Thrombolysis versus primary percutaneous coronary intervention for ST elevation myocardial infarctions at Chilliwack General Hospital

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BACKGROUND: Studies have shown that primary percutaneous coronary intervention (PCI), when performed by an experienced operator immediately after admission in a high-volume tertiary care centre, results in lower in-hospital mortality, and decreased risk of reinfarction and stroke. Furthermore, for those communities without a PCI centre, transport of patients to a PCI centre within 90 min is superior to thrombolysis. Chilliwack General Hospital (CGH, Chilliwack, British Columbia) has a unique situation – the travel time to the nearest coronary catheterization centre (Royal Columbian Hospital, New Westminster, British Columbia) is between 60 min and 120 min.

OBJECTIVES: To compare access to and use of thrombolysis versus PCI in individuals with ST elevation myocardial infarctions (STEMIs) at CGH.

METHODS: A retrospective chart review was conducted on patients who presented to the emergency department at CGH with STEMIs between January 1, 2004, and December 31, 2005. Of the 67 patients who had a STEMI during this time period, 40 patients met inclusion criteria, of whom, 32 received thrombolytics and eight received PCI.

RESULTS: The average door-to-thrombolysis time was 46 min (95% CI 32 min to 60 min). A door-to-thrombolysis time of less than 30 min was achieved in 15 of 32 patients (47%). The average door-to-balloon time was 186 min (95% CI 166 min to 206 min). A door-to-balloon time of less than 90 min was not achieved in any of the eight patients who received PCI.

CONCLUSION: CGH did not meet the American Heart Association guidelines for a door-to-balloon time of less than 90 min.

Key Words: Myocardial infarction; Percutaneous intervention; Thrombolysis

Several studies have shown that primary percutaneous coronary intervention (PCI) performed by experienced operators immediately after patients are admitted to high-volume tertiary care centres with ST elevation myocardial infarction (STEMI) results in decreased mortality, reinfarction and stroke (1-9). Furthermore, for community hospitals without onsite PCI services, transport of STEMI patients to a PCI centre is superior to thrombolysis under specific circumstances, which are described below (10-14).

Thrombolysis is preferred for patients who have STEMI for less than 3 h if the medical contact-to-balloon time is more than 90 min or if the delta time (ie, medical contact-to-balloon time minus medical contact-to-thrombolysis time) is more than 60 min.

Alternatively, PCI is preferred if the medical contact-to-balloon time is less than 90 min and the delta time is less than 60 min, or if there are other reasons (eg, contraindications to thrombolysis, symptom onset of more than 3 h or high-risk STEMI [cardiogenic shock, or Killip class 3 or greater]).

Chilliwack General Hospital (CGH, Chilliwack, British Columbia), a community hospital without onsite PCI services, is unique because the travel time to the nearest coronary intervention centre (Royal Columbian Hospital [RCH], New Westminster, British Columbia),

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La thrombolyse par rapport à l'intervention coronaire percutanée en cas d'infarctus du myocarde avec élévation du segment ST au Chilliwack General Hospital

HISTORIQUE : Des études démontrent que l'intervention coronaire percutanée (ICP) primaire, lorsqu'elle est effectuée par un opérateur expérimenté immédiatement après l'hospitalisation dans un centre de soins tertiaires à fort volume, favorise une diminution de la mortalité en milieu hospitalier et du risque de nouvelle hospitalisation et d'accident vasculaire cérébral. De plus, dans les collectivités non dotées d'un centre d'ICP, le transport des patients vers un tel centre dans un rayon de 90 minutes est supérieur à la thrombolyse. Le *Chilliwack General Hospital* (CGH, Chilliwack, Colombie-Britannique) vit une situation unique, car il est situé à une distance de 60 à 120 minutes du centre de cathétérisme coronaire le plus près (*Royal Columbian Hospital*, New Westminster, Colombie-Britannique).

OBJECTIFS : Comparer l'accès à la thrombolyse et son utilisation par rapport à l'ICP chez les personnes ayant subi un infarctus du myocarde avec élévation du segment ST (IMÉST) au CGH.

MÉTHODOLOGIE : Les auteurs ont procédé à l'analyse rétrospective des dossiers des patients qui s'étaient présentés à l'urgence du CGH en raison d'un IMÉST entre le 1^{er} janvier 2004 et le 31 décembre 2005. Des 67 patients qui ont subi un IMÉST pendant cette période, 40 respectaient les critères d'inclusion. Trente-deux d'entre eux avaient subi une thrombolyse et huit, une ICP.

RÉSULTATS : Le délai moyen entre l'arrivée du patient et la thrombolyse s'élevait à 46 minutes (95 % IC 32 minutes à 60 minutes). On a constaté un délai inférieur à 30 minutes entre l'arrivée et la thrombolyse chez 15 des 32 patients (47 %). Le délai moyen entre l'arrivée du patient et l'intervention par ballonnet s'élevait à 186 minutes (95 % IC 166 minutes à 206 minutes). On n'a constaté aucun délai inférieur à 90 minutes entre l'arrivée et l'intervention par ballonnet chez les huit patients qui avaient subi l'ICP.

