PAKISTAN JOURNAL OF Cardiovascular Intervention

OPEN ACCESS

ORIGINAL ARTICLE

Effect of Intracoronary Vs. Intravenous Tirofiban Bolus on Myocardial Flow Grades in Acute STEMI.

Syed Husnain Raza Bukhari[1], Muhammad Anjum[2], Abdul Basit[1], Javid Iqbal[3], Husnain Shoukat[4], Junaid Salah Ud Din[2]

[1]DHQ Hospital, Sheikhupura-Pakistan.
[2]Punjab Institute of Cardiology, Lahore-Pakistan.
[3]Multan Institute of Cardiology, Multan-Pakistan.
[4]THQ Hospital Mailsi District, Vehari-Pakistan.

Citation:
Bukhari HSR, Anjum M, Basit A, Iqbal J, Shoukat H, Din JSU. Effect of Intracoronary Vs. Intravenous Tirofiban Bolus on Myocardial Flow Grades in Acute STEMI. PJCVI. 2023; 3(2): 20-25

Corresponding Author Email:
hussnain6@msn.com

DOI: 10.58889/PJCVI.5.20.25

Funding:
This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflicts of Interests:
The authors have declared that no competing interests exist.

Received 20/09/2023
Accepted 03/11/2023
First Published 01/12/2023

Abstract

Background: There are a few studies about the advantages and risks of using tirofiban via the intracoronary vs intravenous route in patients with ST-segment elevation myocardial infarction. In this study, the comparison of the efficacy of intracoronary vs intravenous tirofiban is assessed.

Methodology: This comparative study was conducted at the Punjab Institute of Cardiology, Lahore, from March 2019 to March 2020. A total of 250 patients of both genders, aged between 20 to 65 years, were enrolled in this study (March 2019 to March 2020) who had STEMI and had high thrombus burden or TIMI flow grade <3 During Primary PCI. The patients were divided into two groups, namely the intracoronary tirofiban group and the intravenous tirofiban group. Both groups were compared for final TIMI flow and Myocardial blush grade. Moreover, major and minor bleeding, hematoma and mortality was compare among both groups. The data was analyzed using SPSS v23.0. The chi-square test was applied to obtain the comparative analysis. A p-value ≤0.05 was considered statistically significant.

Results: TIMI flow grades in both groups were not similar and showed significant differences, which indicated that both groups were independent as p-value <0.05. TIMI flow grade III was achieved in 83.2% in group A, whereas in group B, it was only 28.8%. The myocardial blush grade was compared in both groups, and the result showed that scores in both the groups were not similar, having significant differences as the p-value was 0.00 (84.8% vs. 46.4%), major and minor bleeding results were compared among both groups and showed statistical insignificance results as p-value = 0.625 (6.4% vs. 8.0%) and 0.705 (12% vs. 13.6%) respectively. The Chi-square results regarding hematoma, Major Adverse Cardiovascular Events (MACE), and mortality in intracoronary and intravenous tirofiban groups were not statistically significant as the p-values were 0.338 (30.4% vs. 27.2%), 0.447 (34.4% vs. 32.8%) and 0.591(2.4% vs. 3.2%) respectively.

Conclusion: In contrast to intravenous administration, the intracoronary administration of tirofiban has shown a superior improvement in myocardial flow grades, including TIMI-flow grade and Myocardial blush grade.

Keywords

Myocardial Infarction, Tirofiban, Myocardial Blush Grade, Intracoronary

Introduction

The European Resuscitation Council describes acute coronary syndrome (ACS) as including three different categories: unstable angina, non-ST segment elevation myocardial infarction (NSTEMI), and ST-elevation myocardial infarction (STEMI)[1].

