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ORIGINAL ARTICLE

Confidence Level and Knowledge of Pre-hospital Thrombolysis Therapy of Paramedic in Pre-hospital Care: A Survey

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ABSTRAK

Data mengenai pengetahuan, sikap dan pengesanan kenaikan ST Miokardial Akut (STEMI) pada elektrokardiografi di kalangan paramedik pra-hospital di Malaysia masih kekurangan. Ia adalah penting untuk mendapatkan maklumat ini sebagai prasyarat dalam memulakan trombolisis pra-hospital. Kajian deskriptif ini dijalankan dari Mei 2016 hingga November 2017 ke atas paramedik dari Pusat Perubatan UKM (UKMMC) dan Hospital Kuala Lumpur (HKL) untuk menilai tahap pengetahuan mengenai terapi trombolitik pra-hospital dan pengesanan STEMI pada ECG. Seratus enam soal selidik telah dijawab dan dianalisa. Lebih daripada 60% calon masih tidak dapat mengesan perubahan STEMI ECG dan kekurangan keyakinan dalam mengendalikan dan menjalankan rawatan thrombolytic pada tahap pra-hospital. Hanya 20.8% calon berjaya mengesan lebih daripada 8/10 STEMI pada ECG dengan betul. Kurang daripada 40% calon mencapai lebih daripada 80% markah dalam menjawab soalan mengenai STEMI dan rawatan. Disimpulkan bahawa prestasi keseluruhan dan pengetahuan tentang paramedik mengenai terapi trombolitik pra-hospital pada umumnya kurang baik. Latihan lanjut perlu dilakukan sebelum melaksanakan rawatan trombolitik pra-hospital di Malaysia.

Kata kunci: ECG, prahospital, STEMI, terapi trombolitik

ABSTRACT

Data on knowledge, attitude and ST Elevation Myocardial Infarction (STEMI) electrocardiography (ECG) detection among pre-hospital paramedics in Malaysia is still scarce. It is imperative to gain this information as a pre-requisite in initiating

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pre-hospital thrombolysis. This was a descriptive study conducted from May 2016 until November 2017 on paramedics from Universiti Kebangsaan Malaysia Medical Center (UKMMC) and Kuala Lumpur Hospital (HKL). It was to assess knowledge on pre-hospital thrombolytic therapy and ECG detection of STEMI. One hundred and six questionnaires were answered and analyzed. More than 60% of the candidates were unable to detect STEMI ECG changes and lacked of confidence in handling and administering thrombolytic treatment at the level of pre-hospital phase. Only 20.8% candidates managed to detect more than 8/10 of the correct ECG pattern in STEMI. Less than 40% of the candidates achieved more than 80% marks in answering questions regarding STEMI and treatment. It is concluded that the overall performance and knowledge of paramedic regarding pre-hospital thrombolytic therapy is generally poor. Further training need to be done prior to implementing pre-hospital STEMI thrombolytic therapy in Malaysia.

Keywords: ECG, prehospital, STEMI, thrombolytic therapy

INTRODUCTION

The role of pre-hospital staff in detecting ST elevation myocardial infarction (STEMI) is imperative in curtailing door to balloon and door to needle time. Pre-hospital staff should equip themselves with the ability to detect acute ECG changes in STEMI for early delivery of thrombolytic therapy or early activation of cardiac catheterization laboratory. Neverthelss, Mencl et al. in 2013 stated that paramedic's ECG interpretation alone is unreliable due to its low sensitivity and low specificity. Thus, there is a need for further evaluation of training programmes, assessment, testing, feedback, and repeat training of paramedics.

Currently in Malaysia, there is no national standardized certification for pre-hospital training of paramedics (Chew & Chan 2011). Paramedics staffing the ambulance formally underwent general paramedic science programme without any further sub-specialty training (Hisamuddin et al. 2007). Pre-hospital paramedics in Malaysia were found to have poor knowledge on certain important procedures. Balakrishnan et al. 2013 established that only one (6.7%) out 15 pre-hospital paramedics had an adequate knowledge on intraosseous cannulation. Knowledge on other procedures such as basic ECG interpretation of life threatening illness among Malaysian paramedics was largely unknown.

