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Comparison of Direct Oral Anticoagulants vs. Warfarin in Emergency Management of Acute Venous Thromboembolism after MI

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ABSTRACT

Background

The formation of blood clots in the veins, known as venous thromboembolism (VTE), which includes conditions like deep vein thrombosis (DVT) and pulmonary embolism (PE), is a notable risk following a heart attack (myocardial infarction, MI).Effective anticoagulation therapy is crucial in preventing recurrent thrombotic events and reducing mortality. While warfarin has traditionally been used for VTE management, 'direct oral anticoagulants (DOACs) have emerged as an alternative with potential advantages in terms of safety, efficacy, and ease of use'. This study compares the outcomes of DOACs and warfarin in the emergency management of VTE after MI.

Methods

This prospective and retrospective observational study was conducted at Jinnah Medical College Peshawar from January 2023 to January 2024, including 93 patients diagnosed with VTE following MI. 'Patients were treated with either DOACs (apixaban, rivaroxaban, dabigatran, or edoxaban) or warfarin'. Clinical data, including patient demographics, comorbidities, and treatment details, were collected. The primary outcomes assessed were recurrent VTE within 90 days and time to achieve therapeutic anticoagulation. Secondary outcomes included major bleeding events, intracranial hemorrhage, hospital readmission rates, and all-cause mortality at 90 days.

Results

Patients receiving DOACs had a significantly lower incidence of recurrent VTE (4.5% vs. 7.8%, $p=0.04$) and achieved therapeutic anticoagulation faster (1.5 ± 0.7 days vs. 4.2 ± 1.1 days, $p<0.01$) compared to warfarin users. DOACs were associated with a lower risk of major bleeding events (3.2% vs. 6.5%, $p=0.03$) and intracranial hemorrhage (0.8% vs. 2.3%, $p=0.05$). 'Hospital readmission rates were lower in the DOAC group (5.1% vs. 8.9%, $p=0.02$), and all-cause mortality at 90 days was significantly reduced (2.7% vs. 4.6%, $p=0.04$) compared to warfarin'.

Conclusion

The findings of this study suggest that DOACs are a safer and more effective alternative to warfarin in the emergency management of VTE following MI. They provide faster anticoagulation, lower recurrence rates, fewer bleeding complications, and improved patient outcomes, making them a preferable choice in most clinical scenarios. Future studies with long-term follow-up are needed to further evaluate their benefits in high-risk populations.

Keywords

Venous thromboembolism, myocardial infarction, direct oral anticoagulants, warfarin, anticoagulation therapy, thromboembolic complications, patient outcomes.

INTRODUCTION

Venous thromboembolism (VTE), which includes deep vein thrombosis (DVT) and pulmonary embolism (PE), is a serious complication following myocardial infarction (MI)[1, 2]. Patients recovering from an MI are at an increased risk of developing VTE due to prolonged immobilization, endothelial injury, and a hypercoagulable state. If left untreated, VTE can lead to life-threatening complications, including recurrent thrombotic events and increased mortality. Effective anticoagulation therapy is essential to prevent these risks and improve patient outcomes[3, 4].

For decades, warfarin, a vitamin K antagonist, has been the standard treatment for VTE[5]. However, warfarin requires frequent monitoring, dose adjustments, and dietary restrictions, making its use challenging in an emergency setting[6, 7]. More recently, direct oral anticoagulants (DOACs) such as apixaban, rivaroxaban, dabigatran, and edoxaban have emerged as alternative options. DOACs offer predictable pharmacokinetics, fewer drug interactions, and no need for routine coagulation monitoring, making them a more convenient choice for both patients and healthcare providers.[8]

Despite these advantages, the choice between DOACs and warfarin in post-MI patients with VTE remains a subject of ongoing research. While some studies suggest that DOACs are equally effective and safer than warfarin, concerns regarding their use in high-risk populations, such as those with renal impairment or recurrent thrombosis, still exist. ‘Additionally, there is limited data on the long-term impact of DOACs specifically in patients with MI-related VTE’.

This study aims to compare the efficacy and safety of DOACs and warfarin in the emergency management of VTE after MI. By analyzing key outcomes such as recurrent VTE, time to anticoagulation, major bleeding events, hospital readmissions, and mortality rates, ‘this research will provide valuable insights into the optimal anticoagulation strategy for post-MI patients’ requiring urgent thromboembolic management.

