



Clinical Reviews in Emergency Medicine

INTERVENTIONS TO IMPROVE EMERGENCY DEPARTMENT–RELATED TRANSITIONS IN CARE FOR ADULT PATIENTS WITH ATRIAL FIBRILLATION AND FLUTTER

James Gilbertson, BSC, MD (CANDIDATE),* Retha Moghrabi, BSC, MD (CANDIDATE),* Scott W. Kirkland, MSC,*
Kaitlyn Tate, RN, BSCN,† William Sevcik, MD, BED, FRCPC,* Ni T. Lam, MD, PHD, FRCPC,*
Cristina Villa-Roel, MD, MSC, PHD,* and Brian H. Rowe, MD, MSC, CCFP(EM), FCCP, FCAHS*‡

*Department of Emergency Medicine, Faculty of Medicine and Dentistry, University of Alberta, Edmonton, Alberta, Canada, †Faculty of Nursing, University of Alberta, Edmonton, Alberta, Canada, and ‡School of Public Health, University of Alberta, Edmonton, Alberta, Canada
Corresponding Address: Brian H. Rowe, MD, MSC, CCFP(EM), FCCP, FCAHS, Department of Emergency Medicine, University of Alberta, 1G1.43 WMC, 8440-112 Street NW, Edmonton, Alberta, Canada T6G 2B7

Abstract—Background: Patients presenting to emergency departments (EDs) with acute atrial fibrillation or flutter undergo numerous transitions in care (TiC), including changes in their provider, level of care, and location. During transitions, gaps in communications and care may lead to poor outcomes. **Objective:** We sought to examine the effectiveness of ED-based interventions to improve length of stay, return to normal sinus rhythm, and hospitalization, among other critical patient TiC outcomes. **Methods:** Comprehensive searches of electronic databases and the gray literature were conducted. Two independent reviewers completed study selection, quality, and data extraction. Relative risks (RRs) with 95% confidence intervals (CIs) were calculated using a random-effects model, where appropriate. **Results:** From 823 citations, 11 studies were included. Interventions consisted of within-ED clinical pathways ($n = 6$) and specialized observation units ($n = 2$) and post-ED structured patient education and referrals ($n = 3$). Three of five studies assessing hospital length of stay reported a significant decrease associated with TiC interventions. Patients undergoing within-ED interventions were also more likely to receive electrical cardioversion. Two of 3 clinical pathways reporting hospitalization proportions showed significant decreases associated with TiC interventions ($RR = 0.63$ [95% CI 0.42–0.92] and $RR = 0.20$ [95% CI 0.12–0.32]), as did 1 observation unit

($RR = 0.54$ [95% CI 0.36–0.80]). No significant differences in mortality, complications, or relapse were found between groupings among the studies. **Conclusions:** There is low to moderate quality evidence suggesting that within-ED TiC interventions may reduce hospital length of stay and decrease hospitalizations. Additional high-quality comparative effectiveness studies, however, are warranted. © 2019 Elsevier Inc. All rights reserved.

Keywords—atrial fibrillation; atrial flutter; emergency department; transitions in care

INTRODUCTION

Adults with atrial fibrillation or flutter (AFF) commonly present to the emergency department (ED). While many patients with acute AFF in the ED are uncomplicated and discharged home, others require consultation and hospital admission (1). Decisions by care providers are complicated not only by presentation heterogeneity, including timing of AFF, patient comorbidities, and contributing etiologies, such as congestive heart failure (CHF), but also by evidence gaps and treatment effectiveness. Management of AFF varies significantly within hospitals and among jurisdictions, including critical approaches to rate vs. rhythm control and dispositional

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decisions, influencing patient length of stay (LoS) in the ED and hospital and ultimately health outcomes (2).

Variation in treatment practices and patient movements to different levels of care requires extensive coordination to ensure patient safety. While such processes are commonly referred to as clinical handovers, the concept of “handover” does not adequately reflect the true complexities of transitions in care (TiC) and discontinuity (3). TiC encompass various factors impacting situations when a patient moves while receiving care, including changes in settings and consultations with different health care providers. Many factors impact the quality and safety of TiC, including location of the health services, availability of decision support systems, and the use of clinical pathways (3). Transitions may involve changes in the level of care (e.g., management protocols or tools, intensive vs. compassionate care), change in care providers, and the locations of care as patients move through the health care system (3–5).