CONCLUSION : Le CGH ne respectait pas les lignes directrices de l'American Heart Association recommandant un délai inférieur à 90 minutes entre l'arrivée du patient et l'intervention par ballonnet.

which is 83 km away, has been anecdotally estimated to be 60 min to 120 min. Currently, there is a paucity of data on the average medical contact-to-thrombolysis time, average medical contact-to-balloon time, and delta time on STEMI patients presenting to CGH. Because CGH emergency physicians were debating on transferring all eligible STEMI patients for PCI therapy, we sought to acquire the average medical contact-to-thrombolysis time, average medical contact-to-balloon time, and delta time to make an informed decision.

METHODS

A retrospective chart review was conducted on all patients presenting to the emergency department at CGH with STEMIs between January 1, 2004, and December 31, 2005. These dates were chosen because 24 h PCI service at RCH had only been available since January 1, 2004. The inclusion criteria included chest pain for at least 30 min, presentation to the CGH emergency department, ST segment elevation of at least 1 mm in two or more concordant leads, and the administration of thrombolytics or transfer to RCH for PCI. The exclusion criteria included contraindications to thrombolytics and not being transferred for PCI. A total of 67 patients with STEMIs were identified within this time period. Forty patients were then included in the study and 27 patients were excluded.

Figure 1) Study design. dx Diagnosis; PCI Percutaneous coronary intervention; STEMI ST elevation myocardial infarction

Figure 2) The areas of ST elevation myocardial infarction involved and their percentages in the study. LBBB Left bundle branch block

The reasons for exclusion included not being given thrombolysis because of age alone, age and cancer, age and bleeding, no chest pain, death, and a missed diagnosis. These patients also did not undergo urgent PCI because most patients were older than 80 years of age, had multiple comorbidities, including dementia, and were from nursing homes. Therefore, it was believed that conservative medical management was more appropriate. One individual was excluded because the STEMI was discovered via an electrocardiogram in the office of an internist and eventually received thrombolysis. Of the 40 patients included in the study, 32 patients received thrombolysis and eight patients received PCI (Figure 1).

RESULTS

Fifteen of the 40 STEMI patients were women and the remaining 25 were men. The areas of infarction are broken down in Figure 2.

The 40 STEMI patients included in the study endured chest pain for a mean ($\pm$ SD) duration of 4.2 ± 5 h before presenting to the emergency department (Figure 3). However, there was a significant range in the duration of chest pain endured by the patients before seeking medical attention, as demonstrated by several individuals who presented only after experiencing chest pain for 10 h or more. In contrast, 23 of the 40 (58%) patients presented within 2 h of chest pain onset. The average chest pain duration for patients who underwent thrombolysis versus PCI was 4.3 h versus 3.9 h.

On presentation to the emergency department, the patients waited an average of 10 ± 10 min before being assessed by the emergency physician.

The decision for either thrombolytics or PCI at CGH was made by emergency room physicians 75% of the time and by internists 25% of the time.

For the 32 patients who received thrombolysis, the average door-to-thrombolysis time was 46 ± 40 min. A door-to-thrombolysis time of less than 30 min was achieved in 15 of the 32 patients (47%). The average door-to-thrombolysis time was 33 ± 21 min if the decision for thrombolysis was made by the emergency physician. Sixty per cent (15 of 25) of the patients treated by emergency department physicians achieved door-to-thrombolysis times of less than 30 min. However, if

Figure 3) Duration of chest pain patients had already experienced on presentation to the Chilliwack General Hospital (Chilliwack, British Columbia) emergency department. PCI Percutaneous coronary intervention

TABLE 1

Time of transfer, door-to-balloon time, door-to-ambulance departure time, ambulance ride time, and Royal Columbian Hospital (RCH) catheter laboratory-to-balloon time for the eight patients who received percutaneous coronary intervention

Patient	Time of transfer	Time, min			
		Door-to-balloon	Door-to-ambulance	Ambulance ride	RCH-to-balloon
1	22:26	172	93	44	35
2	9:18	169	72	44	53
3	16:35	185	65	65	55
4	19:40	195	115	45	35
5	11:40	196	92	60	39
6	20:30	161	66	60	35
7	10:30	161	90	40	31
8	1:50	252	135	45	35
Average	N/A	186 $\pm$ 29	91 $\pm$ 24	51 $\pm$ 9	40 $\pm$ 9

RCH is located in New Westminster, British Columbia. N/A Not applicable

the decision was made by the internist, that time was 87 min. In fact, five of the seven slowest door-to-thrombolysis times involved an internist making the decision to thrombolize the patient.

For the eight patients who received PCI, the average door-to-balloon time was 186 ± 29 min (Table 1). An emergency department door-to-balloon time of less than 90 min was not achieved in any of the eight patients who received PCI.