STEMI patients get a special place in management as it affects their outcomes. It has been observed in studies that if the management of STEMI patients takes an extra hour, the death rate per year rises up to 15 percent[2]. STEMI is the most important topic that needs to be discussed regarding its treatment options, which are through percutaneous coronary intervention (PCI) or thrombolysis. PCI is always a better choice[3]. The improved treatment received by STEMI patients is PPCI, provided it is carried out by professionals[4]. It is conducted in the culprit vessel in the time frame of 12 hours of symptoms but between 90 minutes of presentation[5].

Even after the treatment of PCI, greater than 20% of the patients are affected by no-reflow phenomena. This is related to huge clot burden, low ejection fraction, myocardial salvage, and low survival rate. To overcome this standard, double anti-platelet therapy, acetylsalicylic acid, and clopidogrel are given. Due to their oral route, these drugs might not completely stop the platelets from aggregating. So, complications may still be present after PCI. Therefore, additional medical treatment like glycoprotein IIb/IIIa inhibitors (GPIs) is given. They not only decrease the platelet aggregation but also major cardiovascular events like myocardial infarction and unstable angina, which could occur after PCI is reduced, improve patency of the vessel; hence, the clinical outcome is better[6].

Three GPIs are available, like abciximab, eptifibatide, and tirofiban. Tirofiban is a more prominent GPI because of its size – it is a small nonpeptide molecule. It is preferred over the others due to its availability, cost-effectiveness, and fewer side effects. In the PCI guidelines of the European Society of Cardiology, GPI is given as a class IIa indication during PCI. It is still controversial whether GPI is given with unfractionated heparin (UHF) every time PCI is performed, but they are sure short given for bailout problems like slow flow, obstructed vessel, and other complex conditions. According to European guidelines, either high dose (25 mcg/kg) or low dose (10 mcg/kg) intravenous tirofiban followed by its infusion at 0.15 mcg/kg/min in patients having a fair renal profile, whereas American guidelines suggest high dose tirofiban in STEMI cases. Optimal platelet plug inhibition cannot be achieved by ten mcg/kg of tirofiban[7]. Tirofiban is usually given via intra-arterial or intravenous routes. Higher drug concentration is taken up by the infarct-related artery during the intracoronary injection[8]. Previous studies have not been clear about the advantages and risks of using tirofiban via the intracoronary or intravenous route in patients with ST-segment elevation myocardial infarction. The current study aimed to compare the intracoronary versus intravenous tirofiban for TIMI flow and myocardial blush grade during Primary Percutaneous Coronary Intervention (PPCI).

Methodology

A total of 250 patients of both genders, aged between 20 and 65 years, were enrolled in this comparative study (March 2019 to March 2020). Only patients who had STEMI and had high thrombus burden or TIMI flow grade <3 During Primary PCI were included. The patients were divided into two groups, namely the intracoronary tirofiban group and the intravenous tirofiban group. Informed consent was obtained from all patients, and a comparison of intracoronary tirofiban versus intravenous tirofiban for TIMI flow and myocardial blush grade during PPCI was assessed.

This grading system is research-based and successful in interpreting coronary blood flow in coronary angiography[9,10]. Either with coronary intervention or fibrinolytic therapy, TIMI 3 flow is associated with a better prognosis. This scoring system is simple, can be instantly applied, and is commonly used while performing angiograms of AMI patients to assess the successful revascularization of the artery following fibrinolytic. The only shortcoming of TIMI flow grading is that the results are observer-dependent, and results vary among them. Those patients with TIMI flow

grade 3 of culprit's vessel on angiogram that is achieved one and half hours after fibrinolytic therapy have a good prognosis in contrast to TIMI flow grade of 0 -2. Myocardial Blush Grade (MBG) is used to assess perfusion in the capillary bed at the tissue level[11].

Results

All (250) patients were equally divided into two groups, namely the intracoronary tirofiban group and the intravenous tirofiban group. Each group consisted of 125 patients. TIMI grade flow score in both groups was not similar and showed significant differences, which indicated that both groups were independent as the p-value was <0.05. (Table 1).

Table 1: Comparison of TIMI Grade Flow.

