EFFECT OF LOCAL DELIVERY OF STREPTOKINASE BEFORE PRIMARY PERCUTANEOUS CORONARY INTERVENTION ON MICROVASCULAR PERFUSION IN ACUTE MYOCARDIAL INFARCTION PATIENTS

Hany Mohamed Fakhry, Ahmed Abdalrahman Sharaf Eldin, Tarek Rashed Mohamed and Khaled Mohamed Hamed

Cardiology Department, Faculty of Medicine, Ain-Shams University, Cairo, Egypt

Corresponding author:
Hany Fakhry
Mobile: +02 01002554916
e.mail: :
drhanyfakhry@gmail.com

ABSTRACT

Background: The established reperfusion treatment for acute myocardial infarction with ST segment elevation is primary percutaneous coronary intervention (PCI). Local Streptokinase delivery before primary percutaneous intervention may further improve myocardial perfusion by removing microvascular thrombus [in situ formed or embolized from proximal site (spontaneously formed or after PCI)] and fibrin.

Aim of the Work: To compare the effect of locally administrating streptokinase prior to primary PCI in patient with AMI and thrombus aspiration on myocardial perfusion.

Patients and Methods: 50 patients presented to Ain Shams University hospital by acute STEMI managed by primary PCI and were divided into two group. Group I (25 patient) received intracoronary streptokinase by Clearway RX drug delivery balloon before PCI while Group II (25 patients) underwent thrombus aspiration before PCI.

Results: The local delivery of strepotokinase via clearway RX drug delivery balloon was linked to improved microvascular reperfusion as post-procedural thrombolysis in myocardial infarction (TIMI) 3 flow, and MBG 3 achieved in 92% of patients compared to 68% of patients of thrombus aspiration group

Conclusion: Local delivery of streptokinase before primary PCI was associated with better microvascular reperfusion compared with primary PCI with thrombus aspiration device.

Keywords: Local Delivery of Streptokinase; PCI; AMI

INTRODUCTION:

In the management of acute myocardial infarction with ST segment elevation, primary PCI is a well-established reperfusion approach[1].

However, even once epicardial blockage is removed with a successful primary PCI, myocardial damage does not stop right away. It has been assumed that tissue-level perfusion is endangered by reperfusion damage, embolization of epicardial thrombus, and plaque debris[2].

A thrombus can develop in the microvasculature itself, even if thromboembolism of proximal origin might reduce microvascular perfusion[3].

This theory may help to explain why recent randomised trials have been unable to show a favourable impact of distal protection devices on microvascular perfusion during primary PCI despite the

successful removal of thrombus and plaque debris from epicardial coronary arteries[4].

Primary PCI for acute myocardial infarction attempts to improve myocardial salvage while also maximising epicardial artery revascularization. Because the goal of reperfusion therapy has shifted to include reperfusion downstream at the level of capillary bed, the phrase "the time dependent open artery and open microvascular hypothesis" may now be more appropriate. Microvascular dysfunction is thought to be the cause of the "no-reflow" phenomenon, which describes the failure to achieve myocardial reperfusion despite the presence of a patent coronary artery. It has become clear that clinical outcomes depend on patency of both the microcirculation and the epicardial artery[5].

The reopening of all following vascular compartments throughout the coronary circulation is necessary for complete reperfusion in AMI situations. Due to embolization following PCI and in situ microthrombi formation at the microvascular level, this aim is difficult to accomplish. Mechanical intervention to the epicardial coronary artery, with or without the use of distal protection, would not be adequate to ensure complete reperfusion at the deepest (microvascular) level. It is now more obvious than ever that we need to develop more effective and practical reperfusion procedures in order to achieve the maximum amount of reperfusion at all levels[6].

After primary PCI, no reflow was seen in nearly 30% of STEMI patients[7].

AIM OF THE WORK:

To compare the effect of locally administrating streptokinase prior to primary PCI in patient with AMI and thrombus aspiration on myocardial perfusion.

PATIENTS AND METHODS:

This study is a prospective observational study on patients who presented to Ain Shams University hospitals and Kobry Elkkoba Military hospital with acute STEMI managed by primary PCI in the time period from the 1st of December 2013 to the end of January 2015.

The research included all patients with a clear diagnosis of STEMI defined as usual increase and/or decline of myocardial necrosis biochemical markers with at least one of the following: a) Within the last 12 hours, patient had persistent chest pain that lasted longer than 30 minutes. b) ECG ischemia-related changes: The cut-off levels for new ST elevation at the J-point in leads V2-V3 are 0.2 mV for men and 0.15 mV for women, and/or 0.1 mV in other leads, or new onset LBBB. c) Imaging evidence of fresh loss of viable myocardium or new regional wall motion abnormalities. d) The angiography shows an infarct related artery (IRA) occlusion (TIMI grade 0 or 1) after the PCI wire is introduced. e) Modified TIMI thrombus burden grading scale (grade 3 or 4).

