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ORIGINAL RESEARCH

Anticoagulation Practices Surrounding Emergency Department Cardioversion for Atrial Fibrillation and Flutter

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ABSTRACT

Objective: To assess adherence to international anticoagulation guidelines in emergency department (ED) patients undergoing direct current cardioversion (DCCV) for atrial fibrillation (AF) or flutter, and to describe associated outcomes.

Methods: A retrospective study was conducted at a metropolitan ED (January 2020–December 2023). Of 410 AF/flutter presentations, 158 patients (mean age 57 years; 83.5% male) underwent DCCV. Data on arrhythmia characteristics, anticoagulation timing, and outcomes were reviewed using 2024 European Society of Cardiology criteria.

Results: AF was present in 91.1% and flutter in 8.9% of cases. Most arrhythmias were recent onset (71.5% < 24 h; 10.1% < 48 h), with no precipitant identified in 87.3%. Rivaroxaban (48.7%) and apixaban (22.1%) were the most prescribed anticoagulants. After cardioversion, 76.6% of patients were discharged directly from ED, 12.7% transferred to short-stay, and 10.1% admitted. Adherence to anticoagulation guidelines was achieved in 94% of cases pre-cardioversion and 90% post-cardioversion, with appropriate DOAC dosing in 88.2%. Patients with CHA_2DS_2-VA ≥ 2 were significantly more likely to receive appropriate therapy ($p < 0.01$). ED revisit rates were 17.1% at 30 days and 46.2% at 12 months, often related to recurrent AF.

Conclusion: Most patients undergoing ED cardioversion received guideline-concordant anticoagulation. However, variability in dosing and post-procedural therapy persists, particularly among low-risk patients. High revisit rates highlight the need for improved follow-up, continuity of anticoagulation, and structured care pathways following ED cardioversion.

1 | Introduction

Electrical cardioversion of AF carries a procedural risk if anticoagulation is inadequate [1]. For AF lasting ≥ 24 h or of uncertain duration, international guidelines recommend at least 2 weeks of therapeutic anticoagulation or a transoesophageal echocardiogram to exclude thrombus before DCCV [2]. Anticoagulation is also advised for at least 4 weeks after cardioversion because of transient atrial dysfunction that may increase clot risk.

Despite well-established guidance, real-world adherence remains inconsistent. Earlier studies have shown that a substantial proportion of AF patients are not appropriately anticoagulated, often due to perceived bleeding risk or lack of follow-up systems [3, 4]. In the ED, time pressures and uncertainty around AF duration can further complicate adherence to recommendations.

The introduction of direct oral anticoagulants (DOACs) has simplified periprocedural management through rapid onset, predictable pharmacokinetics, and avoidance of heparin bridging [4, 5]. However, limited data describe how well these practices have translated to emergency settings, where patient turnover is rapid and follow-up pathways may not be well established [6].

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This study aimed to assess adherence to current anticoagulation guidelines among patients undergoing ED DCCV for AF or flutter in an Australian tertiary hospital. It also sought to describe anticoagulant selection, dosing and follow-up patterns in routine clinical practice.

2 | Methods

2.1 | Study Design and Setting

This retrospective cohort study was conducted at a large Australian tertiary hospital ED between 1 January 2020 and 31 December 2023. The site manages approximately 90,000 presentations annually and provides 24-h access to procedural sedation and cardioversion for haemodynamically stable AF or flutter.

2.2 | Participants

Adults aged ≥18 years who underwent DCCV for AF or atrial flutter in the ED were included. Patients were excluded if cardioversion occurred outside the ED or if defibrillation was performed for unstable arrhythmia.

2.3 | Data Collection

Demographic data, arrhythmia type and estimated duration (<24 h, 24–48 h, >48 h or uncertain), CHA_2DS_2-VA and HAS-BLED scores, and any documented arrhythmia precipitant were extracted from electronic medical records. Pre- and post-cardioversion anticoagulation status, the choice of anticoagulant (DOAC or warfarin), and DOAC dosing appropriateness were recorded.

2.4 | Outcome Measures

The primary outcome was adherence to 2024 European Society of Cardiology (ESC) guidelines for the management of AF [2]. Pre-cardioversion adherence was assessed for AF >24 h or of uncertain duration. Post-cardioversion adherence was evaluated for all except those with AF ≤24 h and a CHA_2DS_2-VA score of 0, in whom guidelines allow omission of anticoagulation. Patients not meeting these criteria were classified as non-adherent. ED re-presentations within 30 days and 12 months were also recorded.

2.5 | Statistical Analysis

Continuous variables are reported as means with standard deviation or medians with interquartile range. Categorical variables are presented as percentages. Chi-square or Fisher's exact tests were used for categorical comparisons, and *t*-tests or Mann–Whitney U-tests for continuous data as appropriate. Statistical significance was defined as $p < 0.05$.

TABLE 1 | Baseline characteristics of the cardioversion patient cohort.