Variable		Intracoronary tirofiban Group f(%)	Intravenous tirofiban Group f(%)	p-value
TIMI Grade Flow	Penetration without Perfusion	0	24(19.2)	0.00
	Partial reperfusion	21(16.8)	65(52.0)	
	Normal	104(83.2)	36(28.8)	

The myocardial blush grade results compared in intracoronary and intravenous groups showed that scores in both groups were not similar and had a significant difference as the p-value was 0.00. (Table 2)

Table 2: Comparison of Myocardial Blush Grade.

Variables		Intracoronary tirofiban Group f(%)	Intravenous tirofiban Group f(%)	p-value
Myocardial Blush	Minimal	0	16(12.8)	0.00
	Moderate	19(15.2)	51(40.8)	
	Normal	106(84.8)	58(46.4)	

Major bleeding, compared with minor, showed insignificance, which indicates that there are relationships between the two groups. (p-value = 0.625 & 0.705). The Chi-square results regarding hematoma, MACE, and mortality in intracoronary and intravenous tirofiban groups were not statistically significant as p-values 0.338, 0.447, and 0.591, respectively. (Table 3)

Table 3: Descriptive Statistic of Clinical Outcomes.

Variables		Intracoronary tirofiban Group n(%)	Intravenous tirofiban Group n(%)	p-value
Major Bleeding	Yes	8(6.4)	10(8.0)	0.625
	No	117(93.6)	115(92.0)	
Minor Bleeding	Yes	15(12.0)	17(13.6)	0.705
	No	110(88.0)	108(86.4)	
Hematoma	Yes	38(30.4)	34(27.2)	0.338
	No	87(69.6)	91(72.8)	
MACE	Yes	43 (34.4)	41(32.8)	0.447
	No	82(65.6)	84(67.2)	
Mortality	Yes	3(2.4)	4(3.2)	0.591
	No	122(97.6)	121(96.8)	

Discussion

The results of the current study showed that TIMI flow grade 3 scores in both groups were not similar and were greater in the intracoronary group. This score showed a significant difference, which indicates that both the groups were independent as p-value <0.05.

The myocardial blush grade in our research was compared in intracoronary and intravenous groups, which showed that scores in both groups were not similar, having significant differences as the p-value is 0.00. This grade was also higher in the intracoronary group, which indicates better perfusion than in the intravenous group.

These two values of TIMI flow grade 3 and MBG are favored by Candemir et al., who studied 56 patients and compared high-dose tirofiban through the intracoronary route with 34 patients vs. 22 patients with high-dose tirofiban via the intravenous route. They found TIMI flow grade 3 after PCI in 72.5% vs. 27.5% of patients, respectively, whereas MBG 3 was 94% versus 73%. These two variables significantly favor high-dose tirofiban via the intracoronary route over the intravenous route. The results assume that intracoronary injection of glycoprotein IIb/IIIa inhibitors causes a clot to dissolve immediately as there are more drug levels present in coronaries, causing glycoprotein receptors to inhibit, hence stopping platelets from plugging and improving circulation[12-15].

In our study, major bleeding and minor bleeding showed insignificant results between the two groups as p-value > 0.05. Their values were 0.625 and 0.705 respectively. This is favored by the study conducted by Wu et al. The first research performed on intracoronary tirofiban injection was done by Wu et al., who found that an even lower dose of tirofiban had a remarkable impact on the results. Their results showed that major bleeding in the intravenous group is 8.8%, whereas in the intracoronary group, it is 1.7%, which is also non-significant (p-value 0.201). The same is found with minor bleeding, in which minor bleeding in intravenous is 7.0% and 10.3% in intracoronary cases, which is also insignificant (p-value 0.763)[16].

The findings of our study regarding hematoma, MACE, and mortality in intracoronary and intravenous tirofiban groups were not statistically significant, as the p-values were 0.338, 0.447, and 0.591, respectively. The mortality in both groups, intracoronary tirofiban, and intravenous tirofiban, was observed as 3(2.4%) & 4(3.2%), respectively. Candemir's study results were unable to show any betterment in the prognosis after 30 days because major adverse cardiovascular events were observed after one month and found bleeding, death, and re-infarction to be non-significant and hence do not prefer one route over the other[17].