Exclusion criteria were a) Streptokinase, aspirin, or heparin contraindications, b) TIMI grade II–III flow in the IRA, c) modified TIMI grading scale for thrombus burden (grade 0-2), d) additional epicardial stenosis in the IRA distal to stented segment (significant or insignificant), e) predilatation prior to stenting, and f) mechanical ventilation or inotropic support.

Patients who met the criteria for inclusion underwent the following procedures: a thorough history taking that placed special emphasis on the patients' demographic information; analysis of chest pain, including timing variables; risk factors for coronary artery disease (smoking, hypertension, diabetes, dyslipidemia, and a family history of premature ACAD); a history of any medications; and a physical examination, including vital signs, mechanical complications, and signs of heart failure such as the S3 gallop, basal rales, and raised JVP.

All patients who arrived at the emergency room were subjected to 12-lead surface ECG that showed ST segment elevation in accordance with the criteria of STEMI provided by the ACC/AHA.

Procedure:

For each patient, signed informed permission was acquired. All patients received an oral loading dosage of clopidogrel between 300 and 600 mg, as well as 300 mg of chewable aspirin, prior to the intervention. The PCI cardiologist, a consultant at the cardiology division of Ain Shams University, made the choice on the PCI approach at his or her discretion. It was customary to sterilise and locally infiltrate anaesthetic into the right groin. Using Seldinger's method, a puncture of the right femoral artery was performed. Multiple views of selective left and right coronary angiographies beginning with non infarct related artery. Following diagnostic angiography, qualified cases were randomly assigned to one of two groups: streptokinase or thrombus aspiration (which did not receive any extra therapy). After placing a floppy steerable guidewire through the target lesion in the thrombus aspiration group, the 6-French Export Aspiration Catheter is advanced into the target coronary lesion during continuous aspiration.

The Clear Way, rapid-exchange therapeutic infusion catheter, which is indicated for targeted perfusion of different therapeutic medicines into the coronary, was utilised to provide 250,000 IU of streptokinase to the streptokinase group. Intracoronary nitrates were supplied to all patients following the restoration of antegrade flow to ensure maximal epicardial vasodilation in order to identify the size and length of the stent and to assist stent installation. With the exception of individuals who had an arrest before to the procedure, stents were deployed in each case in line with the results of the angiography. Following PCI, coronary angiography was repeated to assess TIMI and the MBG myocardial blush grade.

Thrombolysis in myocardial infarction (TIMI flow):

To assess success of reperfusion classified as follow[8]:

Grade 0 (no perfusion): There is no antegrade flow beyond the point of blockage.

Grade 1 (penetration without perfusion): The contrast material penetrates beyond the location of blockage but "hangs up," failing to opacify the whole coronary bed distal to the obstruction for the duration of the cineangiographic recording sequence.

Grade 2 (partial perfusion): The contrast material crosses the blockage and opacifies the coronary bed distal to it. However, the rate of entrance of contrast material into the vessel distal to the blockage, as well as its rate of clearance from the distal bed, is noticeably slower than the rate of entry into or clearance from comparable areas not perfused by the previously blocked vessel (e.g., the opposite coronary artery or the coronary bed proximal to the obstruction).

Grade 3 (full perfusion): Antegrade flow into the bed distal to the blockage occurs as quickly as antegrade flow into the affected bed and is as quick as clearance from an uninvolved bed in the same or opposite artery.

The modified TIMI criteria for thrombus grading to evaluate thrombus burden (*Qureshi et al., 2000).*

Grade 0: There was no angiographic evidence of thrombus.

Grade 1: A potential thrombus is present, as evidenced by angiographic features such as an irregular lesion contour or the presence of a smooth meniscus.

Grade 2: There is a tiny thrombus present, with the maximum linear size being less than half the vessel diameter.

Grade 3: There is a moderate thrombus present, with the maximum linear dimension being greater than half but less than 2 vessel diameters.

Grade 4: There is a large thrombus present, with maximum dimensions of 2 or more vessel diameters.

Myocardial blush grades [9]

Grade 0: failure of dye to enter the microvasculature; there is either minimal or no ground glass appearance ("blush) of the myocardium.

Grade 1: The dye slowly enters but fail to exit the microvasculature. The myocardium has a ground glass look ("blush") that does not clear from the microvasculature, and dye staining is present on the following injection.

Grade 2: Dye enters and exits the microvasculature with a delay. The myocardium exhibits a ground glass look ("blush") that is extremely persistent at the end of the washout phase.

Grade 3: The dye enters and exits the microvasculature normally. The myocardium has a ground glass appearance ("blush") that clears normally and is either gone or only mildly/moderately persistent at the end of the washout phase (i.e., dye is gone or mildly/moderately persistent after three cardiac cycles of the washout phase and noticeably diminishes in intensity during the washout phase), similar to an uninvolved artery.