Patients with AFF usually undergo numerous TiC from the time of their initial ED presentation to disposition. Changes in patient’s level of care, for example, typically involve decisions made by the emergency physician regarding symptom management, rate or rhythm control, and additional diagnostic testing or imaging. In the United States, care provision commonly changes through specialist consultation and clinical handovers, and care location for example through temporary admission to specialized units (e.g., critical care, cardiology, and decision units). In Canada, most patients with acute uncomplicated AFF are discharged home after rhythm control strategies to restore normal sinus rhythm (NSR) and, depending on access, may be referred to follow-up care at a primary care provider (PCP) office or specialist outpatient clinic (6,7). During these transitions, coordination and communication errors can occur, resulting in delays in care and poor outcomes (4,8). The current evidence suggests that heterogeneity in AFF presentations and lack of adherence to existing clinical guidelines can impair time to treatment and increase AFF complications (9,10). To address the potential risks of delays in management or suboptimal TiC associated with AFF patients as they undergo ED management, various studies have proposed clinical pathways or structured postdischarge follow-up to provide physicians with recommendations (11,12). The objective of this systematic review was to examine the effectiveness of ED-related TiC-based interventions to improve outcomes (e.g., LoS, hospitalization, and presentations) for adult patients with acute AFF.

METHODS

We developed a study protocol a priori following the Preferred Reporting Items for Systematic reviews and

Meta-Analyses checklist and registered the protocol on PROSPERO (registration # CRD42017064058) (13).

Eligibility Criteria

For the purposes of this review, studies were included if they met the following inclusion criteria:

1. Randomized controlled trials (RCTs) and observational studies with a comparator arm investigating interventions to improve ED-related TiC for adult patients with acute symptomatic AFF.
2. Studies enrolling adults (>17 years of age) who presented to the ED with AFF.
3. Studies assessing any interventions in which the objective was to improve patient transitions within the ED or postdischarge. This included but was not limited to: guidelines or clinical pathways that provided standardized recommendations for management and criteria for patient disposition, interventions related to patient handovers, or referrals for any post-ED health care provider/facility. The interventions were required to include a component for discharge planning, whether it was standardized guidelines or criteria for admission, or referrals to a primary care provider, outpatient clinic, or educational program.

Exclusion Criteria

Noncomparative studies, opinions, editorials, and reviews were excluded from our systematic review, but no studies were excluded based on reported outcomes or results, country of origin, or language of publication.

Interventions

A description of the within-ED or post-ED TiC interventions were reported. Interventions implemented within the ED were described as using a predominantly rate or rhythm control strategy. Among the studies using a rhythm control strategy, the interventions were characterized as initiating electrical cardioversion (shock-first strategy) or medical cardioversion followed by electrical cardioversion (drug-shock strategy).

Outcomes

LoS was the primary outcome. For the purposes of this review, we subdivided LoS into ED LoS—specific to patient time spent in the ED from admission—and overall hospital LoS, defined as time spent in ED and while hospitalized. Additional outcomes of interest included quality of life, patient satisfaction, changes in patient

management (i.e., conversion to NSR, mode of cardioversion, and disposition), and adverse events (AFF complications, mortality, and relapse/reoccurrence of relapse). Finally, we examined the impact of the TiC intervention on communication and medication errors as a result of handovers.

Search Strategy

We completed a comprehensive search of 8 electronic databases, including CINAHL, Cochrane Library, EMBASE, Global Health, LILACS, Medline, PubMed and SCOPUS via an information specialist from database inception to February 2018 (Appendix B). We conducted a search of the “gray literature,” defined as sources outside of these standard bibliographic databases, to identify any studies published in nontraditional sources or unpublished research. Gray literature included ClinicalTrials.gov, OpenGrey, Google Scholar, SCOPUS forward searches of included RCTs, and references of relevant studies (11,14,15). We additionally hand searched the most recent medical conference abstracts (2012–2018) from the *Canadian Journal of Emergency Medicine*, *Academic Emergency Medicine*, and *Annals of Emergency Medicine*. There were no restrictions based on language, publication status, or year of publication.