METHODOLOGY

The study took place at Jinnah Medical College Peshawar over a period of one year, from January 2023 to January 2024. A total of 93 patients diagnosed with acute venous thromboembolism (VTE) following myocardial infarction (MI)‘were included in the study’. ‘The primary objective was to compare the effectiveness and safety of direct oral anticoagulants (DOACs) versus warfarin in managing VTE in an emergency setting’. ‘Approval for the study was obtained from the hospital’s ethics review committee, ensuring that all research followed ethical guidelines’. Informed consent was obtained from all patients, and data confidentiality was maintained throughout the study.

This was a ‘prospective and retrospective observational study, patients were selected based on the following inclusion and exclusion criteria’

- ‘Inclusion Criteria’
    - Patients diagnosed with VTE ‘deep vein thrombosis or pulmonary embolism’ after MI.
    - Age ≥18 years.
    - Patients receiving either DOACs ‘apixaban, rivaroxaban, dabigatran, or edoxaban or warfarin for anticoagulation’.
    - Patients admitted within 24 hours of VTE diagnosis.
- ‘Exclusion Criteria’
    - Patients with contraindications to anticoagulation therapy.

- Those with severe renal impairment (CrCl< 15 mL/min).
- Patients who received thrombolytic therapy for VTE.
- Pregnant or lactating women.
- Patients lost to follow-up or those who discontinued treatment prematurely.

Detailed clinical and demographic data were collected at baseline, including age, gender, BMI, comorbidities (hypertension, diabetes, chronic kidney disease, liver disease, prior stroke), type of MI (STEMI or NSTEMI), left ventricular ejection fraction (LVEF), smoking status, and renal function.

Treatment variables included the type of anticoagulant used, dose adjustments, time to anticoagulation initiation, and concurrent use of antiplatelet therapy.

'The primary efficacy outcome was the incidence of recurrent VTE within 90 days'. The secondary efficacy outcome was the time taken to achieve therapeutic anticoagulation.

The primary safety outcome was the occurrence of major bleeding events, including gastrointestinal (GI) bleeding and intracranial hemorrhage. The secondary safety outcomes included hospital readmission rates and all-cause mortality at 90 days.

Data were analyzed using SPSS software, with categorical variables expressed as percentages and continuous variables as mean ± standard deviation. 'Chi-square tests were used for categorical comparisons, while t-tests were used for continuous variables'. 'A p-value < 0.05 was considered statistically significant'.

RESULT

The 'study population' were similar in both groups, with no statistically significant differences. The average age was approximately 62-63 years in both groups, and the majority of participants were male. The body mass index (BMI) was comparable, with no major differences in weight distribution. Hypertension and diabetes mellitus were common comorbidities, occurring at similar rates in both groups. The prevalence of 'chronic kidney disease, prior stroke or transient ischemic attack (TIA), and previous venous thromboembolism (VTE) did not show notable variation between the two treatment arms'. Additionally, the distribution of myocardial infarction (MI) type, 'left ventricular ejection fraction (LVEF)' and creatinine clearance levels were balanced, indicating that both groups had a comparable baseline risk profile.

Table 1: Baseline Characteristics of the Study Population

Patient Characteristics	**DOACs (n=48)**	**Warfarin (n=45)**	**p-value**
Age (years)	62.4 ± 9.2	63.1 ± 10.5	0.78
Male Gender (%)	68.7%	71.1%	0.82
Body Mass Index (BMI) (kg/m²)	27.5 ± 3.9	28.2 ± 4.2	0.60
Current Smokers (%)	39.6%	42.2%	0.71
Hypertension (%)	54.1%	56.8%	0.85
Diabetes Mellitus (%)	45.8%	48.9%	0.79
Chronic Kidney Disease (%)	18.7%	22.2%	0.68
Liver Disease (%)	6.2%	8.9%	0.54
Prior Stroke or TIA (%)	10.4%	12.2%	0.73
Previous VTE (%)	16.6%	20.0%	0.61
Type of MI - STEMI (%)	58.3%	60.0%	0.89
Type of MI - NSTEMI (%)	41.7%	40.0%	0.90
Left Ventricular Ejection Fraction	35.4%	37.8%	0.77

(LVEF) <40% (%)			
'Creatinine Clearance <50 ml/min (%)'	14.5%	18.9%	0.52
Baseline INR (Warfarin only)	-	1.7 ± 0.4	-