After that, patients were admitted to our CCU for at least 48 hours, during which time an ECG was taken right away and 90 minutes later to track the remission of ST segment elevation and chest discomfort following PCI. Patients were closely watched for femoral access site haemorrhage and other bleeding problems during their hospital stay. After the clotting time or APTT had returned to normal, the sheath removal was started. Blood samples were obtained to evaluate the pattern of cardiac enzymes and their peaking period, as well as the kidney, liver, and complete blood count (CBC) functioning. Pre-discharge echocardiogram was performed on every patient while they were in the hospital, with a focus on left ventricular ejection fraction (LVEF). Significant LV systolic dysfunction was classified as EF 40%.

Statistical Methods:

Statistical Package for Social Sciences (SPSS) application, version 17.0, was used to code, tabulate, and statistically analyses the obtained data. For numerical parametric data, descriptive statistics were performed using the mean, SD (standard deviation), and minimum and maximum of the range, whereas for categorical data, they were performed using the number and %. After that, the proper statistical analyses were used. P values less than 0.05 are considered to be significant; otherwise, they are not. The p-value is a statistical indicator of the likelihood that the findings of a research may have been the product of chance.

Ethical Consideration:

This study was approved by the ethical committee of (Ain Shams university, Faculty of Medicine, cardiology department 3/2013) and an informed written consent was obtained from all patients prior to their inclusion in the study.

RESULTS:

The mean age of the study population was 52.64 years ± 10.50, ranging from 33 to 87 years. Most of the patients were males representing 84.0% (42 patients) of study population. The most prevalent risk factor was smoking affecting 39 patients (78.1%), Hypertension (HTN) was the next affecting 20 patients (40%), the third most common risk factor was diabetes mellitus (DM) affecting 18 patients (36%), while dyslipidaemia affected 10 patients (20%). A positive family history of premature ACAD was encountered in 4 patients (8%) (Table 1).

\

Table (1): Distribution of major risk factors.

		No.	%
Age	Mean ± SD	52.64 ± 10.50	
	Range	33 – 87	
Sex	Female	8	16%
	Male	42	84%
DM	Negative	32	64%
	Positive	18	36%
HTN	Negative	30	60%
	Positive	20	40%
FH	Negative	46	92%
	Positive	4	8%
Dyslipidemia	Negative	40	80%
	Positive	10	20%
Smoking	Negative	11	22%
	Positive	39	78%

DM: diabetes mellitus, HTN: Hypertension, FH: family history, RI: renal impairment, NO.: number

The patients took around 5 hrs ± 228 min before reaching the hospital, while door-to-balloon time was average 40 min ± 22 min (Table 2).

Table (2): Duration of chest pain, and door to balloon time.

	Mean ± SD	315.20 ± 228.08
PTD	Range	30 – 1080
DTB	Mean ± SD	39.30 ± 13.59
	Range	20 – 90

DTB: door to balloon time, SD: standard deviation, PTD: patient to door time.

Anterior wall STEMI was the most prevalent infarction with 36 patients (72.0%) while inferior STEMI came next with 14 patients (28.0%) and lastly lateral wall STEMI was not seen. The left anterior descending artery (LAD) was culprit vessel in 36 patients (72.0%) (Figure 1) followed by the right coronary (RCA) (Figure 2) in 9 patients (18.0%) and left circumflex artery in 5 patients (10 %). Site of occlusion was proximal in 37 patients (74%) while mid in 12 patients (24%) and osteal in only one case (2%) (table 3).

Table (3): Type of STEMI and Procedural data.

		No.	%
STEMI	Anterior	36	72%
	Inferior	14	28%
Vessel	LAD	36	72%
	LCX	5	10%
	RCA	9	18%
Site of occlusion	Mid	12	24%
	Osteal	1	2%
	Proximal	37	74%

STEMI: ST segment elevation myocardial infarction, PTCA: percutaneous transluminal coronary angioplasty, NO: number, SD: standard deviation, LAD: left anterior descending artery, LCX: left circumflex artery, RCA: right coronary artery, PDA: posterior descending artery, OM: obtuse marginal.
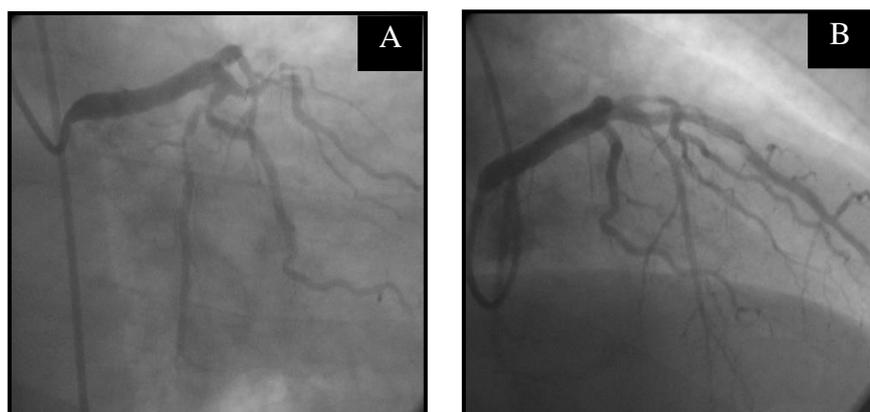
Figure (1): Angiography of case number 9; (A)a 50-year-old man smoker who presented 7 hours after the beginning of symptoms. On the first angiography, the proximal LAD artery was completely blocked (B) in the same projection; however, following a successful intervention, TIMI III flow was seen.
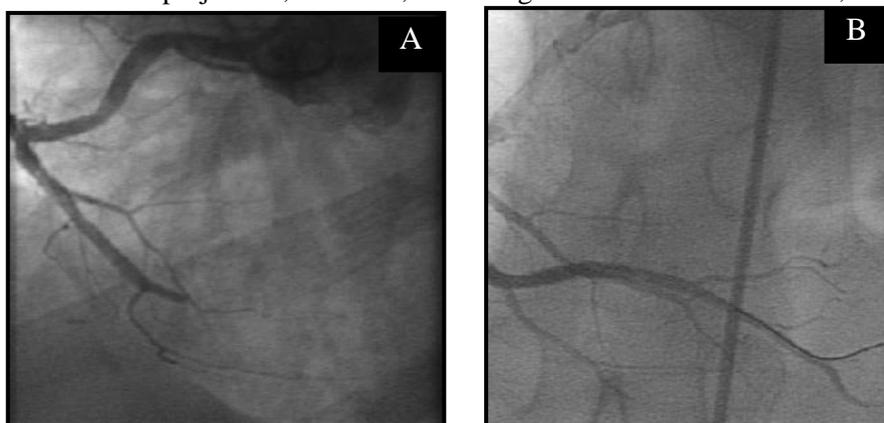