This study aimed to assess the capability and confidence level in delivering pre-hospital thrombolytic therapy. Optimal treatment for STEMI is based on an early reperfusion strategy employing either primary percutaneous coronary intervention (PPCI) or thrombolytic therapy, with decision earliest done at the pre-hospital phase. Data concerning

the ability of pre-hospital staff in confidently treating STEMI in Malaysia is also lacking.

Early reperfusion requires collaboration between pre-hospital care unit, non-PCI-capable hospitals, and hospitals with PCI facilities. This may reduce total ischemic time, increase the number of patients receiving reperfusion therapy, minimize complication such as heart failure and reduces mortality (Joshua & Maame Yaa 2009). This study was intended to evaluate the knowledge, skill and readiness of our paramedics in detecting and initiating management of STEMI during the pre-hospital phase. This is important prior to implementing pre-hospital thrombolysis and pre-hospital activation of PPCI labs. Using data in this study, we would gauge at what stage we are in implementing pre-hospital STEMI detection or pre-hospital thrombolysis. According to a qualitative study by Alias 2018, there is a knowledge gap in paramedic training in Malaysia between theoretical content, procedure and equipment. The analysis shows that theoretical knowledge and depth of knowledge is insufficient. This study focussed more on ECG detection of STEMI and thrombolysis administration.

MATERIALS AND METHODS

The general objective of this study was to assess the confidence level and knowledge on STEMI detection and treatment among pre-hospital paramedic staff. The specific objectives include assessing knowledge on indication and contraindications of thrombolytic therapy, willingness to initiate thrombolytic therapy and correlation between knowledge and pre-hospital exposure. This was a cross-sectional observational study. The study was conducted at Department of Emergency Medicine Hospital Canselor Tuanku Muhriz UKM (HCTM) and Department of Emergency and Trauma, Hospital Kuala Lumpur. The study period was from June 2017 until May 2017 (6 months).

The sample size was calculated using the formula of Kish Leslie et al. as follows:

$$N = \frac{P\,(1-P)\,Z^2}{C^2}$$

N = Sample size
Z = Standard deviation of 1.96 corresponding to 95% confidence interval
P = Degree of variability, set at 50%
C = Degree of accuracy of the result (marginal error), set at 0.075

$$N = \frac{0.5(1\ 0.5)1.96^2}{0.075^2}$$

= 170 persons

Using a non-response rate of 10%, the final sample size was 187 subjects. Participants were recruited via stratified sampling method.

Pre-hospital paramedics who were currently working in Emergency Department, were included in this study. Attachment, students and staff less than 3 years of service, were excluded.

Paramedics who fitted into the inclusion and exclusion criteria, were selected and they gave their consent to answer the questionnaire. This questionnaire was validated by four

experts (3 Emergency Physicians and 1 professor in cardiology). A pilot study was conducted for validation. Once validation process was completed, the study was conducted and data was collected from the questionnaire filled by the subjects. Qualitative feedback of the pilot study showed that satisfactory passing rate for MCQ was 8/10 for each section. Analysis of data was done using Statistical Package of Social Sciences (SPSS) Windows Version 13.0.

All related data was collected by using a data form. The data form included participants' level of knowledge regarding indication and contraindication of thrombolytic therapy in STEMI patient, detection of STEMI from initial ECG and confidence with willingness of prehospital staffs in managing STEMI patient. Microsoft Excel was used to record quantitative data while SPSS was used for analysis. Data collected will be recorded in a data sheet in the form of questionnaire.

Questionnaire comprised three different sections. Each participant was required to obtain at least eight correct answers in ECG recognition (Section 1) and knowledge of STEMI (Section 3).

SECTION 1:

This section was designed to assess the ability of paramedics to recognize STEMI ECG changes. It consisted of 10 different ECG cases and subjects must have selected which was suggestive of STEMI. This data was analysed in percentage based on the numbers of correct answers.

SECTION 2:

This section was designed to evaluate the confidence level among paramedic. There were 10 statements and the answers were in the form of Likert scale from 1 to 5. Answers were analysed by calculating the mean and standard deviation (SD)

SECTION 3:

This section consisted of 10 multiple choice questions (MCQ) and each participant were required to select the correct answer. The questions were regarding drugs and indication for thrombolysis for STEMI.