Selection of Studies

Two reviewers (JG, RM) independently identified potentially relevant studies through title and abstract screening. Once identified, 2 independent reviewers (JG, RM) reviewed the full manuscripts for eligibility using predefined selection criteria. Disagreements were settled via third-party adjudication (CVR, SWK).

Data Extraction

Two reviewers (JG, RM) independently extracted data onto standardized forms that were verified for accuracy by a third party (CVR, SWK), with discrepancies resolved through discussion. We attempted to contact primary authors for clarification of any unclear data.

Quality Assessment

Two reviewers (JG, RM) independently assessed the quality of included studies, with disagreements mediated via a third party (SWK). We conducted quality assessment of the RCTs using the Cochrane Risk of Bias tool, before-after studies were assessed using the Before-After Quality Assessment tool, and cohort studies were assessed using the Newcastle-Ottawa Scale (16–18).

Fidelity Assessment

Fidelity assessment using the *Treatment of Fidelity Assessment Grid* was completed independently by 2 reviewers (JG, RM) and verified by 2 independent methodologists (CVR, KT); our discrepancies were resolved through discussion (19).

Data Synthesis and Analysis

When heterogeneity was low and sufficient data were available to allow for pooling, individual and pooled dichotomous outcomes were calculated as relative risks (RRs) with 95% confidence intervals (CIs) using a random effects model in Review Manager (RevMan) software (version 5.3; IMS Inc., Nordic Cochrane Centre, Copenhagen, Denmark). Continuous outcomes were calculated as mean difference with 95% CI using a random-effects model. We used a random-effects model because it was assumed that study effect sizes would not be identical because of inherent heterogeneity among the studies. Heterogeneity was tested using the I^2 statistic with I^2 values of 25%, 50%, and 75% representing low, moderate, and high degrees of heterogeneity, respectively (16). If a study that assessed multiple interventions was included in the same meta-analysis, the control group was halved to avoid double counting, as recommended by the Cochrane Handbook (16).

Our proposed subgroup analysis of the primary outcome included comparing atrial dysrhythmia type (fibrillation vs. flutter) and sex (male vs. female) could not be conducted as planned because of a lack of available data. In addition, preplanned sensitivity analysis of the primary outcome including fixed effects and study quality (excluding low-quality studies) could not be completed as planned because of a lack of available studies.

RESULTS

Search Results

With duplicates removed, 823 studies were eligible for screening (Figure 1). A total of 791 studies were excluded after relevancy screening, resulting in the full text review of 32 potentially eligible studies. Twenty-one studies were excluded, resulting in 11 included studies. One of the included studies was a 1-year prospective companion follow-up study of patients enrolled in another included RCT (14,20).

Study Characteristics

Characteristics of the studies and interventions are provided in Table 1. Briefly, 6 before-after studies, 3

RCTs, and 2 cohort studies were identified (11,12,14,15,20–26). The studies were published in peer-reviewed journals between 2002 and 2018. All studies enrolled patients with atrial fibrillation (AF); 4 studies specifically reported enrolling patients with AFF (21–24). Overall, the studies assessed 8 TiC interventions set within the ED, and 3 post-ED TiC interventions (11,12,14,15,20–26).

Within-ED TiC interventions. Among studies assessing within-ED interventions, 6 studies assessed clinical pathways with guidelines for management and disposition while 2 studies assessed ED observation units (11,12,15,21–25). The specific care recommendations and management strategies of the within-ED TiC interventions are provided in Appendix A. Briefly, the majority of studies recommended a predominantly rhythm-based strategy ($n = 5$), followed by rate control ($n = 1$), both strategies ($n = 1$), or provided no specifications ($n = 1$) (11,12,15,21–25). Among the studies recommending rhythm control-based strategies, more studies recommended either a shock-first or drug-shock strategy followed by strictly a shock-first strategy, or a drug-shock strategy (11,12,15,21,24,25). Of the 2 studies that recommended the use of either a shock-first or drug-shock strategy, 2 studies reported that physicians chose predominantly electrical cardioversion, while

another study reported that physicians primarily used medical cardioversion (15,21,25).