Figure (2): Angiography for case number (26); patient is a 55-year-old male smoker who presented 6 hours after the beginning of symptoms. (A) The initial angiography shows complete blockage of the distal RCA; (B) and in the same projection, TIMI III flow was seen following a successful intervention.

Coronary angiography revealed TIMI 0 in 37 patients (74%) and TIMI I in 13 patients (26%) while all patients revealed MBG 0 (100%) (Table 4).

Post procedural TIMI III flow was seen in 40 patient (80%) and TIMI II was seen in 10 patients (20%) while TIMI I was not seen in any one of the included cases. post procedural MBG 3 was seen 40 patients (80%) and MBG 2 was seen in 10 patients (20%) while MBG 1 was not seen in any one of the included cases (Table 4).

Table (4): TIMI flow and MBG before and post procedural.

		No.	%
TIMI bef	TIMI 0	37	74%
	TIMI 1	13	26%
MBG bef	Grade 0	50	100%
Post procedural TIMI	TIMI 1	0	0%
	TIMI 2	10	20.0%
	TIMI 3	40	80.0%
Post procedural MBG	MBG 1	0	0%
	MBG 2	10	20.0%
	MBG 3	40	80.0%

Coronary angiography of local delivery of SK group revealed 17 patient (68%) with TIMI 0 and 8(32%) patient with TIMI 1 while coronary angiography of thrombus aspiration group revealed 20 patient (80%) with TIMI 0 and 20 patients (5%) with TIMI I, which was statistically non significant both groups represent MBG 0 (100%) before the procedure (Table 5).

Table (5): Comparison between local delivery of SK group and thrombus aspiration group as regard TIMI flow and MBG before the procedure.

		Local delivery of SK		Thrombus asp.		Chi Square Test	
		No.	%	No.	%	X²	P-value
TIMI bef	TIMI 0	17	68%	20	80%	0.936	0.333
	TIMI 1	8	32%	5	20%		
MBG bef	Grade 0	25	100%	25	100%	NA	NA
PTCA done /not	Not done	25	100%	25	100%	NA	NA

NA: Not applicable

Local delivery of SK group showed post procedural TIMI III in 23 patients (92%) and TIMI II in 2 patients (8%), no TIMI 0 was seen. On the other hand, thrombus aspiration group showed post procedural TIMI III in 17 patients (68%) and TIMI II in 8 patients (32%), no TIMI 0 was seen. This was statistically significant p-value 0.033. Local delivery of SK group showed post procedural MBG 3 in 23 patients (92%) and MBG 2 in 2 patients (8%), no MBG 1 was seen. On the other hand, thrombus aspiration group showed post procedural MBG 3 in 17 patients (68%) and MBG 2 in 8 patients (32%), no MBG 1 was seen. This was statistically significant p-value 0.033 (Table 6).

Table (6): Comparison between local delivery of SK group and thrombus aspiration group as regard TIMI flow and MBG after the procedure.

		Local delivery of SK		Thrombus asp.		Chi Square Test	
		No.	%	No.	%	X²	P-value
Post procedural TIMI	TIMI 1	0	0%	0	0%	4.500	0.033
	TIMI 2	2	8.0%	8	32.0%		
	TIMI 3	23	92.0%	17	68.0%		
Post procedural MBG	MBG 1	0	0%	0	0%	4.500	0.033
	MBG 2	2	8.0%	8	32.0%		
	MBG 3	23	92.0%	17	68.0%		

In terms of ST segment resolution and peaking of cardiac enzymes, there was no significant difference between the streptokinase group and the thrombus aspiration group (Table 7).

