

Assessing the Awareness of EVT Practices Among Emergency Medicine Physicians in Turkey

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Background: Trauma is the leading cause of death in those aged 1–44 years; nearly half of these fatalities are due to bleeding. As resuscitative endovascular balloon occlusion of the aorta (REBOA) and other endovascular resuscitation and trauma management (EVT) methods became known in Turkey, they started to arouse interest. The main objective of this study is to reveal the impressions of emergency medicine (EM) doctors about EVT and REBOA application possibilities, and the secondary objective is to determine the issues that are limiting their spread.

Methods: We conducted a 22-question cross-sectional survey via e-mail between 1 January and 1 April 2020. The questions were formulated to be closed-ended, semi-closed-ended, and open-ended. The evaluation questions utilized 3- and 5-point Likert scales and Yes/No questions. EM specialists, residents, consultants, and physicians working as emergency department (ED) directors in Turkey were included. EM specialists working in units other than EDs and specialists from other branches were excluded.

Results: Among the 512 people contacted for this study, 132 agreed to participate. The numbers of participants that were aware of REBOA and EVT were 114 and 99, respectively. Participants thought that femoral vascular access, extracorporeal membrane oxygenation (ECMO), and REBOA were more applicable in EDs (median 4, 4, and 4.5, respectively; interquartile range 1–5). Participants considered lack of knowledge and skills and lack of equipment as barriers to REBOA (median 5 and 5, respectively).

Conclusions: To disseminate EVT practices in Turkey, projects should be conducted primarily to address lack of knowledge, skills, and equipment.

Keywords: REBOA; EVT; Emergency Department; Survey Study

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INTRODUCTION

Trauma ranks first among the causes of death for individuals aged 1–44 years [1], with nearly half of these fatalities resulting from bleeding within the golden

hours. The death of a disease-free person, who is not expected to pass away due to health reasons, while living their daily life is a social and public concern. Although local administrations and occupational health teams take indispensable precautions, it is imperative to ensure that trauma patients receive optimal care.

Endovascular resuscitation and trauma management (EVT) is a ground-breaking concept based on the permanent repair of the cause of bleeding through methods such as endovascular stent and graft procedures or embolization, following fast-acting but temporary bleeding control with resuscitative endovascular balloon occlusion of the aorta (REBOA). The methods for achieving rapid and high-quality intervention to stop bleeding are still discussed in many trauma study groups [2,3]. This highlights the applications of EVT [4].

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EVT_M, a concept recently recognized in Turkey, has been an undeniable help in providing the comfort needed for golden hour interventions for trauma patients [4,5]. However, given the limited use of EVT_M in Turkey, it is crucial to identify and discuss the factors hindering its widespread implementation. For this reason, this survey study aims to investigate the awareness and applicability of EVT_M, with two objectives. The main objective is to explore the awareness of EVT_M and REBOA procedures among emergency medicine (EM) physicians in Turkey, and the secondary objective is to identify strategies for addressing issues that are limiting the spread of knowledge and use.

METHODS

This cross-sectional survey consists of 22 questions. The Cronbach's Alpha value of the scale utilized in this study was measured to be 0.78.

The study participants consisted of EM physicians, residents, and consultants working in second- and third-level emergency departments (EDs) in Turkey. Moreover, physicians working as ED directors were included. EM physicians not currently working in the ED and specialists from other branches were excluded. Third-level health service providers are high-level health institutions that provide training and research services for diseases that require advanced examination and special treatment defined in the relevant legislation. Second-level health service providers are health institutions that provide outpatient or inpatient diagnosis, treatment, and rehabilitation services.