Studies using clinical pathways included stepwise flowcharts, decision aids, guidelines recommendations, and criteria for hospital admission or discharge. Three studies specified that the clinical pathways included referrals to follow-up care (22,23,25). The studies did not report recommendations or guidelines for consultations requests or patient handovers. Two studies stratified patients and made recommendations for care based on patient acuity or stroke/bleeding risk tools (21,23). Two studies assessed the impact of ED observation units on patient care (11,12). Patients presenting to the ED with AF were transferred to an observation unit, which incorporated care plans focusing on rate or rhythm control, cardiac monitoring, and reassessment for further treatment and disposition (11,12). One study arranged cardiology follow-up within 3 days of discharge while the other involved outpatient clinic referral within 2 weeks of discharge (11,12).

Post-ED TiC interventions. Post-ED TiC interventions ($n = 3$) consisted of patient education and referrals to a PCP for discharged patients (14,20,26). Two studies assessed standardized nurse-led AF education sessions, with summary pamphlet material and advised PCP follow-up (14,20). The third study involved direct referral to a structured, nurse-led, physician-supervised clinic involving AF education (26).

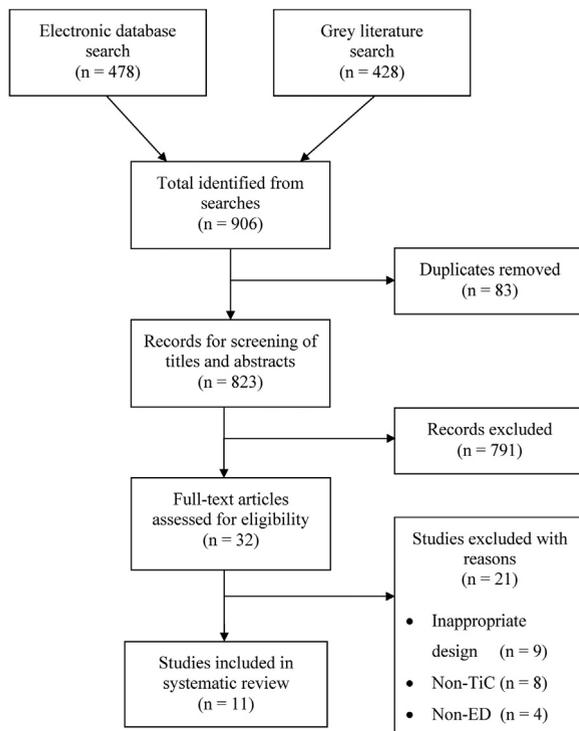


Figure 1. Systematic literature search overview. ED = emergency department; TiC = transitions in care.

Fidelity Assessment

The theoretical framework(s) supporting the study interventions were not described. While studies reported who provided training, their skills were not detailed. Intervention implementation was described for all studies; however, control groups were not described beyond a statement of “usual care.” Methods to ensure the patients received the intended components of the ED-related TiC interventions were not described in 8 of the 11 studies (14,20–26). Finally, steps taken to assess if study participants put new skills or behaviors into practice were only described in 3 of the included studies (Appendix C) (14,21,26).

Risk of Bias Assessment

Two of the 3 RCT studies had a high overall risk of bias with the third rated as unclear (11,14,15). Studies were considered as having a high risk of bias because of the lack of allocation concealment, lack of blinding of participants and personnel, insufficient reporting of enrollment/attrition, and selective outcome reporting (11,15). The quality of the before-after studies was moderate. Potential sources of bias included

Table 1. Descriptive Characteristics of the Emergency Department–Related Transition in Care Intervention Studies Included in this Systematic Review

