Medical emergency teams and end-of-life care: a systematic review

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ABSTRACT

Background: The medical emergency team (MET) is now common in many hospitals. Apart from early identification and management of patients who are potentially unwell on the ward, the MET may also be involved in end-of-life (EOL) care. It is not known how often METs perform EOL interventions.

Methods: We performed a systematic review to identify the frequency of EOL interventions in comparison with other commonly performed interventions during MET calls. We searched PubMed, Embase and bibliographies of retrieved articles. Studies which reported METs that delivered EOL care were included. We assessed the validity of all included studies.

Results: Thirty-five studies met our inclusion criteria. We assessed the frequency of MET interventions and EOL care in 16 studies. Limitations of Medical Therapy (LOMT) were instituted in 1.7% to 30.8% of MET calls. Discussions regarding LOMT were frequently performed more commonly than resuscitation interventions such as endotracheal intubation. None of the included studies reported palliative care interventions after MET calls.

Conclusions: We show that EOL care is commonly delivered during MET calls, and should be emphasised in training for MET members.

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Over the past decade, there has been widespread implementation of medical emergency teams (METs) or rapid response teams (RRTs) in hospitals, in an attempt to reduce the incidence of cardiac arrests, adverse events, hospital mortality and unanticipated intensive care unit admissions.[1-5] These teams are trained to identify and treat acute cardiac, respiratory and neurological emergencies, to work efficiently in multidisciplinary teams and to communicate effectively.[6,7]

Patients who need the services of an MET often have significant comorbidity and, overall, limited life expectancy.[8-10] There is emerging evidence that one of the more common interventions delivered by METs is to initiate discussion about end-of-life (EOL) care, such as limitation-of-medical-therapies (LOMT) and not-for-resuscitation (NFR) orders.[10-12] If METs are frequently involved with EOL issues when called to attend patients, it is important they are appropriately trained and equipped to deal with these situations. The training offered to METs should reflect the clinical scenarios that they encounter. It is not known how commonly METs deal with EOL issues and if this should form an aspect of their training, how commonly they deal with patients with LOMTs, nor how often METs implement palliative treatments for patients deemed unsuitable for more invasive therapy.

We undertook this systematic review to assess the frequency of EOL interventions, including issuing of do not resuscitate (DNR) or NFR orders by METs in comparison with other commonly performed ward interventions during the activation of MET.

Methods

Search strategy

We conducted an electronic literature search using the PubMed and Embase databases. We used medical subject heading and keyword searches for "medical emergency team" or "rapid response team", combined with keyword searches for "observational", "cohort" or "prospective" and "clinical trials", and the MESH terms "random allocation" or "therapeutic use". We examined reference lists and contacted authors who were experts in the field to identify any additional studies that might have been missed by the electronic database search. There was no language restriction. Each database was searched from inception until October 2012. The search was performed independently by both of us.

Study selection

Titles and abstracts of all studies identified by the search were reviewed by both of us to assess if they could meet the study inclusion criteria. The inclusion criteria were that the study: reported the deployment of an MET or RRT; was a controlled trial or an observational study; and reported activities performed by METs in human subjects. Studies assessed by either of us as potentially meeting the inclusion criteria were retrieved and we assessed full-text articles (or abstracts of studies when the full text was not available) for meeting inclusion criteria. We included manuscripts that reported: results of randomised controlled trials or observa-

tional studies; activities performed by the MET or RRT; involvement of the MET or RRT in EOL decision making; and if the study population was adult humans. We applied the inclusion criteria and resolved any disagreement by discussion.

Validity appraisal and data extraction

The validity of all included manuscripts was assessed using two simple criteria: were any methods used to verify the data; and were the methods of the study defined a priori? We independently assessed each study and resolved any disagreement by discussion.

Data were extracted from each study into a study-specific database, according to the a-priori definitions. We recorded the frequency of EOL interventions, including assignment of NFR orders and palliation by the MET. We also recorded the NFR or DNR rates from before the MET calls. Commonly performed interventions by METs on the ward and patient dispositions after MET review were also recorded. We recorded baseline features of the MET hospital such as hospital type, number of beds and the composition of the METs. The total number of MET calls during the study period was also recorded.

