 emergency calls at the hospital. Three of the MID emergency calls have insufficient data to enable analysis and thus were excluded.

The mean age of patients requiring an emergency code was 62 (SD 13.7) years. The patients were male in 54% of cases and were inpatients in 86% of cases (Table 1).

Of the events in the MID, 28% were Respond Blue and 72% Respond MET. The most common reason for initiation of an emergency code in the MID was seizures, constituting 14% of the total. Of note, seizure was the main reason for the emergency call in 55% of calls initiated in the MRI department. Altered conscious state (13%) was the next most common reason, followed by hypotension (12%), cardiopulmonary arrest (10%), hypoxia (8%), vaso-vagal (7%), contrast anaphylaxis (4%) and other miscellaneous causes including bradycardia, hypoglycaemia, tachypnoea, threatened airway, tachycardia, chest pain, severe abdominal pain, bradypnoea and rigors, accounting for 32%. 74% of the emergency calls were initiated between 08:00 h and 17:00 h and the remaining 26% occurring after hours (Table 2).

Table 2
Characteristics of 'Respond MET' and 'Respond Blue' calls in the medical imaging department. *N* = 121.

Call type	
Respond MET	87 (72%)
Respond Blue	34 (28%)
Time of call	
In hours[a]	89 (74%)
After hours	32 (26%)
Reason for call	
Seizures	17 (14%)
Altered conscious state (drop in GCS by 2 or more)	16 (13%)
Hypotension (systolic BP less than 90)	14 (12%)
Cardiopulmonary arrest	12 (10%)
Hypoxia	10 (8%)
Vaso-vagal	8 (7%)
Contrast anaphylaxis	5 (4%)
Other miscellaneous causes	39 (32%)

Values are number and (percentage). MET = medical emergency team.
[a] In-hours = 08:00 h to 17:00 h Monday to Friday, excluding public holidays.

Emergency calls were initiated in all imaging modalities. One hundred (83%) of the calls occurred in the context of diagnostic imaging, whilst 21 (17%) occurred in the context of procedural imaging. Forty-five percent of the emergency calls were for patients attending the MID for CT, 12% for computed radiography, 10% for MRI, 10% for nuclear medicine, 10% for ultrasound, 10% for DSA procedures and 2% for fluoroscopy (Table 3). During the study period, a total of 87,079 CT studies, 327,322 computed radiography studies, 45,082 MRI studies, 19,715 nuclear medicine studies, 60,496 ultrasound studies, 8039 DSA studies and 9090 fluoroscopic studies were performed.

Image guided procedures are performed in the general MID and in the DSA suite. Of the 21 medical emergency calls initiated in the context of image-guided procedures, these occurred in the general MID on nine occasions and in DSA on 12 occasions.

Planned imaging was abandoned due to the emergency and the need for resuscitation on 12 occasions, all of which were in the context of patients presenting for diagnostic imaging (12% of the one hundred patients initially presenting for diagnostic imaging).

Table 3
Imaging characteristics of 'Respond MET' and 'Respond Blue' calls in the medical imaging department. *N* = 121.

Imaging modality	
CT	55 (45%), 0.00063%[a]
CR	15 (12)%, 0.00004%[a]
Nuclear medicine	12 (10%), 0.00060%[a]
Ultrasound	12 (10%), 0.00020%[a]
MRI	12 (10%), 0.00027%[a]
DSA	12 (10%), 0.00137%[a]
Fluoroscopy	3 (2%), 0.00033%[a]
Imaging technique	
Diagnostic	100 (83%)
Procedural (including MID and DSA)	21 (17%)

CT: computed tomography; CR: computed radiography; DSA: digital subtraction angiography.
[a] Values are number, (percentage) and percentage of total studies performed in modality.