Author and Year of Publication	Country of Origin	Subjects (n)	ED-TiC Type	Dysrhythmia Type	Intervention	Control Group
Within-ED interventions						
Clinical pathways						
Barbic et al., 2017 (21)	Canada	301	Before-after	Uncomplicated AFF <24 h	Clinical pathway with guidelines for management and disposition	Routine ED management
DeMeester et al., 2018 (22)	U.S.	1108	Before-after	New or recurrent AFF	An algorithm outlining evaluation, management, disposition, and follow-up	Routine ED management
Gehi et al., 2018 (23)	U.S.	198	Before-after	ECG confirmed AFF	Clinical pathway with guidelines for management and disposition with follow-up ensured	Routine ED management
Kim et al., 2002 (15)	U.S.	18	RCT	AF <48 h (55.6%), AF ≥48 h (16.7%), and AF unknown (27.8%)	Clinical pathway with guidelines for management and disposition	Routine ED management and hospital admission
Jones et al., 2006 (24)	U.S.	260	Before-after	AFF requiring admission	Clinical pathway with guidelines for management and admission to cardiology	Routine ED management and admission to internal medicine
Ptaszek et al., 2016 (25)	U.S.	359	Cohort study	EP-confirmed AF, history of AF (40.9%)	Clinical pathway with guidelines for management and disposition	Routine ED management and disposition
ED observation unit						
Conti et al., 2012a (12)	Italy	1552	Before-after	AF <48 h (63.0%) and AF ≥48 h (37.0%)	ED observation unit	Routine ED management
Conti et al., 2012b (12)	Italy	1923	Before-after	AF <48 h (63.0%) and AF ≥48 h (37.0%)	ED observation unit and referral to outpatient clinic for further investigation	Routine ED management
Decker et al., 2008 (11)	U.S.	153	RCT	AF <48 h (100%)	ED observation unit with guidelines for management and disposition	Routine ED management and admission to cardiology
Post-ED interventions						
Patient education and referral						
Carter et al., 2016 (26)	Canada	433	Before-after	“Newly diagnosed” AF	Referred to patient education clinic and GP referral	Routine ED management and specialist referral
Fuenzalida et al., 2015 and 2017 (14,20)	Spain	240	RCT	First-episode AF (15.4%), paroxysmal AF (24.2%), persistent AF (2.1%), and permanent AF (58.3%)	Patient education and GP referral	Routine ED management and discharge

AF = atrial fibrillation; AFF = atrial fibrillation and flutter; BA = before and after study; ECG = electrocardiogram; ED = emergency department; EP = emergency physician; GP = general practitioner; RCT = randomized controlled trial; TiC = transition in care.

nonrepresentative pre- or postintervention groups, lack of a valid outcome assessment, or the study groups being drawn from different sources (12,23,24,26). The quality of the cohort study was generally considered to be high (25).

Primary Study Outcome

Length of stay. Within-ED TiC interventions. The impact of the within-ED based interventions on overall hospital LoS was mixed (Table 2). Four studies assessed the impact of a clinical pathway on hospital LoS, of which 2 studies reported a decrease (43 vs. 82 h, $p < 0.01$) and inpatient LoS once admitted from the ED (32 vs. 85 h, $p < 0.002$) (15,23–25). Another study reported a decreased hospital LoS of <24 h among intervention patients (<24 h vs. 50.4 ± 55.2 h; p value not reported) (15). No differences in mean hospital LoS were reported after implementation of a clinical pathway vs. standard ED care (23). One study assessing the impact of an ED observation unit reported a significant decrease in median hospital LoS (10.1 vs. 25.2 h, $p < 0.001$) compared with standard hospitalization (11).

The impact of within-ED TiC interventions on ED LoS was also mixed (Table 2) (21,22,24,25). While 1 study reported that patients experienced reduced ED LoS after implementation of a clinical pathway (absolute difference 44.0 min [95% CI 36.2–51.8 min]), another study reported that patients attending a clinical pathway had an increased mean ED LoS (16 vs. 85 h, $p < 0.001$) compared with usual care (21,25). The remaining studies reported no significant differences in ED triage time or ED LoS after implementation of a clinical pathway (22,24).

Secondary Study Outcomes

Quality of life and Patient/ED staff satisfaction measures. None of the studies reported outcomes pertaining to quality of life, patient satisfaction, or health care provider satisfaction.

Conversion to sinus rhythm. Within-ED TiC interventions. One cohort study reported a significant increase in patients converting to NSR among patients attending a clinical pathway vs. standard ED care (RR = 1.39 [95% CI 1.24–1.56]; Figure 2) (25). The remaining studies did not report a difference in the proportion of patients converting to NSR (Figure 2) (11,12,15,25).

Mode of cardioversion. Within-ED TiC interventions. Seven studies reported the use of electric cardioversion (Figure 3) (11,12,15,21,22,24,25). One RCT and a pooled meta-analysis of 3 before-after studies failed to identify any differences in the proportion of patients undergoing electrical cardioversion after implementation of

a clinical pathway; however, 1 cohort study reported an increased use of electric cardioversion after implementation of a clinical pathway (RR = 1.36 [95% CI 1.03–1.81]) (15,21,22,24,25). Two studies assessing an ED observation unit reported that patients were more likely to undergo electrical cardioversion as reported in a RCT (RR = 2.20 [95% CI 1.38–3.49]) and a before-after study (RR = 2.38 [95% CI 1.73–3.27]) (11,12). Conversely, the evidence regarding chemical (aka: pharmacological) cardioversion in AFF failed to demonstrate an effect, with the largest before-after observational unit trial suggesting a modest benefit in favour of control (Figure 4).