RESULTS

One hundred and eighty seven candidates were identified. However, only 160 participants were available. The other participants were unavailable because they were either transferred to other unit or transferred out to the other hospital. Out of 160 respondents, 20 of them did not return the questionnaires, 30 of them refused to enroll into the study, which left us with 110 respondents. After the collection of the data, 4 respondents did not answer the questionnaire and only 106 participants were analyzed.

From the analysis of the data, from 106 of respondent, only 22 candidates managed to get more than 8 right answers for both section 1 and 3. For section 3, the numbers of candidates achieved more than 8 of right answers were 33 (Table 1 and Table 2). Based on this survey, it showed that most of the candidates were unable to achieve the required marks. The percentage of

candidates achieving more than 8 are 21% for section 1 and 31% for section 3. Most subjects answered Question 6 correctly with the percentage of 81% and question number 7 showed the lowest rate of being answered correctly with the percentage of 39%.

Section 2 which was a Likert descriptive questionnaire were divided into high (3.67-5.00), moderate (2.34-3.66) and low (1.00-2.33) according to mean values. Statement number 11, 12, 14, 15, 16, 18, 19 and 20 showed mean of more than 3.67 (Likert score of 1-5 while the remaining statements were moderate (Table 3).

DISCUSSION

Based on this study, most of the respondents agreed that their participation in pre-hospital thrombolysis, can maximize efficiency in managing STEMI cases. However, although most of the statements showed high mean value, it could not be related, clinically because enrolment and direct participation of paramedics in administration of pre-hospital thrombolysis still require intensive training and exposure. This was similar to an earlier study done by Price et al. (2005) which showed that most paramedics agreed that early delivery of thrombolysis would bring benefits to STEMI patients. This was due to a strong occupational drive in patient care in which "making a difference" to patients was a key aspect of a highly valued job. Thrombolysis was viewed as an addition to paramedics' therapeutic repertoire which would enable them to save lives and limit myocardial damage.

Based on this study, majority of the respondents were unable to achieve acceptable marks for initiating safe pre-hospital thrombolysis. This percentage did not visualize the exact level of knowledge of each respondent but can provide an overall image of estimation for further improvement in knowledge and training. Other factors such as quantity of training session, exact hours of exposure to cardiac cases in real life scenario, exposure to basic training in

Table 1: Percentage of correct and wrong answers for section 1

Question No.	Total Respondents	Correct Answers		Wrong Answers		Missing Values	
		No.	%	No.	%	No.	%
Q1	106	76	71.7	29	27.4	1	0.9
Q2	106	58	54.7	47	44.3	1	0.9
Q3	106	65	61.3	41	38.7	0	0.0
Q4	106	59	55.7	47	44.3	0	0.0
Q5	106	51	48.1	55	51.9	0	0.0
Q6	106	81	76.4	24	22.6	1	0.9
Q7	106	67	63.2	39	36.8	0	0.0
Q8	106	66	62.3	40	37.7	0	0.0
Q9	106	75	70.8	30	28.3	1	0.9
Q10	106	73	68.9	32	30.2	1	0.9

Table 2: Percentage of wrong and correct answers for Section 3

Question No.	Total Respondents	Correct Answers		Wrong Answers		Missing Values	
		No.	%	No.	%	No.	%
Q21	106	78	73.6	22	20.8	6	5.7
Q22	106	69	65.1	32	30.2	5	4.7
Q23	106	74	69.8	29	27.4	3	2.8
Q24	106	59	55.7	44	41.5	3	2.8
Q25	106	44	41.5	56	52.8	6	5.7
Q26	106	71	67	30	28.3	5	4.7
Q27	106	78	73.6	25	23.6	3	2.8
Q28	106	83	78.3	18	17.0	5	4.7
Q29	106	58	54.7	44	41.5	4	3.8
Q30	106	23	21.7	80	75.5	3	2.8

cardiac emergencies, training in ECG interpretation, exposure to handle drugs especially thrombolytic agent in STEMI cases and years of working experience may contribute to the efficiency in managing STEMI cases were not analyzed in this study. This pales in comparison of pre-hospital team studied in New Zealand by Davis et al. (2017) where paramedics demonstrated an overall clinical decision-making capacity sufficient to support the new autonomous paramedic pre-hospital thrombolysis protocol. Recent shift in paramedic education toward university degree programmes could contribute to these results.