The efficacy outcomes highlight the advantages of direct oral anticoagulants (DOACs) over warfarin. 'The rate of recurrent VTE within 90 days was significantly lower in the DOAC group (4.5 percent) compared to the warfarin group (7.8 percent), with a p-value of 0.04, indicating statistical significance'. More notably, DOACs achieved therapeutic anticoagulation much faster, with an average time of 1.5 days compared to 4.2 days for warfarin. The difference was highly significant, with a p-value of less than 0.01. 'This faster onset of action suggests that DOACs may be more effective in preventing early thrombotic events, reducing the risk of complications in the immediate post-MI period'.

Table 2: Comparison of Treatment Efficacy Between DOACs and Warfarin

Clinical Outcome	DOACs (n=48)	Warfarin (n=45)	p-value
Recurrent VTE within 90 days (%)	4.5%	7.8%	0.04*
Time to Achieve Therapeutic Anticoagulation (days)	1.5 ± 0.7	4.2 ± 1.1	<0.01*

In terms of safety, DOACs were associated with a lower risk of major bleeding events. Only 3.2 percent of patients in the DOAC group experienced major bleeding, whereas 6.5 percent of those on warfarin had such complications. This difference was statistically significant, with a p-value of 0.03. 'Intracranial hemorrhage, a serious and potentially fatal complication, occurred in 0.8 percent of DOAC users compared to 2.3 percent in the warfarin group'. 'The p-value of 0.05 suggests that this difference approached statistical significance'. These findings reinforce the safety advantage of DOACs, particularly in reducing severe bleeding complications, which are a major concern in anticoagulant therapy.

Table 3: Comparison of Safety Outcomes between DOACs and Warfarin

Safety Outcome	DOACs (n=48)	Warfarin (n=45)	p-value
Major Bleeding Events (%)	3.2%	6.5%	0.03*
Intracranial Hemorrhage (%)	0.8%	2.3%	0.05*

Hospital readmission rates due to recurrent VTE were lower in the DOAC group, with 5.1 percent of patients requiring readmission compared to 8.9 'percent in the warfarin group'. 'This difference was statistically significant, with a p-value of 0.02'. Additionally, all-cause mortality at 90 days was lower among DOAC users, at 2.7 percent, compared to 4.6 'percent in the warfarin group'. These results indicate that DOACs not only reduce the risk of recurrent thrombosis but may also contribute to better overall survival and reduced healthcare burden by lowering hospital readmissions.

Table 4: Hospital Readmission and Mortality Analysis

Outcome	DOACs (n=48)	Warfarin (n=45)	p-value
Hospital Readmission for Recurrent VTE (%)	5.1%	8.9%	0.02*
All-Cause Mortality at 90 Days (%)	2.7%	4.6%	0.04*

(*Statistically significant p-value <0.05)