Erdem et al. conducted a study and observed that major adverse cardiovascular events during hospital stays were 2.7% and 2.1% in the intracoronary and intravenous groups, respectively, with a p-value of 1.00. The separate parts of the MACE in intracoronary versus intravenous groups: deaths were 2.1% as compared to 2.7%, repeat revascularizations were 4.1% versus 8.3%, recurrent MI 4.1% and 8.3%, respectively. These MACE values support our study.

El-Hefny et al. gave tirofiban to 50 patients via intracoronary and 50 patients via intravenous route during the primary percutaneous coronary intervention of AMI patients and compared whether its outcome is associated with a decrease in infarct expansion or not. These patients who underwent PPCI and suffered from anterior myocardial infarction reached the hospital within the time frame and were given glycoprotein IIb/IIIa inhibitors either through the intracoronary or intravenous course. Patients with intracoronary tirofiban had a decrease in infarct size and fewer chances of heart failure due to preserved LV function. However, there was no significant difference in major adverse cardiovascular events or bleeding chances with either strategy[18].

Conclusion

TIMI flow and myocardial blush grade were higher in the patients receiving intracoronary tirofiban than intravenous tirofiban during primary percutaneous coronary intervention (PPCI). So, we

conclude that, in contrast to intravenous administration, the intracoronary administration of tirofiban has shown superior efficacy in improving myocardial flow in patients with ST-elevation myocardial infarction (STEMI) undergoing primary percutaneous coronary intervention (PCI).

Acknowledgment

The authors would like to acknowledge the Medical Affairs Department of Getz Pharma for their technical support and assistance in the publication process.

