EuroIntervention 2014;10-T83-T86

A review of the role of nurses and technicians in ST-elevation myocardial infarction (STEMI)

David Zughaft[1,2]*, RN; Jan Harnek[1,2], MD, PhD, FESC

1. Department of Cardiology, Lund University, Lund, Sweden; 2. Department of Coronary Heart Disease, Skane University Hospital, Lund, Sweden

Abstract

The role of nurses and technicians in the treatment of ST-elevation myocardial infarction (STEMI) by primary percutaneous coronary intervention (PPCI) is vital for the success of the multidisciplinary Heart Team. Several editorials have emphasised the importance of a holistic treatment which links each step of care to the next, a chain that is essential for quality and efficacy in the management of STEMI patients. In pre-hospital acute coronary care, the first medical contact is most commonly a nurse and/or a paramedic. The time from symptom onset to reperfusion is crucial for the long-term outcome. On arrival at the hospital, it is important for the nurse or paramedic to share an overview of what has been done to the patient so far, in a structured and evidence-based way, with the receiving nurse and physician. During PPCI, the role of nurses and technicians includes puncture site assessment, administration of pharmaceuticals and the ability to anticipate and prevent complications. In patients with cardiogenic shock and cardiac arrest, advanced knowledge of haemodynamic support systems is required. In the future, this knowledge must be extended from a limited number of individuals in a small number of centres to a standard of care which is available for all citizens throughout Europe. This review demonstrates the necessity for a multidisciplinary team approach where every person plays an equal, important role in every element of PPCI. The future role of nurses and technicians is intriguing and demands education and experience from an advanced medical and nursing point of view, where the multidisciplinary Heart Team and the knowledge of the different key players are vital.

Introduction

In the era of reperfusion therapy, primary percutaneous coronary intervention (PPCI) is the gold standard in the treatment of acute ST-elevation myocardial infarction (STEMI)[1-3]. Current guidelines give a class Ia recommendation for reperfusion therapy in all patients with a symptom duration <12 hrs and persistent ST-elevation[4]. Using this treatment standard, many patients presenting with STEMI are directed to a PPCI centre as first in-hospital unit. However, the availability of 24/7/365 PPCI centres varies considerably across Europe, and the role of nurses and technicians is quite different depending on reperfusion strategy. Despite this variation, the role of nurses and technicians is crucial from the holistic perspective which links each step of care to the next, a chain that is essential for quality and efficacy in the management of STEMI patients. For the nurses in the ambulance and in the coronary catheterisation laboratory (cathlab), as well as the staff members at the cardiac intensive care unit (CICU) and the nurses at the follow-up unit, the strength of the chain is dependent on a swift, reliable and professional attendance. This lifeline is thus the guarantee of healthcare beyond simply the technical work of the physician or the quality of the devices used during PPCI.

Several editorials and clinical trials have emphasised the importance of a multidisciplinary team approach for successful treatment of STEMI. However, few publications have reviewed the role of the nurse and technician in the Heart Team. The aim of this present review is to provide an overview of the current and future role of nurses and technicians.

*Corresponding author: Department of Cardiology, Lund University, Getingev 1-5, 221 05 Lund, Sweden.
E-mail: David.Zughaft@med.lu.se

DOI: 10.4244/EIJV10STA13

The role of nurses and technicians - current and future state

SYMPTOM ONSET

In pre-hospital acute coronary care, the first medical contact is most commonly a nurse and/or a paramedic. The time from symptom onset to reperfusion is crucial for the long-term outcome. Several studies have shown that gender and ethnicity influence symptom characteristics, impact on diagnostic assessment and time to reperfusion[5,6]. Therefore, the ability to identify a STEMI on the electrocardiogram (ECG) is vital[7]. ESC guidelines give a class Ib recommendation to an instant ECG at first medical contact. An increasing number of countries have implemented the idea of sending a pre-hospital ECG to a PPCI centre for interpretation and of the potential redirection of the ambulance direct to the cathlab. Continuous education, experience and a close collaboration with the cardiologist are important issues for the success of the pre-hospital team.