Table (7): Comparison between Impact of local delivery of SK and thrombus aspiration on ST

		Local delivery of SK	Thrombus asp.	Independent t-test	
				t	P-value
ST resolution	Mean ± SD	72.44 ± 17.38	71.92 ± 10.25	0.129	0.898
	Range	35 – 100	50 – 88		
Peak Trop T	Mean ± SD	7.26 ± 4.14	8.92 ± 5.61	-1.184	0.242
	Range	1.8 – 16.8	2.4 – 19.1		
Peak CK	Mean ± SD	2602.64 ± 1310.39	2943.16 ± 1709.82	-0.790	0.433
	Range	877 – 5412	490 – 6670		
Peak CK-MB	Mean ± SD	639.00 ± 282.78	512.16 ± 357.52	1.391	0.171
	Range	90 – 1014	69 – 1498		

segment resolution, peaking of cardiac enzymes.

The median time from treatment to the post-procedural ECG in all patients was 60 minutes, based on the ECGs collected at baseline and after the operation. Complete ST-segment resolution occurred in 72% of the Streptokinase local delivery group, while the thrombus aspiration group had less than 72% resolution, which was statistically insigni-ficant (P value = 0. 98). Peak CK-MB in local delivery of SK group was 639, while those with thrombus aspiration group were 512, which was statistically not significant (p value = 0.17). LVEF was measured by Simpson's method post procedure in all patients. The mean LVEF was slightly higher in the thrombus aspiration group than in the streptokinase group (49.8% *v* 48.7%) which was statically non significant (p =0.66) (Table 8).

Table (8): Comparison between Impact of local delivery of SK and thrombus aspiration on cardiac function as assessed by echocardiography.

		Local delivery of SK	Thrombus asp.	Independent t-test	
				t	P-value
LV EDD	Mean ± SD	51.64 ± 4.54	50.20 ± 4.73	1.098	0.278
	Range	44 – 59	42 – 59		
LV ESD	Mean ± SD	38.68 ± 4.51	36.12 ± 5.25	1.849	0.071
	Range	32 – 45	22 – 45		
EF Simpson's	Mean ± SD	48.68 ± 9.37	49.84 ± 8.98	-0.447	0.657
	Range	35 – 65	34 – 68		

All patients had their infarct-related artery effectively opened, and each received at least one stent. There was no severe bleeding or groin problems. One patient in each group experienced little bleeding (according to the TIMI bleeding categories), which was treated with manual compression. During post-procedural evaluation, one patient in the streptokinase group developed a femoral pseudo aneurysm, which was likewise addressed with manual compression.

Table (9): Impact of local delivery of SK intracoronary in hospital complication.

		Local delivery of SK		Thrombus asp.		Chi-Square Test	
		No.	%	No.	%	X^2	P-value
IN HOSP. ST relev.	No	25	100%	25	100%	NA	NA
IN HOSP. bleeding	No	25	100%	25	100%	NA	NA
IN HOSP. CVS	No	25	100%	25	100%	NA	NA
IN HOSP. MI	No	25	100%	25	100%	NA	NA
IN HOSP. death	No	25	100%	25	100%	NA	NA

DISCUSSION

Across the globe, ACADs rank among the leading causes of mortality. On the other hand, PCI constitutes one of the preferred treatment options for such patients.

Primary PCI for STEMI continues to be a class I recommendation in accordance with the most recent ACC/AHA revised PCI guidelines[10].

There were 50 patients involved in the current study. From December 1, 2013, to January 30, 2016, those patients had primary PCI in the cath labs of Ain Shams University and the Kobry Elkobba military hospital.

Baseline demographic and clinical characteristics:

In the present study, we discovered that the mean age of the study population was older than that represented in the Karachi Institute Registry 2007 (KIR), which was 51.2 years old, but it was still somewhat younger than that in the National Registry of Myocardial Infarction 2007 (NRMI) (52.64 versus 76.9 years) [11].

84% of the patients in our research were men. In light of the fact that men made up 73% of the Euro Heart Survey 2007 (EHS), females were underrepresented among our patients. 90.3% of the KIR's population was male, which appears to be the situation in developing nations. Only the male gender made up 50.3% of the NRMI[11].

Additionally, we discovered that smoking was the most common risk factor, present in 78% of research populations, followed by hypertension (HTN) (40%) and diabetes mellitus (DM) (36%) before dyslipidaemia, which only affected 20% of study populations. HTN was observed in 48% of KIR participants, followed by smoking in 39% and DM in 25%. 60% of people in the EHS on PCI registry reported smoking, whereas 25% had diabetes. While

HTN was discovered in 49.5% of patients in the multicenter, randomised research APEX AMI (Assessment of Pexelizumab in Acute Myocardial Infarction), dyslipidemia was discovered in 47.6% of patients, and diabetes mellitus (DM) was discovered in 15.3% [12].

Poor dietary habits and a sedentary lifestyle among Egyptians may be the cause of the greater rate of smokers, hypertensives, and diabetic patients, which may raise the incidence of DM and HTN overall. Another cause might be the superior medical care provided by European nations.