Characteristic	Cohort ($n = 158$)
Age—mean (SD), years	57.1 (14.8)
Male sex, *n* (%)	132 (83.5)
Atrial fibrillation (%)	144 (81.1)
Atrial flutter, *n* (%)	14 (8.9)
Arrhythmia duration <24 h, *n* (%)	113 (71.5)
24–48 h, *n* (%)	16 (10.1)
>48 h, *n* (%)	15 (9.5)
Uncertain duration, *n* (%)	14 (8.9)
Any precipitant identified, *n* (%)	20 (12.7)

Note: Precipitant refers to documented acute trigger for arrhythmia, as opposed to idiopathic onset.
Abbreviation: SD, Standard deviation.

TABLE 2 | Pre- and post-cardioversion anticoagulation use by CHA_2DS_2-VA score group.

CHA_2DS_2-VA score	Pre-cardioversion anticoagulation, *n* (%)	Post-cardioversion anticoagulation, *n* (%)
0 ($n = 60$)	25 (41.7%)	34 (56.7%)
1 ($n = 45$)	27 (60.0%)	32 (71.1%)
2 ($n = 26$)	23 (88.5%)	26 (100%)
≥3 ($n = 27$)	25 (92.6%)	27 (100%)

3 | Results

3.1 | Patient Characteristics

A total of 158 patients underwent ED DCCV during the study period (Table 1). The mean age was 57.1 years (SD 14.8) and 83.5% were male. AF was present in 91.1% and atrial flutter in 8.9%. Most arrhythmias were of short duration: 71.5% <24 h, 10.1% between 24 and 48 h, and 9.5% >48 h, with 8.9% uncertain. The median CHA_2DS_2-VA score was 1 (IQR 0–2), indicating that two-thirds (66.5%) were at low risk (<2). HAS-BLED scores were 0–1 in 96% of patients.

3.2 | Anticoagulation Management

Among 45 patients with AF >24 h or uncertain duration, 42 (93.3%) received appropriate pre-cardioversion anticoagulation or a documented TOE (Table 2). Three underwent urgent cardioversion without either, generally due to rapid ventricular response and clinician decision to proceed for symptom relief.

Following cardioversion, 142 (89.9%) were prescribed at least 4 weeks of anticoagulation, whereas 16 were not. All patients without post-cardioversion anticoagulation had CHA_2DS_2-VA scores of 0–1.

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TABLE 3 | Estimated arrhythmia duration and associated anticoagulation strategy among ED cardioversion patients.

Estimated arrhythmia duration	No anticoagulation, *n* (%)	Post-only anticoagulation, *n* (%)	Pre + Post anticoagulation, *n* (%)
< 24 h (*n* = 113)	34 (30.1%)	15 (13.3%)	64 (56.6%)
24–48 h (*n* = 16)	4 (25.0%)	2 (12.5%)	10 (62.5%)
> 48 h (*n* = 15)	0 (0%)	0 (0%)	15 (100%)
Unknown duration (*n* = 14)	1 (7.1%)	2 (14.3%)	11 (78.6%)

TABLE 4 | Comparison of anticoagulation and outcomes in patients undergoing ED cardioversion, stratified by stroke risk.

	CHA_2DS_2-VA < 2 (*n* = 105)	CHA_2DS_2-VA ≥ 2 (*n* = 53)	*p*
Age (years)	50.3 ± 11.1	70.6 ± 13.0	< 0.001
Pre-cardioversion anticoagulation	17/24 (70.8%)	19/21 (90.5%)	0.14
Post-cardioversion anticoagulation	44/60 (73.3%)	53/53 (100%)	< 0.001
DOAC prescribed (vs. warfarin)	64/66 (97.0%)	50/53 (94.3%)	0.65
Appropriate DOAC dose	62/66 (93.9%)	43/53 (81.1%)	0.04
Admitted to hospital from ED	5 (4.8%)	12 (22.6%)	0.002
30-day ED re-presentation	17 (16.2%)	10 (18.9%)	0.66

DOACs were used in 95% of anticoagulated patients: rivaroxaban (48.7%), apixaban (22.1%), and dabigatran (4.5%). Warfarin use was limited to 3.2%. DOAC dosing was appropriate in 88.2% of cases, whereas 11.8% received reduced doses without justification, typically in younger, lower-weight males.

3.3 | Comparison by Stroke-Risk Group

When stratified by CHA_2DS_2-VA score, those with scores ≥ 2 were older (mean 70.6 vs. 50.3 years, $p < 0.001$) and more likely to be admitted to hospital (22.6% vs. 4.8%, $p = 0.002$). Post-cardioversion anticoagulation was prescribed for all higher-risk patients compared with 73.3% in lower-risk cases ($p < 0.001$). Appropriate DOAC dosing was slightly lower among the higher-risk group (81.1% vs. 93.9%, $p = 0.04$) (Table 4).

3.4 | ED Disposition and Follow-Up

Of all patients, 121 (76.6%) were discharged directly from ED, 20 (12.7%) were admitted to short-stay, and 16 (10.1%) were admitted to inpatient units (Table 3). At 30 days, 27 patients (17.1%) re-presented to an ED, and by 12 months, 73 (46.2%) had at least one re-presentation. These visits were predominantly for recurrent AF. Patients aged ≥ 65 years had higher recurrence (58% vs. 41%, $p = 0.03$).