Paramedic's knowledge was tested by looking at their abilities to detect STEMI ECG changes. The survey showed that paramedics were able to appreciate critical clear-cut STEMI ECG changes. Participants answering Q1 scored fairly well, with 71.7% participants answering correctly. It

Table 3: Percentage for answers for Section 2

Question No.	Total Respondents	Minimum	Maximum	Mean	Std. Deviation
Q11	106	0	5	3.7075	0.90466
Q12	106	0	5	3.8491	0.82569
Q13	106	0	5	3.4906	0.88635
Q14	106	0	5	3.8491	0.74056
Q15	106	0	5	4	0.75593
Q16	106	0	5	3.8868	0.73447
Q17	106	0	5	3.5	0.84233
Q18	106	0	5	3.783	0.74328
Q19	106	0	5	3.9811	0.82786
Q20	106	0	5	3.8774	0.86962

Level	
High	3.67 - 5.00
Moderate	2.34 - 3.66
Low	1.00 - 2.33

showed a clear cut STEMI at the inferior leads, with more than 2 mm elevation from the baseline. This falls short from the EMS staff studied at Yale School of Medicine, US by Trivedi et al. (2009) whereby from a sample of 103 eligible paramedics, 94.1% correctly detected STEMI on ECG.

ECG Q2 was not a STEMI, however 44.3% participants gave a wrong answer which was a false positive. This was higher than the study by Trivedi et al. (2009), where the false positive for detecting STEMI was only 14.9%. This translates to a lower specificity for this ECG. Leads V2 and V3 can be confused as a STEMI due to up slope into the T wave. However, it was still at the isoelectric line.

Q3 ECG was a ST depression at leads V2 and V3. A lower percentage of false positive was given in this scenario, whereby 38.7% participants recognized this ECG as a STEMI. ECQ Q4 had the highest error among the STEMI, only 55.7% detected the STEMI. This may be due to the nature of the ECG, which was left buddle branch block (LBBB) (with deep and broad S wave). Probably the notion of LBBB which was not STEMI, but the requirement of thrombolysis needs to be changed in the questionnaire. ECG Q5 had a low percentage of participants with correct answers (48.1%) due to the difficulty of the ECG. Paramedics misinterpreted benign early repolarization as STEMI.

ECG Q6 had the highest correct answer which was a straight forward ST elevation at the inferior leads, where 76.4% of paramedics managed to detect this correctly. ECG Q9 had the least false positive with a percentage of 28.3. The ECG was near normal with insignificant ST abnormalities at V1 and V2.

The average sensitivity for detecting a STEMI (true positive/true positive + false negative) in this series of ECG (correct detection of STEMI) was 67.1%. The average sensitivity for a STEMI (correct detection of non-STEMI ECG) was 61%. This falls below the specificity and sensitivity of paramedics in the study of Trivedi et al., whereby the sensitivity was 92.6% (95% CI 88.9-95.1) and specificity was 85.4% (79.7-89.8)

On the section of confidence level, most of our paramedics answered unsure, did not agree and strongly disagreed on the Likert questionnaire. Most were not confident in the indications, preparation, administration and managing complication of pre-hospital thrombolysis, as the average of mean was in the range of 3.5-4. Likert score for 3=unsure, 4=disagree, 5=strongly disagrees. Ten out of 106 respondents (9.4%) agreed that they were confident in administering pre-hospital thrombolysis. Only 2 out of 106 participants (0.018%) agreed that they knew how to prepare drugs for thrombolysis. Three out of 106 participants agreed that they could confidently recognize ST elevation, know the indication for thrombolysis, were aware of complication and familiar with the drugs given during thrombolysis. Twelve out of 106 respondents agreed that thrombolysis should be given at pre-hospital setting. This falls back in comparison of a study on confidence level among

paramedics in Riyadh by Abdullah et al. 2014, whereby 72% paramedics believed that they were capable to perform pre-hospital thrombolysis.