Data analysis

The primary analysis was descriptive. Data are summarised as counts and frequencies. When possible, we used the number of MET calls as the denominator and, if this was not available, we used the number of patients as the denominator.

Results

The electronic search retrieved 2323 references, and one further study[13] was identified by a search of reference lists. A total of 131 articles were reviewed in full text, with 35 meeting the inclusion criteria.[1,2,8,11,13-43] A total of 2289 studies were excluded because they were not relevant or did not meet inclusion criteria. The flow of the studies and reasons for exclusion are shown in Figure 1.

The characteristics of the studies and the results of the validity assessment are shown in Table 1.[1,2,8,11,13-43] There were 22 tertiary hospitals, two district hospitals, two university hospitals, one teaching hospital, one community hospital and one metropolitan hospital. Two studies were conducted in mixed hospitals.[23,40] Four studies did not report the type of hospital.[24,25,33,35] Only one study fulfilled the validity criteria.[18] Five studies reported data verification methods and 12 studies defined a-priori methods in their study.

Sixteen studies reported the frequency of interventions performed by the MET.[1,13,14,16,21-23,26,28,30-32,34,35,40,43] The most common interventions are shown in Table 2. In one study, LOMT was the equal most common intervention performed by the MET.[28] In five studies, LOMT was reported as being performed more frequently than endotracheal intubation. Although LOMT was commonly instituted in these studies (1.7%–30.8%), none of them reported initiation of palliative care treatment after institution of LOMT.

Figure 1. Flow of studies through systematic review

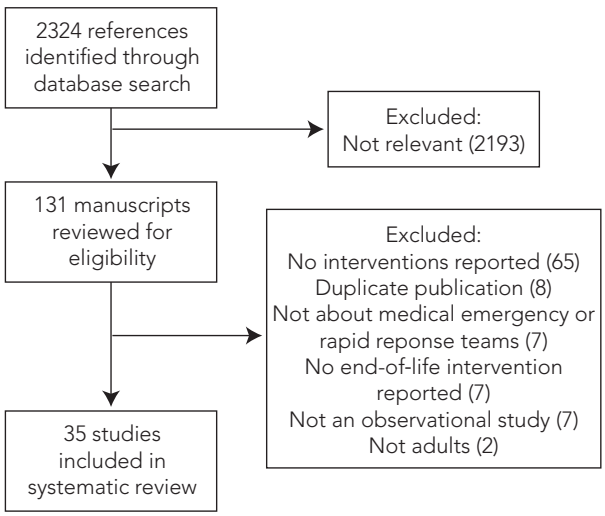

Table 3 shows the disposition of patients after an MET call. A significant proportion of patients were transferred to a higher level of care (range, 9.1%–57.7%). Patients with pre-existing DNR orders ranged from 6% to 34%. Table 4 shows the compositions of the METs. The staff members most commonly described as team leaders were registrars, although other team leaders included ICU specialists and registered nurses.[13,15,21,27,30,34,35,39-41]

Discussion

We performed a systematic review to determine how frequently METs are dealing with issues involved in EOL care. We found that EOL interventions were commonly performed by METs. Initiation of LOMT was performed in many of the studies more commonly than ICU interventions such as endotracheal intubation, basic and advanced life support, and vasopressor and inotropic support. METs are commonly led by medical personnel at the registrar level.[44,45] Given the relative frequency with which METs initiate LOMT discussions (compared with delivering acute resuscitative interventions) and the frequency with which patients with pre-existing LOMT orders are encountered by METs, it is imperative that training for METs has a focus on EOL issues.