In fact, more smokers, diabetic patients, and younger patients were included in the current study than in the EHS on PCI registry. If not for sample inconsistencies, this discrepancy would point to a higher incidence of ACAD risk factors in the Egyptian population, together with an earlier start of severe ACAD needing PCI [11].

Only 20% of the study sample had dyslipidemia, compared to 63% of patients with EHS underwent PCI. This might be as a result of our patients' underdiagnosis of dyslipidemia (no routine laboratory test was done).

Timing variables:

Our registry's mean pain-to-door time (symptom onset-to-ER time) was 315 minutes, which was longer than the Aga Khan University Hospital Registry's median Pain-to-door time of 175 minutes. The Aga Khan University Hospital Registry included 296 patients with STEMI from January 1 till December 31, 2010. This may be because high-volume centres with primary PCI facilities are less accessible, and patients may also be less aware of the value of seeking medical advice right away if they experience chest pain, which raises questions about the need to launch extensive national patient education programmes [13].

Longer Pain-to-door times can also be related to the fact that Egypt has historically had trouble delivering prompt emergency services, and people occasionally had to wait an hour for an ambulance. Traffic jams, outdated vehicles that required regular repair, a high amount of abusive and non-emergency phone calls to ambulance lines all contributed to longer response times [14].

The difference between our registry's average door-to-balloon time and the Aga Khan University Hospital Registry in Pakistan can be attributed to our primary PCI management protocol, which calls for the immediate transfer of patients from the emergency room to the cath lab after loading them up with aspirin and clopidogrel. Thereafter, skilled senior residents begin coronary angiography until the operator arrives.

Angiographic and Procedural Data:

In our randomised experiment, we compared primary PCI with a thrombus aspiration device to the effects of local administration of streptokinase on microvascular perfusion in patients with acute myocardial infarction.

The primary outcome was post-procedural thrombolysis in myocardial infarction (TIMI) flow. A secondary end point was the frequency of a myocardial blush grade. MBG has been demonstrated to be an important determinant in assessment of the efficiency of the microcirculatory system[15].

Based on these evaluations, intracoronary local delivery of streptokinase was linked to improved microvascular perfusion.

We chose a streptokinase dose of 250 kU because we believed it would be high enough to promote fibrinolysis at the site of injury while remaining low enough to decrease the risk of bleeding.

At this dosage, the intracoronary streptokinase concentration at the injury site should be 50 times greater than it would be at the standard intravenous streptokinase dose (1.5 MU), resulting in a 6 times lower concentration in the systemic circulation[16].

ClearWay RX has the capacity to maximise site-specific medication delivery when utilised appropriately. This is made possible by the specific mode of action of ClearWay RX, which occludes flow, confines the thrombus, and permits selective local medication infusion. These procedures work together to administer the medication with the least amount of dilution and to lengthen the drug's duration in the coronary artery while the balloon is inflated. When compared to intravenous medication administration, the ClearWay RX drug delivery balloon can deliver up to 500x1 the drug concentration without adding to the systemic burden beyond the first bolus. Rapid exchange.014" guidewire compatible platform, the ClearWay RX, enables access to a number of challenging target locations throughout the body. Balloon lengths of 10mm to 50mm and balloon diameters ranging from 1.0mm to 4.0mm are available with ClearWay RX[17].

The use of The Clear method RX drug delivery balloon for intracoronary local administration of streptokinase is related with improved microvascular reperfusion, according to the findings of our randomised trial, with post-procedural TIMI 3 flow and MBG 3 reached in 92% of patients.

While 70% of patients with acute myocardial infarction might be anticipated to have reperfusion after receiving intracoronary streptokinase [16]. Furthermore, 50% of patients can anticipate reperfusion when streptokinase is administered intravenously [18].

It is crucial to highlight that, interestingly, the use of thrombus aspiration devices in the current trial had no impact on

the resultant TIMI flow or MBG 68%. The TASTE research, which included 7244 STEMI patients in Sweden and Iceland who got primary PCI, also found that the manual thrombus aspiration prior to PCI had no appreciable effect on the primary end criteria of all-cause mortality at 30 days [19].

The specific mechanisms causing myocardial cardiac malperfusion after rotation of coronary artery patency are likely to be multifactorial. The generation of oxygen free radicals, increased myocardial-cell calcium levels, cellular and interstitial edoema, endothelial dysfunction, vasoconstriction, and thrombosis are some of the concepts that have been put up. Endothelial damage also promotes a procoagulant environment. Fibrin and platelet aggregates have been seen in the coronary microvasculature of acute myocardial infarction patients. In addition to fibrin formation, red-cell and platelet aggregation also contributes to microvascular obstruction and increased resistance in the microvasculature[20].