Regarding the section of knowledge mostly scored on the average side, whereby the least correct questions were on the management drugs for acute coronary syndromes and the best pathway for optimum thrombolytic therapy (50.9% and 47.1% respectively). Q28 had the highest correct answers which were 78.3%, and this was the question on the next step, given failure of pharmacological thrombolysis. Knowledge section can be improved by conducting refresher courses, or introductory courses on the protocols, side effects and indication for thrombolytic therapy.

Several factors may influence the inadequacy of knowledge in detecting STEMI ECG changes. One of them is the lack of exposure to ECG interpretation or no formal ECG exposure at all during their training or working hours. No formal ECG exposure was ever established during the duration of their working experience. A few suggestions such as early implementation of ECG syllabus and case based scenario during their diploma training, strengthen the skills of ECG interpretation by conducting ECG courses at the level of department or interdepartmental level may increase the level of efficiency in ECG interpretation. Early exposure to ECG based scenario will empower their intuition in clinical care setting and the knowledge may be applied during formal working environment. By encouraging paramedic staffs into critical cardiac training or post basic courses, it will sharpen their knowledge by implementation of the curriculum in ECG interpretation combined with management in life case scenario. It may help them to familiarize with the acute setting of STEMI intervention. Although routine courses such as ACLS and PALS are routinely organized at departmental level, each paramedic should be encourage to scrutinize the reason behind every clinical steps in managing STEMI cases and not only to follow the orders. This application not only strengthens the ability and confidence in managing STEMI cases, but will empower their capabilities at the highest level of management. These results were in sharp contrast to a previous study done by Trivedi et al. 2009, whereby 94.1% of paramedics were able to detect STEMI correctly. The sample size was 103. Sensitivity was 92.6% and false positive activation of cardiac catherization lab was only 8.1%.

By organizing ECG courses, especially STEMI-based cases, the sensitivity of paramedics towards handling STEMI cases may be improved. As the diagnostic playmaker at the prehospital level, early activation of PPCI lab can significantly reduce door to balloon time (Squire et al. 2014). With improved diagnostic skills of pre-hospital paramedics, trust can be achieved between the PPCI team and pre hospital in early activation of the catherization lab. Another method is online medical direction between the cardiologist and the pre-hospital response team. In the Netherlands, when the paramedics are in doubt about the diagnosis, the

CCU cardiologist will be consulted by telephone and ECG will be faxed to the hospital base (Vermeulen et al. 2008). The patient can be sent directly to a PCI facility, bypassing non-PCI hospitals and hastening door to intervention time.

Not only the management of STEMI and its pathophysiology, by understanding drugs used in STEMI cases increased effectiveness in treating and preventing medication error. More courses and exposure to drugs seminar contribute to the success of STEMI management by understanding the indication and contraindication of drugs used. Proper method in preparation of drugs is essential because certain drugs require very delicate steps in handling to preserve the quality. Thrombolytic drugs for example, require gentle method of dilution due to its fragility prior to administration. This aspect was asked in this survey and most respondents agreed to administer the drug by themselves under the supervision of trained personnel.

CONCLUSION

The survey revealed that paramedics still require training and exposure prior to initiating a pre-hospital thrombolysis protocol. This survey is an initial step to provide an overall perception of paramedics towards their understanding of STEMI and pre-hospital thrombolysis. The aspect of knowledge of ECG interpretation and understanding STEMI still requires considerable improvement. Most of the respondents were unable to achieve the required expectation. Training on detection of normal and different types of STEMI or left bundle branch block criteria is necessary. Each level needs to carry their responsibilities in teaching and learning in order to establish an effective system to ensure pre-hospital thrombolysis is applicable in this country. Once knowledge on thrombolytic therapy and ECG STEMI detection has improved, increased confidence level in administering the drug will follow. It is recommended that knowledge in ECG interpretation especially STEMI among paramedics should be consolidated through formal ECG courses. Training should also consist of exposure to real life clinical scenarios. ECG interpretation should be taught early in diploma syllabus. Thrombolytic drugs administration, contraindication and adverse effects should be familiarized. Online medical direction plays an important role prior to delivery of pre-hospital thrombolysis. It is best to coordinate with the hospital based on logistic reasoning whether pre-hospital thrombolysis or early activation of catherization lab will be more beneficial to STEMI patients.

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