References

1) Amsterdam, E.A., Wenger, N.K., Brindis, R.G., Casey, D.E., Ganiats, T.G., Holmes, D.R., Jaffe, A.S., Jneid, H., Kelly, R.F., Kontos, M.C. and Levine, G.N., 2014. 2014 AHA/ACC guideline for the management of patients with non-ST-elevation acute coronary syndromes: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Am J Cardiol , 64(24): e139-e228.
2) Willem, S., Lee, W., Craig, V.L., Maaret, C. and Lisa, K., 2018. The proportion of South Africans living within 60 and 120 minutes of a percutaneous coronary intervention facility. Cardiovasc J Afr, 29(1): 6.
3) Savonitto, S., De Luca, G., Goldstein, P., van t'Hof, A., Zeymer, U., Morici, N., Thiele, H., Montalescot, G. and Bolognese, L., 2017. Antithrombotic therapy before, during, and after emergency angioplasty for ST-elevation myocardial infarction. Eur. Heart J. Acute Cardiovasc. Care, 6(2): 173-190.
4) Salarifar, M., Mousavi, M., Yousefpour, N., Nematipour, E., Kassaian, S.E., Poorhosseini, H., Hajizeinali, A., Alidoosti, M., Aghajani, H., Nozari, Y. and Amirzadegan, A., 2014.Effect of early treatment with tirofiban on initial TIMI Grade 3 flow of patients with ST-elevation myocardial infarction. Iran. Red Crescent Med. J., 16(1).
5) Tang, X., Li, R., Jing, Q., Liu, Y. and Liu, P., 2015. Efficacy and safety of intracoronary versus intravenous administration of tirofiban during percutaneous coronary intervention for the acute coronary syndrome: a meta-analysis of randomized controlled trials. PloS one, 10(6): e0129718.
6) Ulus, T., Şenol, U., Tahmazov, S., Iskenderov, K., Mutlu, F. and Çavuşoğlu, Y., 2017. High-dose bolus tirofiban versus low-dose bolus in patients with acute coronary syndrome undergoing percutaneous coronary intervention.Turk Kardiyol Dern Ars, 45(2): 126-133.
7) Zhao, X.M., Gao, C.Y., Chu, Y.J., Yang, L., Yang, X.Z., Xu, W.K., He, W.Q., Zhang, P.R., Liu, X.Y. and Tian, L.X., 2015. Fondaparinux vs. enoxaparin in patients with non - ST elevation acute coronary syndromes (NSTE - ACS) treated with percutaneous coronary intervention and tirofiban: an exploratory study in China. J Clin Pharm Ther, 40(5): 584-589.
8) Karmpaliotis, D., Turakhia, M.P., Kirtane, A.J., Murphy, S.A., Kosmidou, I., Morrow, D.A., Giugliano, R.P., Cannon, C.P., Antman, E.M., Braunwald, E. and Gibson, C.M., 2004. Sequential risk stratification using TIMI risk score and TIMI flow grade among patients treated with fibrinolytic therapy for ST-segment elevation acute myocardial infarction. Am. J. Cardiol., 94(9): 1113-1117.
9) Mehta, R.H., Ou, F.S., Peterson, E.D., Shaw, R.E., Hillegass, W.B., Rumsfeld, J.S., Roe, M.T. and American College of Cardiology–National Cardiovascular Database Registry Investigators, 2009. Clinical significance of post-procedural TIMI flow in patients with cardiogenic shock undergoing primary percutaneous coronary intervention. JACC Cardiovasc. Interv., 2(1): 56-64.
10) Yildiz, M. and Henry, T.D., 2020. Pre-procedure Thrombolysis In Myocardial Infarction (TIMI) flow grade: Has its time come and gone?
11) Candemir, B., Kilickap, M., Ozcan, O.U., Kaya, C.T., Gerede, M., Ozdemir, A.O., Ozdol, C., Kumbasar, D. and Erol, C., 2012.Intracoronary versus intravenous high-dose bolus plus maintenance administration of tirofiban in patients undergoing primary percutaneous coronary intervention for acute ST-elevation myocardial infarction.J. Thromb. Thrombolysis, 34(1): 65-72.
12) Feng, L., Li, M., Xie, W., Zhang, A., Lei, L., Li, X., Gao, R. and Wu, Y., 2019. Prehospital and in-hospital delays to care and associated factors in patients with STEMI: an observational study in 101 non-PCI hospitals in China. BMJ open, 9(11): e031918.
13) Fitts, J., Ver Lee, P., Hofmeister, P., Malenka, D. and Northern New England Cardiovascular Study Group, 2008. Fluoroscopy - guided femoral artery puncture reduces the risk of PCI - related vascular complications. J. Interv. Cardiol., 21(3): 273-278.
14) Fuster, V., 1994. Lewis A. Conner Memorial Lecture. Mechanisms leading to myocardial infarction: insights from studies of vascular biology. Circulation, 90(4): 2126-2146.
15) Gaasch, W.H., 1994. Diagnosis and treatment of heart failure based on left ventricular systolic or diastolic dysfunction. JAMA, 271(16): 1276-1280.

16) Galal, H. and Essmat, E., 2014.Impact of upstream high bolus dose tirofiban on left ventricular systolic function in patients with acute anterior myocardial infarction treated by primary coronary intervention.Egypt. Heart J., 66(3): 251-257.
17) Garg, P., Morris, P., Fazlanie, A.L., Vijayan, S., Dancso, B., Dastidar, A.G., Plein, S., Mueller, C. and Haaf, P., 2017. Cardiac biomarkers of the acute coronary syndrome: from history to high-sensitivity cardiac troponin. Intern Emerg Med., 12(2): 147-155.
18) Wu TG, Zhao Q, Huang WG, Wei JR, Chen SW, Zhao J, et al. (2008) Effect of intracoronary tirofiban in patients undergoing percutaneous coronary intervention for the acute coronary syndrome. Circ J 72:1605–1609.