In a lab environment, streptokinase has been shown to inhibit red-cell aggregation and reduce platelet aggregation[21]. In an open-chest model of anterior descending artery blockage and reperfusion, streptokinase has also been demonstrated histopathologically to enhance the perfusion of the microvasculature in severely ischemic myocardium after blood flow has been restored[22]. Additionally, it eases congestion at the injured site. So it's possible that intracoronary streptokinase, administered before initial PCI, might improve myocardial perfusion through routes that aren't invoked by distal protective devices.

The majority of patients who arrive with myocardial infarction and ST-segment elevation can effectively receive local administration of streptokinase, according to the results of our randomised investigation. As evidenced by a noticeable improvement in the myocardial blush grade and TIMI flow, local administration of streptokinase

prior to stenting enhances myocardial reperfusion when compared to thrombus aspiration as the initial step in primary PCI.

In our research cohort, there were no occurrences of total in-hospital mortality recorded, compared to 8.1% in the hospital registry of the Aga Khan University and 5.81% in the New York State Primary Angioplasty Registry [13]. The research population's very modest size may help to explain this.

Conclusion:

According to the findings of this study, which were based on prospective review of 50 patients presenting by STEMI to Ain Shams University hospitals and Kobry Elkobba Military Hospital in a selected period of time. The impact of local delivery of streptokinase before primary PCI on microvascular perfusion in patients with acute myocardial infarction was linked to improved perfusion at the microvascular level compared with primary PCI with thrombus aspiration.

Financial support and sponsorship

Nil.

Conflicts of interest

We have no conflicts of interest to disclose.

Author's Contribution

H M F, A A S selected the patients and reviewed their images and did the interventional procedure, collected, tabulated, and analyzed the data

KMH, TRM, supervised management of the cases, interpreted the patient data and wrote the manuscript.

All authors read and approved the final manuscript.

Abbreviations:

PCI: percutaneous coronary intervention; STEMI: ST-elevation myocardial infarction; TIMI: thrombolysis in

myocardial infarction; AMI: Acute myocardial infarction IRA: Infarct related artery; JVP: Jugular venous pulse; CBC: Complete blood count; LVEF: Left ventricular ejection fraction; LAD: Left anterior descending; LCX: left circumflex artery; RCA: right coronary artery; PDA: posterior descending artery; OM: obtuse marginal; EHS: Euro Heart Survey; HTN: Hypertension

REFERENCES

1. Antman EM, Anbe DT, Armstrong PW. ACC/AHA guidelines for the management of patients with ST-elevation myocardial infarction — executive summary: a report of the American College of Cardiology/ American Heart Association Task Force on Practice Guidelines (Writing Committee to revise the 1999 guidelines for the management of patients with acute myocardial infarction). J Am Coll Cardiol 2005; 44:671-719.

2. Kaul S and Ito H. Microvasculature in acute myocardial ischemia. Part II. Evolving concepts in pathophysiology, diagnosis, and treatment. Circulation 2004; 109:31.

3. Henriques JP, Zijlstra F, Ottervanger JP. Incidence and clinicalsignificance of distal embolization during primary angioplasty for acutemyocardial infarction. Eur Heart J 2002; 23:1112–1117.

4. Sakuma T, Leong-Poi H, Fisher NG, Goodman NC, Kaul S. Further insights into the "no-reflow" phenomenon after primary angioplasty in acute myocardial infarction: the role of micro thromboemboli. J Am Soc Echocardiogr 2003; 16:15.

5. Stone GW, Maehara A, Witzenbichler B. Intracoronary abciximab and aspiration thrombectomy in patients with large anterior myocardial infarction: the INFUSE-AMI randomized trial. JAMA 2012; 307:1817-1826.

6. Gick M, Jander N, Bestehorn HP. Randomized evaluation of the effects of filter-based distal protection on myocardial perfusion and infarct size after primary percutaneous catheter intervention in myocardial infarction with and without ST segment elevation. Circulation 2005; 112:1462-9.

7. Ndrepepa G, Tiroch K, Fusaro M. Five-year prognostic value of no-reflow phenomenon after percutaneous coronary intervention in patients with acute myocardial infarction. J Am Coll Cardiol 2010; 55:2383-2389.

8. Yanishi K, Nakamura T, Nakanishi N, Yokota I, Zen K, Yamano T, Shiraishi H, Shirayama T, Shiraishi J, Sawada T, Kohno Y. A Simple risk stratification model for ST-Elevation Myocardial Infarction (STEMI) from the combination of blood examination variables: acute myocardial infarction-Kyoto Multi-Center Risk Study Group. PloS one 2016; 11(11):e0166391.

9. Henriques JP, Zijlstra F, Van 'T, Hof AW. Angiographic assessment of reperfusion in acute myocardial infarction by myocardial blush grade Circulation 2013; 107:2115-9.

10. Auffret V, Laurin C, Leurent G, Didier R, Filippi E, Hacot JP, Zabalawi A, Rouault G, Saouli D, Druelles P, Coudert I. Pharmacoinvasive strategy versus primary percutaneous coronary intervention for ST-segment elevation myocardial infarction in patients≥ 70 years of age. Am J Cardiol 2020; 125(1):1-0.