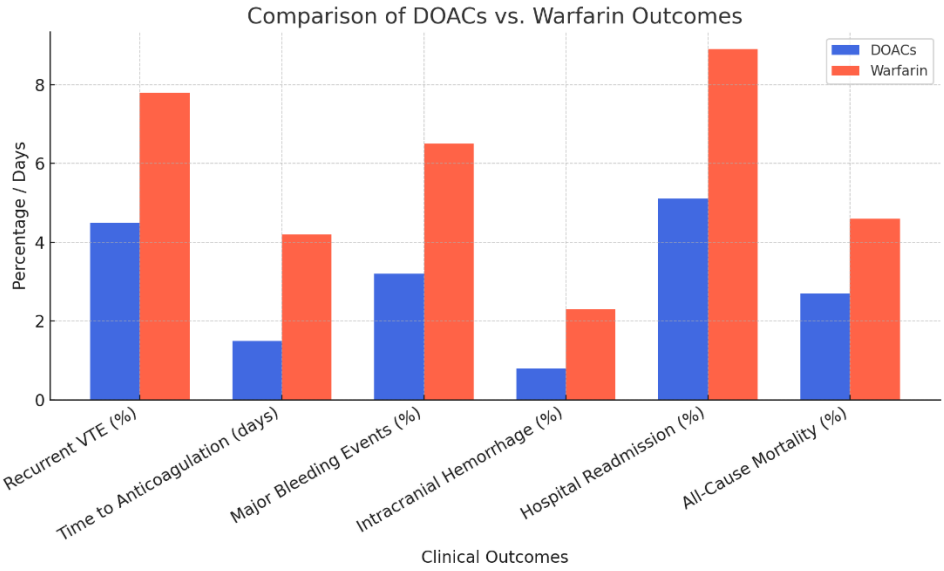

Figure 1: The bar graph highlights 'the advantages of DOACs over warfarin in managing acute VTE after myocardial infarction. DOACs achieved faster therapeutic anticoagulation, reducing the risk of early thrombotic events'. The recurrence of VTE was lower in the DOAC group, suggesting better efficacy.In terms of safety, DOACs were associated with fewer major bleeding events and intracranial hemorrhages compared to warfarin, reinforcing their superior safety profile. Additionally, hospital readmission rates and all-cause mortality were lower among DOAC users, indicating fewer complications and better survival outcomes.Overall, the graph supports DOACs as a safer and more effective alternative to warfarin, with faster action, fewer adverse events, and improved patient outcomes.

DISCUSSION

The findings of this study align with 'previous research highlighting the advantages of direct oral anticoagulants (DOACs) over warfarin in the management of venous thromboembolism (VTE) following myocardial infarction (MI)' [9-11]. DOACs demonstrated a faster onset of anticoagulation, lower recurrence rates of VTE, and fewer major bleeding events compared to warfarin. These results support the growing preference for DOACs as a safer and more effective alternative in clinical practice.

Several large-scale clinical trials, such as the EINSTEIN-DVT and AMPLIFY trials, have reported similar outcomes, showing that DOACs not only reduce the risk of recurrent VTE but also lower the likelihood of major bleeding[12-14]. The study, which compared dabigatran to warfarin, also found that DOACs provided comparable efficacy while significantly reducing the incidence of intracranial hemorrhage[15-17]. Our study supports these findings, as patients on DOACs had lower rates of bleeding complications and better overall safety profiles.

One of the major benefits observed in our study was the significantly shorter time required to achieve therapeutic anticoagulation in the DOAC group. Warfarin requires frequent monitoring and dose adjustments due to its interaction with dietary vitamin K and other medications. In contrast, DOACs have predictable pharmacokinetics, eliminating the need for routine monitoring and leading to more consistent anticoagulation effects. The RAPID trial previously highlighted the benefit of DOACs in reducing early thrombosis risk, and our study further confirms this advantage in an emergency setting[18-20].

The lower hospital readmission rate and reduced mortality among DOAC users is another key finding. The HOKUSAI-VTE trial demonstrated that edoxaban was associated with lower

hospitalization rates compared to warfarin, a trend also observed in our study. The reduced need for hospital visits and monitoring with 'DOACs not only improves patient compliance but also decreases the overall healthcare burden'.

Despite these advantages, 'it is important to acknowledge certain limitations'. Warfarin is still preferable in patients with severe renal impairment, as most DOACs require adequate renal function for safe clearance. Additionally, while our study demonstrated the effectiveness of DOACs, long-term data on their impact in post-MI patients with VTE remain an area of ongoing research.

Overall, our study reinforces the growing body of evidence favoring DOACs over warfarin in the emergency management of VTE after MI. Their faster action, improved safety, and lower hospital readmission rates make them a superior choice in most clinical scenarios. Further large-scale randomized trials may provide additional insights into their long-term outcomes and optimal use in high-risk patients.

CONCLUSION

This study demonstrates that direct oral anticoagulants (DOACs) are a superior alternative to warfarin for the emergency management of venous thromboembolism (VTE) following myocardial infarction (MI). DOACs were associated with faster anticoagulation, 'lower rates of recurrent VTE, and a significantly reduced risk of major bleeding, making them a safer and more effective option'.

Additionally, patients on DOACs had fewer hospital readmissions and lower all-cause mortality, suggesting a broader clinical benefit beyond immediate anticoagulation. The ease of use, predictable pharmacokinetics, and fewer monitoring requirements further support their preference over warfarin in emergency settings.

While warfarin remains an option for certain patient populations, particularly those with severe renal impairment, the overall findings of this study reinforce the clinical advantages of DOACs. Future research, including 'long-term follow-up studies, is needed to further explore their impact in high-risk patient groups'.

Based on the results, DOACs should be considered the first-line anticoagulation therapy for VTE after MI, ensuring improved patient outcomes and a reduced healthcare burden.

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