PRE-HOSPITAL PHARMACEUTICAL THERAPY

Once a STEMI is diagnosed, administration of pharmaceutical agents is initiated prior to hospital arrival. There is clear evidence for the benefits of pre-hospital anticoagulant therapy such as dual antiplatelet therapy (DAPT) and administration of heparin. In addition, there is a class Ic recommendation for titrated intravenous opiates to relieve pain, and a class IIa recommendation for tranquillisers to be considered in anxious patients. On arrival at the hospital, it is crucial for the nurse or paramedic to share an overview of what has been done to the patient so far, in a structured and evidence-based way, with the receiving physician. One example of sharing information in a structured manner is the SBAR approach[8,9].

SBAR is a tool developed by the US Marine Corps, and consists of a structural matrix comprising: situation, background, assessment and recommendation (SBAR). Using this matrix, it is possible for the nurse in a swift way to obtain and deliver an overview of the current respiratory and haemodynamic condition of the patient, occurrence of arrhythmias during transportation, pharmaceutical therapy, medical history and other important information.

PPCI CENTRE

In the coronary cathlab, the role of nurses must be directed towards patient preparation and, in the fastest and safest possible way, making the patient ready for arterial puncture. This includes an updated respiratory and haemodynamic status (ECG, management of possible arrhythmias, blood pressure, SpO2, respiratory frequency), intravenous access and administration of i.v. fluids, opiates and tranquillisers. Furthermore, a professional calm and emphatic attitude is important to build, in a very short time, a trustworthy relationship, achieve patient compliance and empower coping strategies in the current situation[10].

Coherently, the role of the technician should be to aim towards the same goal. The technician is responsible for device preparation, radiology matters and, in some centres, puncture site assessment. According to current guidelines, the radial approach should be the first choice (class IIa)[4]. Preparation of the radial artery includes an assessment of the collateral circulation of the ulnar artery, with the modified Allen's test and preferably with the use of pulse oxymetry to avoid access-site complications[11].

MANAGEMENT OF COMPLICATIONS

Following arterial puncture, the role of the nurse and technician shifts its focus towards management of potential complications during the PPCI. The professional role of nurses and technicians should be aimed at developing the ability to anticipate and prevent the occurrence of complications. These skills evolve by experience, and have a major impact in optimising the performance of the team and the clinical results. PCI-related complications include coronary complications such as dissection, perforation, tamponade and coronary rupture, as well as complications related to STEMI-like arrhythmias, acute heart failure and reperfusion injury. The most critical phase during a STEMI is the reperfusion. Although reperfusion of the ischaemic myocardium is a prerequisite for myocardial salvage, the reperfusion injury itself may cause additional damage[12]. Upon reperfusion, a significant increase of blood flow arises with an inflow of reactive oxygen and increase of intracellular Ca^{2+} [13-15]. For the nurse and technician, this implies the need for increased vigilance and management of patient discomfort, pain, occurrence of arrhythmias, impairment in haemodynamic variables and possibly a cardiac arrest during reperfusion.

Equally important is the anticoagulant treatment of the patient during the PPCI. Many patients may be treated pre-hospital with aspirin and an ADP-receptor blocker, for example clopidogrel, prasugrel or ticagrelor (class Ib). During the PPCI procedure, there is a class Ib recommendation for anticoagulant agents such as bivalirudin and a class Ic recommendation for unfractionated heparin if bivalirudin or GP IIb/IIIa inhibitors are not administered[4]. The role of the nurse comprises not only providing the patient with pharmaceuticals ordered by the physician, but also understanding the current anticoagulant strategy. Furthermore, nurses and technicians may need to determine the state of the anticoagulant effect measured by analysis, such as activated coagulation time (ACT).