After asking certain demographic data questions, the participants were queried about their knowledge, experience, and ideas about REBOA and other EVT_M procedures. In the next section, they were asked questions about obstacles to REBOA implementation, applicability of EVT_M procedures in EDs, and management of EVT_M complications. The questions were formulated to be closed-ended, semi-closed-ended, and open-ended. The evaluation questions utilized 3- and 5-point Likert scales and Yes/No (Y/N) questions. The options for closed-ended questions were determined using an open-ended pre-study. At the end of this preliminary question and options determination process, all the authors gave their consent for the questions determined. The questionnaire was modified to ensure that all questions could be completed and to prevent any missing data. To further minimize the risk of incomplete or inaccurate answers, the contact information of the team was provided so that the participants could reach them for any clarifications.

The questionnaire was sent to the participants via e-mail, using a web-based link shared on common platforms of professional groups. Between 1 January and 1 April 2020, 132 out of the 512 people contacted agreed to participate in the study.

Data Analysis

The data collected during this study was analyzed using the SPSS 21 software program. The denominator in each proportion presented represents the number of participants who answered the question. As some participants skipped certain questions based on the subject matter, the denominator varied for each individual question. Descriptive statistics, including median (range) values, were used to analyze the responses. The responses were compared using the Fisher's exact test, Chi-square test, and Kruskal-Wallis test when appropriate. An alpha of 0.05 was used for significance.

Ethical Approval and Informed Consent

This study was conducted with the approval of the Aydin Adnan Menderes University Clinical Research Ethics Committee, with the reference number 2019/192, and informed consent was not required.

RESULTS

Among the 512 people contacted for this study, 132 agreed to participate. These 132 people consisted of 58 (43.9%) EM residents, 46 (34.9%) EM specialists, 25 (18.9%) EM consultants, and 3 (2.3%) ED directors. As to work experience in the ED, 23 (17.4%) had worked for less than two years, 41 (31.1%) had worked for two to five years, and 68 (51.5%) had worked for more than five years. Three (2.3%) participants worked in a private hospital (secondary care), 23 (17.4%) in a public hospital (secondary care), 51 (38.6%) in a training and research hospital (tertiary care), and 55 (41.7%) in a university hospital (tertiary care). The median age of the participants was 32 (25–50) years.

REBOA and EVT_M Knowledge, Experience, and Opinions

The knowledge, experience, and opinions of the participants about REBOA and EVT_M are presented in Table 1. A total of 114 (86.4%) of the participants were aware of REBOA. Among these 114, 15 (13.2%) had previously performed REBOA, while the rest obtained their awareness through various means, such as attending congresses, seminars, and courses, or reading articles and books. Participants who had experience with REBOA performed the procedure for indications such as pelvic fractures, massive vaginal bleeding, cardiogenic shock, and on patients with multiple traumas. Out of the 114 participants with REBOA awareness, 42 (36.8%) declared it feasible, 39 (34.2%) declared it not applicable, and 33 (29%) were undecided on this issue. When they were compared according to their institutions, participants working in secondary care thought that REBOA was not applicable more, and the results

Table 1 Familiarity of the participants with REBOA and EVTm.

	Answer	No.	%
Have you heard of the name REBOA? <i>n</i> = 132	Yes	114	86.4
	No	18	13.6
Is REBOA application performed in your clinic? <i>n</i> = 114	Yes	15	13.2
	No	99	86.8
Do you think the REBOA procedure is applicable in your clinic? <i>n</i> = 114	Yes	42	36.8
	No	39	34.2
	Partially	33	29
Have you heard of the complications of REBOA application? <i>n</i> = 114	Yes	77	67.5
	No	37	32.5
If complications develop while administering REBOA in the emergency clinic, can you manage? <i>n</i> = 77	Yes	39	50.6
	No	38	49.4
Do you think other clinics in the hospital will support you if complications develop during the REBOA procedure? <i>n</i> = 77	Yes	7	9.1
	No	26	33.8
	Partially support	29	37.6
	They must support	15	19.5
Have you heard of the name EVTm? <i>n</i> = 132	Yes	99	75
	No	33	25
Do you have EVTm experience? <i>n</i> = 99	Yes	17	17.2
	No	82	82.8
Do you think other clinics in the hospital will support you if complications develop during the EVTm procedure? <i>n</i> = 132	Yes	17	12.9
	No	41	31.1
	Partially support	46	34.8
	They must support	28	21.2