Table 1. Baseline characteristics and validity of included studies

Study first author	Year	Hospital type	Beds	Study design	Data verification*	A-priori methods†
Baxter[13]	2008	Tertiary	900	Audit	No	No
Beitler[14]	2011	Tertiary	809	Prospective cohort	No	Yes
Bellomo[1]	2003	Tertiary	NR	Before and after	No	Yes
Boniatti[15]	2010	University	794	Retrospective cohort	No	No
Buist[2]	2002	Tertiary	300	Audit	No	No
Calzavacca[16]	2009	Tertiary	NR	Retrospective cohort	No	No
Calzavacca[17]	2010	Tertiary	400	Prospective cohort	No	Yes
Calzavacca[18]	2008	Tertiary	400	Prospective cohort	Yes	Yes
Calzavacca[19]	2010	Tertiary	400	Retrospective cohort	No	Yes
Casamento[20]	2008	Metropolitan	NR	Prospective cohort	Yes	No
Chan[21]	2008	Tertiary	404	Prospective cohort	No	No
Dacey[22]	2007	Community	350	Prospective cohort	No	Yes
Downey[8]	2008	Tertiary	400	Retrospective cohort	No	Yes
Flabouris[23]	2010	Multiple	NR	Prospective cohort	No	Yes
Georgeto[24]	2011	NR	NR	Before and after	No	No
Gray[25]	2011	NR	NR	Before and after	No	No
Hourihan[26]	1995	Tertiary	460	Prospective cohort	No	No
Jäderling[27]	2011	Tertiary	650, 400	Prospective cohort	No	No
Jones[11]	2012	University	NR	Prospective cohort	Yes	No
Kenward[28]	2004	District general	700	Prospective cohort	No	No
Knott[29]	2011	Tertiary	450	Retrospective cohort	No	Yes
Konrad[30]	2010	Tertiary	900	Before and after	No	No
Laurens[31]	2011	District	150	Before and after	No	No
Lighthall[32]	2010	Tertiary	150	Before and after	No	No
Low[33]	2010	NR	770	Audit	No	No
Medina-Rivera[34]	2010	Teaching	331	Retrospective cohort	No	No
Meynaar[35]	2011	NR	NR	Retrospective cohort	No	No
Micallef[36]	2011	Tertiary	650	Prospective cohort	Yes	No
Quach[37]	2008	Tertiary	400	Retrospective cohort	No	Yes
Schneider[38]	2011	Tertiary	400	Retrospective cohort	No	No
Shah[39]	2011	Tertiary	NR	Retrospective cohort	No	No
Stelfox[40]	2012	2 district, 1 tertiary	2040	Retrospective cohort	No	Yes
Tirkkonen[41]	2013	Tertiary	769	Prospective cohort	No	Yes
Trinkle[42]	2011	Tertiary	650	Retrospective cohort	Yes	No
Wong[43]	2005	Tertiary	NR	Prospective cohort	No	No

NR = not reported. * Study authors described a method of checking data source. † The protocol was defined clearly and explicitly a priori.

Our study has several strengths. We used robust methods, ensuring that our study was compliant with current recommendations for the conduct and reporting of systematic reviews of observational studies.[46] We identified published and unpublished studies and were able to obtain additional data directly from study authors. The differing settings and compositions of METs included mean that the results are generalisable. Our study also has several weaknesses: few studies reported methods of data verification and few had a-priori methods; and the quantitative results were not presented in a way that would allow quantitative synthesis.

Many of the included studies recorded the frequency with which the MET instituted LOMT and NFR orders, but none reported the frequency of palliative care interventions implemented by the MET.[47] This is in contrast to a recent retrospective study which showed an improvement in palliative care following institution

Table 2. Interventions performed by medical emergency teams, including limitations-of-medical-therapy orders, *n* (%)