11. Moretti C, D'Ascenzo F, Omedè P, Sciuto F, Presutti DG, Di Cuia M, Colaci C, Giusto F, Ballocca F, Cerrato E, Colombo F. Thirty-day readmission rates after PCI in a metropolitan center in Europe: incidence and impact on prognosis. J Cardiovasc Med. 2015; 16:238-45.

12. Sorin J, David J, Philip E. Reperfusion after primary angioplasty for ST-elevation myocardial infarction: predictors of success and relationship to clinical outcomes in the APEX-AMI Angiographic Study. Eur Heart J 2008; 29: 1127–1135.

13. Sadia A, Sajid D, Safia A. Outcomes in ST Elevation Myocardial Infarction; a comparison of a tertiary care center in Pakistan with European centers. J Pak Med Assoc 2011; 12: 1215-19.

14. Emara HF, El Kilany WM, Zaki TM, El-Missiri AM. Administration of intracoronary streptokinase during primary percutaneous coronary intervention for

anterior wall myocardial infarction with definite coronary thrombosis. Cardiol Cardiovasc Res 2020; 4(1):11.

15. De Lemos JA and Warner JJ. New tools for assessing microvascular obstruction in patients with ST elevation myocardial infarction. Heart 2004; 90:119-20.

16. Sezer M and Oflaz H. Intracoronary Streptokinase after Primary Percutaneous Coronary Intervention 2007; 356:1823-34.

17. Sianos G, Papafaklis MI, Daemen J. Angiographic stent thrombosis after routine use of drug-eluting stents in ST-segment elevation myocardial infarction: the importance of thrombus burden. J Am Coll Cardiol 2007; 50(7):573-583.

18. Yang CJ, Chen PC, Lin CS, Tsai CL, Tsai SH. Thrombolytic therapy-associated acute myocardial infarction in patients with acute ischemic stroke: A treatment dilemma. The American Journal of Emergency Medicine 2017; 35:804-e1.

19. Frobert O, Lagerqvist B, Gudnason T, Olivecrona GK, James SK. Thrombus Aspiration in ST-Elevation myocardial infarction in Scandinavia (TASTE trial). A multicenter, prospective, randomized, controlled clinicalregistry trial based on the Swedish angiography and angioplasty registry (SCAAR) platform. Study design and rationale. Am Heart J 2010; 160:1042–1048.

20. Prasad A and Gersh BJ. Management of microvascular dysfunction and reperfusion injury. Heart 2005; 91:1530-2.

21. Ben-Ami R, Sheinman G, Yedgar S. Thrombolytic therapy reduces red blood cell aggregation in plasma without affecting intrinsic aggregability. Thromb Res 2002; 105:487-92.

22. Woo KS, Armiger LC, White HD, Norris RM. Can streptokinase produce beneficial effects additional to coronary recanalization, Quantitative microvascular analysis of critically injured reperfused myocardium. Microvasc Res 2000; 60:8-20.

تأثير حقن مادة الاستربتوكيناز داخل الشرايين التاجية فيما قبل التدخل الاولى بالقسطرة العلاجية للمرضى المصابين بجلطة حادة جديثة بالقلب

هاني محمد فخري ـ أحمد عبد الرحمن شرف الدين ـ طارق راشد محمد ـ خالد محمد حامد

قسم القلب والاوعية الدموية ـ كلية الطب – جامعة عين شمس

الخلفية: إن علاج إعادة التروية الراسخ لاحتشاء عضلة القلب الحاد مع ارتفاع مقطع ST هو التدخل الأولي بالقسطرة العلاجية. في المرضى الذين يعانون من احتشاء عضلة القلب الحاد، افترضنا أن حقن الاستربتوكيناز داخل الشرايين التاجية قبل التدخل الاولى بالقسطرة العلاجية قد يحسن نضح عضلة القلب عن طريق إزالة خثرة الأوعية الدموية الدقيقة [التي تشكلت في الموقع أو انصمت من الموقع القريب] والفيبرين.

النتائج: هذه دراسة قائمة على الملاحظة للمرضى الذين قدموا إلى مستشفى جامعة عين شمس المصابين باحتشاء حاد في عضلة القلب بارتفاع ST تم معالجته بالتدخل التاجي الأولي عن طريق الجلد في الفترة الزمنية ما بين ٢٠١٣/٩ و ٢٠١٦/١. تم ربط حقن الاستربتوكيناز الموضعي داخل الشرايين التاجية باستخدام بالون توصيل الدواء Clearway RX بتحسين ضخ الأوعية الدموية الدقيقة بالحصول على تدفق الدم TIMI3، وتم تحقيق MBG 3 في ٩٢ ٪ من المرضى مقارنة بـ ٦٨ ٪ من مرضى مجموعة شفط الجلطة

الخلاصة: ارتبط الحقن الموضعى للستربتوكيناز قبل التدخل التاجي الأولي عن طريق الجلد بتحسين ضخ الأوعية الدموية الدقيقة مقارنة بالتدخل التاجي الأولي عن طريق الجلد باستخدام جهاز شفط الخثرة.