EVTm: endovascular resuscitation and trauma management; REBOA: resuscitative endovascular balloon occlusion of the aorta.

were statistically significantly different from those working in tertiary care ($p < 0.05$). Out of the 77 participants who declared that they were aware of the complications related to REBOA, 39 (50.6%) stated that they were able to manage these complications in the ED. However, only seven participants (9.1%) thought that the relevant departments would provide support without any difficulty if complications were to occur.

Obstacles to REBOA Implementation

The responses to the closed-ended question about the obstacles to REBOA implementation are summarized in Table 2 (Q.12). The participants identified lack of knowledge or skills, lack of equipment, and other clinics' inhibitions as barriers to the implementation of REBOA, with median scores of 5, 5, and 4, respectively (interquartile range (IQR) = 1–5). When these obstacles were compared according to the institutions, the lack of knowledge or skills for those working in secondary care hospitals was found to be statistically significant ($p < 0.05$).

The responses of the participants to the open-ended questions about the barriers to REBOA application can

be summarized in their own words as follows: lack of awareness about REBOA; limited studies on its reliability; inadequate knowledge and experience of relevant departments to help in case of any complications; reluctance of clinic chiefs to include REBOA application in their curriculum; high cost; lack of support of the hospital management; and need for additional training of other health professionals on REBOA.

Opinions of the Applicability for Each EVTm Procedure in EDs

The opinions among the participants about the applicability for each EVTm procedure in EDs are summarized in Table 2 (Q.19). Among the EVTm methods, participants think that femoral vascular access and extracorporeal membrane oxygenation (ECMO) are more applicable in the ED, with both methods having a median score of 4 (IQR = 1–5). When the applicability of these methods was compared according to the institutions, no statistically significant difference was found ($p = 0.433$ and $p = 0.470$ respectively). The awareness of the use of the endovascular stent graft, endovascular plug, endovascular selective balloon occlusion, and hybrid

Table 2 Distribution of participants' opinions about REBOA and other EVT/M procedures.

Q.12 What do you think about the reasons that prevent REBOA from being performed in the ED? n = 114 (%)							
	Disagree completely	Strongly disagree	Undecided	Strongly agree	Agree completely	Median (Min.–Max.)	
Lack of knowledge and skills	5 (4.4)	5 (4.4)	3 (2.6)	36 (31.6)	65 (57)	5 (1–5)	
Lack of materials and equipment	3 (2.6)	2 (1.7)	5 (4.4)	27 (23.7)	77 (67.5)	5 (1–5)	
Inhibition/reaction of my colleagues in my branch	15 (13.2)	29 (25.4)	27 (23.7)	24 (21)	19 (16.7)	3 (1–5)	
Not enough time for the procedure	13 (11.5)	25 (21.9)	17 (14.9)	34 (29.8)	25 (21.9)	4 (1–5)	
Not in the scope of the emergency	41 (35.9)	32 (28.2)	20 (17.5)	7 (6.1)	14 (12.3)	2 (1–5)	
Inhibition/reaction of other branches	9 (7.9)	22 (19.3)	22 (19.3)	28 (24.6)	33 (28.9)	4 (1–5)	
It doesn't interest me	56 (49.1)	26 (22.8)	12 (10.6)	11 (9.6)	9 (7.9)	2 (1–5)	