Study first author	IR 1	IR 2	IR 3	IR 4	IR 5	IR 6	IR 7	IR 8	IR 9	IR 10	Other
Baxter[13]	O_2 743 (38.5%)	Fluids 618 (32%)	Br'dilator 290 (15%)	Diuretics 193 (10%)	V'pressor 154 (8%)	**LOMT** 154 (8%)	A'arrhythmic 135 (7%)	NIV 135 (7%)	Tr'ostomy 116 (6%)	CVS med. 116 (6%)	Intub. 97 (5%)
Beitler[14]	O_2 538 (62.9%)	Fluids 247 (28.9%)	Intub. 140 (16.4%)	Br'dilator 112 (13.1%)	Suction 98 (11.5%)	Seizure Rx 83 (9.7%)	V'pressor 82 (9.6%)	**LOMT** 70 (8.2%)	A'arrhythmic 69 (8.1%)	Diuretic 63 (7.4%)	Glucose 57 (6.7%)
Bellomo[1]	O_2 21 (21.2%)	Fluids 18 (18.2%)	IV acc. 18 (18.2%)	Diuretic 11 (11.1%)	NIV 9 (9.1%)	Br'dilator 8 (8.1%)	BVM 6 (6.1%)	GTN 6 (6.1%)	Seizure Rx 5 (5.1%)	V'pressor 5 (5.1%)	**LOMT** 2 (2%)
Calzavacca[16]	O_2 930 (41.6%)	Fluids 439 (19.6%)	Circ. supp. 306 (13.7%)	Diuretic 260 (11.6%)	Drug manage. 156 (7%)	**LOMT** 141 (6.3%)	NIV 140 (6.3%)	IV acc. 114 (5.1%)	V'pressor 93 (4.2%)	Intub. 82 (3.7%)	NA
Chan[21]	IV acc. 150 (39.9%)	Fluids 60 (16%)	NIV 41 (10.9%)	Intub. 28 (7.4%)	CVC 28 (7.4%)	Diuretics 27 (7.2%)	Naloxone 20 (5.3%)	GTN 18 (4.8%)	Suction 18 (4.8%)	Seizure Rx 14 (3.7%)	**LOMT** 8 (2.1%)
Dacey[22]	O_2 299 (86.9%)	Medical Rx 203 (59%)	Fluids 110 (32%)	Br'dilator 65 (18.9%)	ACLS 58 (16.9%)	Suction 38 (11%)	Intub. 38 (11%)	**LOMT** 35 (10.2%)	NIV 34 (9.9%)	BLS 11 (3.2%)	NA
Flabouris[23]	O_2 1102 (59.1%)	IV acc. 649 (34.8%)	Fluids 552 (29.6%)	Seizure Rx 503 (27%)	BVM 337 (18.1%)	BLS 214 (11.5%)	A'arrhythmic 209 (11.5%)	Ventil. 196 (10.5%)	**LOMT** 184 (9.9%)	Suction 168 (9%)	Intub. 166 (8.9%)
Hourihan[26]	Ventil. 97 (33%)	Fluids 89 (30.3%)	Intub. 77 (26.2%)	V'pressor 60 (20.4%)	O_2 60 (17%)	ACLS 26 (8.8%)	NIV 24 (8.2%)	Blood trans. 7 (2.4%)	**LOMT** 5 (1.7%)	NA	NA
Kenward[28]	O_2, fluids 32 (23.5%)	**LOMT** 32 (23.5%)	BLS 31 (22.8%)	O_2, med. 29 (21.3%)	O_2 13 (9.6%)	Med. 6 (4.4%)	Fluids 1 (0.7%)	NA	NA	NA	NA
Konrad[30]	O_2 482 (70%)	Fluids 324 (47%)	ABG 262 (38%)	**LOMT** 124 (18%)	NA	NA	NA	NA	NA	NA	NA
Laurens[31]	O_2 251 (84.8%)	Med. 194 (65.5%)	IV acc. 166 56.1%)	Fluids 123 (41.6%)	Suction 59 (19.9%)	**LOMT** 55 (18.6%)	Intub. 51 (17.2%)	CPR 47 (15.9%)	Defib. 18 (6.1%)	NA	NA
Lighthall[32]	O_2 68 (18%)	ABG 67 (17.7%)	Fluids 60 (15.9%)	IV acc. 21 (5.6%)	NIV 19 (5%)	Intub. 13 (3.4%)	**LOMT** 10 (2.6%)	NA	NA	NA	NA
Medina-Rivera[34]	O_2 16 (17.6%)	Fluids 16 (17.6%)	Intub. 13 (14.3%)	A'hypertens. 7 (7.7%)	**LOMT** 6 (6.6%)	V'pressor 5 (5.5%)	ACLS 4 (4.4%)	Diuretic 4 (4.4%)	Steroids 4 (4.4%)	A'convuls. 3 (3.3%)	Nebuliser 3 (3.3%)
Schneider[38]	Amiodarone 273 (49%)	Magnesium 244 (43.8%)	Potassium 189 (33.9%)	IV acc. 173 (31.1%)	β-blocker 145 (26%)	Fluids 103 (18.5%)	Digoxin 64 (11.5%)	**LOMT** 32 (5.7%)	V'pressor 21 (3.8%)	NIV 21 (3.8%)	CVC 9 (1.6%)
Stelfox[40]	O_2 2616 (67%)	Fluids 1251 (32%)	IV acc. 1104 (28.3%)	Suction 499 (12.8%)	Nebuliser 466 (11.9%)	IDC 372 (9.5%)	**LOMT** 329 (8.4%)	Intub. 301 (7.7%)	Vasoactive med. 176 (4.5%)	NG tube 154 (3.9%)	CVC 90 (2.3%)
Wong[43]	O_2 11 (84.7%)	IV acc. 5 (38.5%)	IV fluids 5 (38.5%)	**LOMT** 4 (30.8%)	ABG 3 (23.1%)	Suction 1 (7.7%)	Suction 1 (7.7%)	NA	NA	NA	NA