4 | Discussion

This study provides one of the first detailed descriptions of real-world anticoagulation practices surrounding emergency department cardioversion for atrial fibrillation and flutter within an Australian tertiary hospital setting. It demonstrates that high adherence to guideline-recommended anticoagulation practices in the ED cardioversion setting is achievable, even in the absence of a dedicated protocol. Conducted in an Australian tertiary hospital, the findings reflect current practice in a busy emergency environment where decision-making relies on individual clinician judgement and access to contemporary anticoagulants.

Adherence rates in this study (94% pre-cardioversion, 90% post-cardioversion) compare favourably with international reports where rates of 60%–70% have been documented [7, 8]. The increasing use of DOACs likely underpins this improvement, offering simplified dosing and faster onset compared with warfarin [6].

The small proportion of underdosed patients (11.8%) mirrors findings from previous work demonstrating that clinicians sometimes lower doses unnecessarily due to perceived bleeding risk [9]. Although these cases may represent cautious practice, inappropriate dose reductions can reduce efficacy and do not significantly improve safety. Educational interventions or electronic prescribing prompts may help optimise dosing accuracy.

The high recurrence rate of AF within 12 months (46%) is consistent with prior studies showing that cardioversion rarely provides long-term rhythm stability [8, 10]. This highlights the need for coordinated outpatient follow-up and rhythm-control planning rather than reliance on single ED-based interventions. Structured referral pathways and patient education could reduce recurrence and repeat presentations.

Although this cohort achieved high compliance, some challenges remain. The small subset of patients who underwent cardioversion without prior anticoagulation underscores the tension between symptom control and procedural safety.

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Although emergency circumstances can necessitate immediate intervention, future prospective work could explore clinical reasoning and risk–benefit assessments in these situations.

In this cohort, post-cardioversion anticoagulation was universal among patients with CHA_2DS_2-VA scores ≥ 2 but less consistent in lower-risk patients.

One possible explanation is that the transient thromboembolic risk associated with cardioversion itself, related to atrial mechanical dysfunction or "atrial stunning", may be underrecognised [11]. This can lead to omission of short-term anticoagulation following cardioversion, especially in patients with a low CHA_2DS_2-VASc score, where the perceived long-term stroke risk is minimal. This highlights a potential bias towards long-term risk factors over procedure-related risks.

An ongoing area of debate in emergency atrial fibrillation management is whether immediate cardioversion is necessary, or whether a delayed "wait-and-see" strategy should be preferred. A previous study demonstrated that approximately 70% of patients with recent-onset atrial fibrillation will spontaneously revert to sinus rhythm within 48 h without cardioversion, with no significant difference in short-term clinical outcomes compared with early cardioversion [12]. These findings support a more conservative rhythm-control approach in selected, haemodynamically stable patients.

Despite this, acute cardioversion remains common in emergency departments due to symptom burden, patient preference, ED throughput pressures, and clinician familiarity. Our cohort reflects real-world practice in which early cardioversion continues to be frequently utilised. Importantly, when cardioversion is performed, appropriate periprocedural anticoagulation remains essential to mitigate thromboembolic risk.

Limitations of this study include its retrospective design, which may introduce documentation bias, and reliance on hospital records that do not capture events managed outside the health service. The small number of non-adherent cases precluded meaningful analysis of predictors. Additionally, the cohort was relatively young with low bleeding risk, which limits its generalisability to older populations. These limitations are typical of single-centre observational work but nonetheless provide valuable insight into current real-world ED practice.

Overall, the findings suggest that guideline adherence can be maintained even without a formal protocol, provided clinicians are familiar with current recommendations and DOAC prescribing principles. The results align with contemporary literature demonstrating that emergency physicians can safely manage AF cardioversion when supported by accessible anticoagulant options and follow-up arrangements [10, 13].

5 | Conclusion

High levels of adherence to anticoagulation guidelines were achieved for emergency department cardioversion of atrial fibrillation and flutter in an Australian tertiary hospital. Most patients received appropriate pre- and post-procedural therapy with contemporary anticoagulants, reflecting strong alignment with international recommendations.

However, the study identified subtle gaps in timing and dosing practices. A small proportion of patients received reduced DOAC doses without indication, and some clinicians may underestimate the short-term thromboembolic risk associated with cardioversion itself. This highlights the importance of recognising that even brief episodes of AF can carry procedure-related embolic potential, independent of long-term stroke risk scores.

High revisit rates within 12 months suggest that while acute management is generally guideline-concordant, continuity of care remains a challenge. Improving access to structured follow-up pathways, patient education, and rhythm-control clinics could reduce recurrence and optimise ongoing anticoagulation management.

Overall, these findings reinforce that ED cardioversion can be performed safely and effectively when anticoagulation practices adhere to evidence-based guidance. Ongoing efforts should focus on maintaining dosing accuracy, promoting awareness of periprocedural risk, and ensuring timely post-discharge review to sustain long-term outcomes for patients with atrial fibrillation or flutter.

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The authors have nothing to report.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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