The average time spent at the CGH emergency department for the assessment, workup and transfer of the patient was 91 ± 24 min. The average ambulance ride time from CGH to RCH was 51 ± 9 min. This did not include the time needed to prepare the patient for transport. The average time from arrival at the RCH catheter laboratory to balloon inflation was 40 ± 9 min (Table 1).

Accordingly, the average delta time (average door-to-balloon time minus the average door-to-needle time) was 140 min.

DISCUSSION

The majority of STEMI patients experienced an average of approximately 2 h of chest pain before presenting to the emergency department. However, many patients endured chest pain for more than 5 h before seeking medical attention. In fact, a few individuals waited more than 10 h. Patients in Chilliwack should be encouraged to seek medical attention earlier if they experience chest pain. This is especially true for patients with known coronary artery disease. The American College of Cardiology (ACC) recommends that patients with chronic angina should consider calling 911 if their chest pain does not resolve with the first spray of nitroglycerin. For patients without a history of coronary artery disease, awareness can be heightened through education at physicians' offices, and public health and community awareness programs. It is also worth mentioning that in different registries of patients with acute myocardial infarctions, the time from symptom onset to hospital presentation was more than 4 h in 50%, more than 6 h in 40% and more than 12 h in 9% of patients (15), similar to our results. Sadly, data also

suggest that despite increased public awareness between 1987 and 2000, these values did not change at all (16).

Regarding emergency department efficiency, the average time from emergency department triage to emergency physician assessment was only 10 min. This met national level II standards of less than 15 min, as outlined in the Canadian Emergency Department Triage and Acuity Scale (17).

In addition, emergency physicians provided acute management and made the decision to thrombolyze or transfer the patient for PCI in 75% of the 40 STEMI. This ability of the emergency physicians was responsible for the good door-to-needle times achieved (average of 33 min). In fact, 15 of the 25 STEMI patients thrombolyzed by the emergency physicians (60%) achieved door-to-needle times within the ACC recommendation of less than 30 min. These results are slightly better than the performance of more than 1000 hospitals in the United States between 1999 and 2002, in which 46% of more than 68,000 patients given thrombolytic therapy met the time to treatment goal of less than 30 min (18). The same could not be said when internists were consulted to manage the STEMI patient because there was an associated delay of 54 min in the door-to-thrombolysis time, with an average of 87 min. This delay is inherently due to the time required to contact the internists and for the internists to complete their assessments. This delay is costly because the benefit of thrombolysis falls by 1.6 lives per 1000 patients per hour of delay, especially when the absolute benefit of thrombolysis is only 30 lives per 1000 patients when administered within 1 h of chest pain onset (19).

The timeliness was not as good for the eight STEMI patients who had PCI. Not one patient came close to meeting ACC guidelines of 90 min. The average door-to-balloon time was too long at 186 ± 29 min. The delta time was calculated to be 140 min, which is not remotely close to the ACC guidelines of less than 60 min. Previous studies have shown that thrombolysis is favoured over PCI if the delta times are more than 60 min (20). There were delays in many parts of the PCI process. These include the longer catheter door-to-balloon inflation times

recorded in our study compared with times achieved in published studies (40 min versus 26 min) (12,14). Another factor was the long average ambulance ride times of 51 min. Finally, a significant amount of time (calculated to be 91 min) was accrued at CGH in the assessment, investigation and transfer of the patients because a standardized protocol was not set up to expedite the transfer of these patients.

There are several areas in the STEMI pathway where interventions can be made to reduce the door-to-balloon time at CGH to meet ACC guidelines. First, because 36% of the patients with STEMI presented to CGH via ambulance, having ambulance-based 12-lead electrocardiography capability and improved prehospital communications with local CGH emergency physicians and RCH interventional cardiologists for direct transfer to the RCH catheter laboratory may be a suitable solution. Second, ambulance ride time could potentially be improved, however minimally, and probably would not result in a significant decrease in the door-to-balloon time. Third, RCH catheter door-to-balloon inflation time could be improved to match that of other studies (12,14), which would result in a 14 min reduction in the door-to-balloon time. Finally, the most significant improvement in the door to balloon time, perhaps by 60 min, could be possible if strategies were implemented to accelerate the assessment, investigation and transfer of STEMI patients in the CGH emergency department. One possible solution is to improve communication among various parties (the ambulance service, emergency room physicians and nurses, and RCH interventional cardiology) by setting up a standardized protocol to expedite the transfer of STEMI patients to RCH for PCI.

Overall, the results of the present study suggest that the optimal management of STEMI patients presenting to the emergency department at CGH is onsite thrombolysis, preferably performed by emergency physicians, because of the lack of timely PCI therapy in the current system. However, if a standardized protocol was initiated to reduce the assessment, investigation and wait times of STEMI patients at CGH, a door-to-balloon time of 90 min could potentially be achieved, making PCI the optimal management strategy for STEMI patients.

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