IR = intervention ranking. O_2 = oxygen. Br'dilator = bronchodilator. V'pressor = vasopressor. **LOMT** = limitation of medical therapy. A'arrhythmic = anti-arrhythmic. NIV = non-invasive ventilation. Tr'ostomy = tracheostomy. CVS = cardiovascular. Med. = medication. Intub. = intubation. Rx = therapy. IV acc. = intravenous access. BVM = bag valve mask. GTN = glyceryl trinitrate. Circ. supp. = circulatory support. Drug manage. = drug management. CVC = central venous catheter. ACLS = advanced cardiac life support. BLS = basic life support. Ventil. = ventilation. Blood trans. = blood transfusion. ABG = arterial blood gas. CPR = cardiopulmonary bypass. Defib. = defibrillation. A'hypertens. = antihypertensive. A'convuls. = anticonvulsant. IDC = indwelling catheter. NG = nasogastric.

Table 3. Disposition of patients after medical emergency team review

Study first author	Total patients (*n*)	Total MET calls (*n*)	Transferred to higher level care, *n* (%)	DNR rate before MET (%)	LOMT orders, *n* (%)	Palliative care instituted
Baxter[13]	NR	1931	637 (33%)	20%	154 (8%)	NR
Beitler[14]	740	855	473 (55.3%)	NR	70 (8.2%)	NR
Bellomo[1]	NR	99	18 (18.2%)	NR	2 (2%)	NR
Boniatti[15]	901	1051	489 (46.5%)	NR	30 (2.9%)	NR
Buist[2]	124	152	NR	NR	13 (8.6%)	NR
Calzavacca[16]	1167	2237	403 (18%)	25%	197 (8.8%)	NR
Calzavacca[17]	200	200	35 (17.5%)	15%	19 (9.5%)	NR
Calzavacca[18]	228	251	42 (16.7%)	14%	21 (8.4%)	NR
Calzavacca[19]	1664	2237	267 (11.9%)	23%	141 (6.3%)	NR
Casamento[20]	195	218	60 (27.5%)	19%	24 (11%)	NR
Chan[21]	NR	376	171 (45.5%)	NR	8 (2.1%)	NR
Dacey[22]	NR	344	140 (40.7%)	NR	35 (10.2%)	NR
Downey[8]	200	200	NR	8%	46 (23%)	NR
Flabouris[23]	NR	1864	326 (17.5%)	NR	184 (9.9%)	NR
Georgeto[24]	889	NR	406 (%NR)	NR	34 (%NR)	NR
Gray[25]	NR	132	12 (9.1%)	NR	31 (23.5%)	NR
Hourihan[26]	NR	294	53 (18%)	NR	5 (1.7%)	NR
Jäderling[27]	3063	NR	616 (%NR)	34% (K); 31% (A)	400 (%NR)	NR
Jones[11]	518	652	NR	20%	56 (8.6%)	NR
Kenward[28]	130	136	34 (25%)	NR	32 (23.5%)	NR
Knott[29]	71	NR	NR	32%	23 (%NR)	NR
Konrad[30]	540	689	146 (21.2%)	NR	124 (18%)	NR
Laurens[31]	NR	296	58 (19.6%)	NR	55 (18.6%)	NR
Lighthall[32]	NR	378	218 (57.7%)	NR	10 (2.6%)	NR
Low[33]	880	NR	115 (%NR)	NR	213 (%NR)	NR
Medina-Rivera[34]	NR	91	NR	NR	6 (6.6%)	NR
Meynaar[35]	981	1058	606 (57.3%)	NR	88 (8.3%)	NR
Micallef[36]	NR	1458	NR	9%	116 (8%)	NR
Quach[37]	NR	200	88 (44%)	9%	37 (18.5%)	NR
Schneider[38]	458	557	52 (9.3%)	20%	32 (5.7%)	NR
Shah[39]	NR	1206	659 (54.6%)	NR	34 (2.8%)	NR
Stelfox[40]	3494	3905	664 (17%)	31%	329 (8.4%)	NR
Tirkkonen[41]	458	569	155 (27.2%)	6%	34 (6%)	NR