Q.19 What do you think about the applicability of the each EVT/M procedure by EM specialists? n = 132 (%)							
	No idea	Disagree completely	Strongly disagree	Undecided	Strongly agree	Agree completely	Median (Min.–Max.)
Femoral vascular access	37 (28)	1 (0.8)	2 (1.5)	15 (11.4)	23 (17.4)	54 (40.9)	4 (0–5)
ECMO	30 (22.7)	3 (2.3)	5 (3.8)	11 (8.3)	40 (30.3)	43 (32.6)	4 (0–5)
Endovascular stent graft	48 (36.4)	3 (2.3)	12 (9.1)	22 (16.7)	25 (18.9)	22 (16.7)	3 (0–5)
Endovascular embolization	40 (30.3)	5 (3.8)	13 (9.8)	15 (11.4)	25 (18.9)	34 (25.8)	3 (0–5)
Endovascular plug	68 (52.5)	2 (1.5)	10 (7.6)	21 (15.9)	16 (12.1)	15 (11.4)	2 (0–5)
Endovascular selective balloon occlusion	44 (33.3)	3 (2.3)	6 (4.5)	19 (14.4)	28 (21.2)	32 (24.2)	3 (0–5)
Hybrid resuscitation	58 (43.9)	2 (1.5)	6 (4.5)	20 (15.2)	20 (15.2)	26 (19.7)	3 (0–5)

Q.20 What do you think about the manageability of the each EVT/M complication in your clinic? n = 132 (%)							
	No idea	Disagree completely	Strongly disagree	Undecided	Strongly agree	Agree completely	Median (Min.–Max.)
Bleeding at the intervention site	11 (8.3)	1 (0.8)	3 (2.3)	5 (3.8)	30 (22.7)	82 (62.1)	5 (0–5)
Aortic-artery dissection rupture	18 (13.6)	22 (16.7)	29 (22)	19 (14.4)	32 (24.2)	12 (9.1)	2 (0–5)
Embolic events	15 (11.7)	5 (3.8)	20 (15.2)	25 (18.9)	45 (34.1)	22 (16.7)	4 (0–5)
Balloon-related mechanical complications	19 (14.4)	11 (8.3)	24 (18.2)	29 (22)	37 (28)	12 (9.1)	3 (0–5)
Reperfusion injury	17 (12.9)	9 (6.8)	18 (13.6)	30 (22.7)	40 (30.3)	18 (13.6)	3 (0–5)
Circulatory disorder	14 (10.6)	7 (5.3)	15 (11.4)	22 (16.7)	54 (40.9)	20 (15.2)	4 (0–5)

ECMO: extracorporeal membrane oxygenation; ED: emergency department, EM: emergency medicine; EVT/M: endovascular resuscitation and trauma management; Q: Question; REBOA: resuscitative endovascular balloon occlusion of the aorta

resuscitation is not sufficient. Out of 132 participants, rates of awareness were 63.6%, 47.5%, 66.7%, and 56.1%, respectively.

Reflections on the Management of EVT_M Complications

Reflections on the management of EVT_M complications are summarized in Table 2 (Q.20). Opinions regarding the most and the least manageable complications were bleeding at the access area and aortic rupture (median 5 and 2, respectively) (IQR = 1–5). There was no significant difference in the answers given by the participants according to their title and institution ($p = 0.195$ and $p = 0.438$, respectively).

DISCUSSION

Since EVT_M has led to satisfactory results in increasing the rate of patients managed non-operatively [6], the care given to trauma patients is being continuously improved. Therefore, it is important to contribute to the spread of this development in Turkey, by revealing the points of view of the doctors working in the EDs in Turkey on EVT_M methods.

In a study conducted by Sutherland et al. in the United States, the usage rate of REBOA of the participants was given as 49.3% [7]. In this study that we conducted in Turkey, the REBOA awareness rate was 86.4%, while the application rate was 13.2%; the EVT_M awareness rate was 75% and the implementation rate was 17.2% among emergency physicians (Table 1).

Despite this Level of Awareness, Why are the Implementation Rates in Turkey Low?