During insertions of expandable stents, nurses and technicians should focus on the types of stent that are used (bare metal stents [BMS] versus drug-eluting stents [DES], drug-eluting balloons [DEB], and bioresorbable vascular scaffolds [BVS]). This is important to be able to understand the potential benefits or downsides of the chosen strategy and, in addition, to be alert to post-stent complications such as coronary dissection, slow flow/no-flow and, after the procedure, the rare but serious complication of acute stent thrombosis.

PUNCTURE SITE CLOSURE

The last step of the procedure is puncture site closure. Depending on whether the radial or femoral approach has been used, different closure devices are possible. For the radial approach, a radial compression device is applied and, in the ward, handled by nurses. It has been suggested that the early management of the radial compression

device is correlated to complications of radial artery occlusion[16]. In the femoral approach, closure devices such as Perclose® (Abbott Vascular, Santa Clara, CA, USA), Angio-Seal™ and FemoSeal™ (St. Jude Medical, St. Paul, MN, USA) may be used. It is important for the nurses in the ward to be aware of how to manage the puncture site, how to instruct and inform the patient and, most importantly, how to identify complications such as haematoma, bleeding, pseudoaneurysm and retroperitoneal haematoma. This includes education in anticoagulant therapy, physiology of the femoral arteries and identification of the patient population at risk (elderly, renal impairment, etc.)[17].

CARDIOGENIC SHOCK AND CARDIAC ARREST

The most demanding situation in the cathlab is probably patients in cardiogenic shock or in a cardiac arrest. These patients are afflicted with a considerable mortality and require a fully functional multidisciplinary team to increase survival rates[18]. The role of nurses and technicians includes advanced knowledge of cardiopulmonary resuscitation with manual or mechanical chest compressions such as the LUCAS device[18] (Physio-Control, Inc./Jolife AB, Lund, Sweden), administration of pharmaceuticals, as well as coordination and cooperation with the anaesthetics professionals. In a cardiac arrest, the most vital assignment in order to resuscitate the patient successfully is to continue with the PCI towards reperfusion and perform high-quality cardiopulmonary resuscitation coherently.

In order to increase survival rates in this high-risk population, the role of nurses and technicians in the cathlab involves extended management of the haemodynamic support system. The intra-aortic balloon pump (IABP) has been used for many years and the preparation and system set-up are the responsibility of the nurses and technicians in most centres. Other strategies of haemodynamic support are currently increasing. Mild hypothermia by invasive cooling devices shows promising results in critical patients[19,20]. Furthermore, left ventricular assist devices (LVAD) such as the Impella™ (Abiomed, Danvers, MA, USA) and extracorporeal membrane oxygenation (ECMO) are currently used in high-volume centres. The introduction of LVAD and invasive cooling systems in the cathlab makes new demands on nurses and technicians and their ability to manage patients with advanced life support during a PPCI.

Future perspective

The treatment of STEMI is in many ways associated with a favourable outcome and a low mortality. However, a future perspective would have to include a more consistent care of the most critical patient population who are in cardiogenic shock or cardiac arrest. Even though LVAD are often used in some centres, knowledge and experience of these highly specialised devices must be extended in the future from a small number of centres and individuals, to a standard of care available for all citizens throughout Europe. This is a cultural challenge for the future which requires education, clinical training and experience, and which will certainly improve the professional level of the non-medical staff of the emergency PCI team.

Conclusion

The aim of this present review is to present the current and future perspective of the role of nurses and technicians in the treatment of STEMI. The review demonstrates the necessity for a multidisciplinary team approach where every person plays an equal, important role in every element of PPCI. The future role of nurses and technicians is intriguing and demands education and experience from an advanced medical and nursing point of view, where the multidisciplinary Heart Team and the knowledge of the different key players are vital. This requires systematic work towards a subspecialty of interventional nursing care, preferably in the regime of the Nurses and Allied Professions Committee within the EAPCI. The aim should be to stride towards standardisation in training, education and a certification for the nurses and technicians who work in the field of interventional cardiology.

Conflict of interest statement

The authors have no conflicts of interest to declare.

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