Trinkle[42]	443	575	145 (25.2%)	NR	25 (4.3%)	NR
Wong[43]	22	13	4 (30.8%)	NR	4 (30.8%)	NR

MET = medical emergency team. DNR = do not resuscitate. LOMT = limitation of medical therapies. NR = not reported.

of an RRT. In a recent retrospective study, fewer than 20% of patients were referred to palliative or spiritual care services after a change in resuscitation orders.[48] The authors concluded, in a separate study, that EOL care is not improved despite the introduction of RRTs in their institutions.[49] EOL care and advance care planning are part of the National Safety and Quality Health Service Standards, recently implemented to deliver more patient-centred care.

There are a number of reasons for poor uptake of EOL decision making. A recent systematic review identified patient-specific and doctor-specific factors which determine the likelihood of engaging in EOL care discussion.[50] An increasing emphasis on patient-centred care will create

a less paternalistic approach to medical care and, we hope, will more appropriately align patient autonomy with best interest for better patient outcomes. There is increasing evidence to suggest that unwell patients are more willing to participate in EOL care discussions than their treating doctors perceive them to be.[51]

There are some issues that warrant further investigation. It is less than optimal that EOL care decisions need to be made with the time pressure and stress of an MET call, when they could be made by the treating medical team well before the event. Identifying systematic methods to introduce more appropriate EOL care planning for patients at high risk of short-term mortality might be a useful research objective, if a little difficult to achieve.[52]

Conclusions

METs are commonly required to attend patients and deal with EOL care. The training of METs should reflect this, and training on EOL issues should be a priority for MET programs.

Competing interests

None declared.

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Table 4. Composition of medical emergency teams (METs)

Personnel	MET senior	Other members
Medical staff		
Intensive care unit specialist	8	1
Intensive care unit registrar or fellow	13	0
Medical registrar	3	6
Surgical registrar	0	1
Anaesthetist	0	5
Other (physician assistant, principal house officer)	2	–
Nursing staff		
Intensive care unit	2	23
Emergency department	0	1
Unspecified	0	11
Other staff		
Pharmacist	0	1
Respiratory therapist	0	8
Orderly	0	1
Not reported	8	15

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