In our study, when we asked if REBOA could be applied in EDs, we found that the answers Yes/No/Partially were 36.8%, 34.2%, and 29%, respectively (Table 1). In the study conducted by Sutherland et al they asked about the applicability of REBOA. The answers Yes/No/Undecided were found to be 37.7%, 12.2%, and 50.1%, respectively. Of those, the most cited reason was lack of clear patient selection and indication criteria [7]. Samuels et al. listed the reservations about using REBOA in their study as follows: (1) a lack of practice guidelines for REBOA implementation based on high-quality evidence; and (2) the inability to acquire and maintain the knowledge and skills [8]. In our study, the obstacles in its implementation were: (1) lack of knowledge and experience; (2) lack of materials and equipment; and (3) other clinics' inhibitions/negative reactions to the case (Table 2). In contrast, in a Canadian study, it was stated that most of the REBOA applications were performed by trauma surgeons, and they were used less by emergency specialists, cardiovascular surgeons, and intensive care specialists [9].

How Can We Overcome the Obstacles in REBOA Application?

This situation can be overcome by: (1) course training; (2) involving hospital administrators so that they are able to support innovative approaches; and (3) re-setting a multidisciplinary approach to trauma patients with hospital sources. REBOA training was implemented in September 2017 in Örebro, Sweden. According to the results of this training workshop, it has been revealed that with a limited-hour training curriculum, successful REBOA practice by clinicians without REBOA training or previous experience is possible [10]. From our study, it is indicated that planning training courses would be the best way to spread the knowledge of REBOA. Persuading the hospital administrators of the benefits of using REBOA catheters would be another part of the solution. In addition, perioperative management of REBOA and REBOA administration procedures should be studied with anesthesiologists and surgeons in an interdisciplinary way.

Hybrid Resuscitation Models in EDs

According to Coccolini et al., with the modern conception of hybrid and EVT_M procedures, satisfactory results have been increasing for patients managed non-operatively, opening up new options in trauma patient management [6]. In our study, the awareness rate of hybrid Resuscitation was determined to be 56.1%. For us to participate in this evolution, hybrid resuscitation rooms should be introduced, designed, and implemented in our emergency services. In this context, the hybrid emergency service model was introduced to Turkey in a special issue series recently published, and all the details, from its architecture to the healthcare opportunities it is expected to offer, were mentioned [11].

Reflections on the Management of EVT_M Complications

In a study by McGreevy et al., balloon rupture occurred in one patient, there was one occurrence of distal embolism, and acute kidney failure developed in two out of 15 patients who survived 22 interventions with the ER-REBOA catheter. A surgical embolectomy was performed for distal embolism. Bleeding at the intervention site, balloon migration, or multiorgan failure were not reported [12]. In our study, 50.6% of the participants thought that they could manage the complications of REBOA themselves. Despite this, only 9.1% for REBOA and 12.9% for other EVT_M procedures answered "Yes" to the question of having peace of mind regarding support for the management of complications by other branches (Table 1). REBOA complications can be minimized with practical exercises and mental preparations. Since the EVT_M concept is a practice that other clinics

do not know well in Turkey, the proportion who answer “Yes” is low. Therefore, after an EVT M procedure, how the anesthetist should manage the patient in the operation room, how to make decisions in a situation that the surgeon is not used to, and how to intervene in complications should be studied more widely in our clinics.

CONCLUSION

Improving the quality of care of trauma patients shortens the recovery time of patients and increases the likelihood of them returning to their original lives. As the Tr-EVT M team (Turkish Endovascular Hybrid Trauma and Bleeding Management Team), our task in Turkey is to improve the knowledge of and skills in EVT M among ED doctors, to develop improvement projects that will provide the appropriate environment and time such as structural rearrangement of ED plans, and to increase interdisciplinary cooperation between emergency medicine, trauma surgery, intensive care, interventional radiology, and anesthesiology departments.

Ethics Statement

- (1) All the authors mentioned in the manuscript have agreed to authorship, read and approved the manuscript, and given consent for submission and subsequent publication of the manuscript.
- (2) The authors declare that they have read and abided by the JEVT M statement of ethical standards including rules of informed consent and ethical committee approval as stated in the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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