Disposition. Within-ED TiC interventions. A significant decrease in hospitalizations was identified in 2 before-after studies (RR = 0.54 [95% CI 0.36–0.80] and RR = 0.63 [95% CI 0.42–0.92]) and 1 cohort study (RR = 0.20 [95% CI 0.12–0.32]) after implementation of a clinical pathway (Table 2) (12,22,25).

Adverse Events

AFF complications. Within-ED TiC interventions. Studies infrequently reported a relapse of AFF or related complications (i.e., stroke, thromboembolic events, bleeding, or complications after cardioversion) and no differences were found between the groups (Table 2) (11,15).

Post-ED TiC interventions. Among the 3 studies assessing post-ED TiC interventions, 1 reported a significant reduction in major complications (including heart failure, stroke, bradycardia, monitoring for >24 h or pacemaker, malignant dysrhythmias, or bleeding) and death among patients receiving nurse-led education compared with usual care patients (RR = 0.57 [95% CI 0.33–0.99]) (14). A significant decrease in heart failure-related complications (RR = 0.66 [95% CI 0.48–0.91]) among intervention patients after 12 months was found; however, no differences in complications related to stroke, antidysrhythmic treatment, anticoagulants, and subsequent hospitalizations were found (20). Finally, no differences in stroke and major/minor bleeding were reported between intervention patients referred to an education clinic/general practitioner referral compared with control patients who were only referred to a specialist (26).

Mortality. Within-ED TiC interventions. Death in AFF studies was rare, with only 1 study reporting a single death in the control group (21).

Post-ED TiC interventions. No differences in mortality between intervention and control patients were identified among studies assessing a post-ED TiC intervention (14,23,26).

Table 2. Overview of the Impact of Transition in Care Interventions on Patient Outcomes

Study	Secondary Outcomes					
	LoS	Disposition (Admissions)	Adverse Events	Conversion to Sinus Rhythm	Mortality	Relapse
Within-ED interventions						
Clinical pathways						
Barbic et al., 2017 (21)	ED LoS—I: 218 (IQR 152–375) min; C: 262 (IQR 162–431) min; significant decrease	NR	ED visits for CHF—RR = 0.18 (95% CI 0.06–0.51); significant decrease Bleeding—RR = 0.75 (95% CI 0.05–11.88) Stroke—0 events; no difference	NR	RR = 0.25 (95% CI 0.01–6.10); no difference	AF-related—RR = 0.96 (95% CI 0.54–1.70); no difference
DeMeester et al., 2018 (22)	ED LoS—I: 4.6 h; C: 4.73 h (p value not reported); no difference	RR = 0.84 (95% CI 0.78–0.90); significant decrease	NR	NR	0 events	ED presentations for any reason—RR = 0.97 (95% CI 0.53–1.77); no difference
Gehi et al., 2018 (23)	Hospital LoS—MD = 0.50 (95% CI –0.75 to 1.75); no difference	NR	NR	NR	NR	NR
Kim et al., 2002 (15)	Hospital LoS—I: 43 h; C: 82 h ($p < 0.01$); significant decrease ED LoS—I: 5.9 h; C: 6.5 h (p value not reported); no difference	NR	NR	NR	NR	NR
Jones et al., 2006 (24)	Hospital LoS—I: <1 day; C: 2.1 (SD 2.3) days (p value not reported)	NR	0 events	RR = 1.12 (95% CI 0.83–1.50); no difference	0 events	NR
Ptaszek et al., 2016 (25)	Hospital LoS—I: 32 h; C: 85 h ($p < 0.002$); significant decrease ED LoS—I: 85 h; C: 16 h ($p < 0.001$); significant increase	RR = 0.20 (95% CI 0.12–0.32); significant decrease	NR	RR = 1.39 (95% CI 1.24–1.56); significant increase	NR	AF-related—RR = 1.41 (95% CI 0.73–2.70); no difference
ED observation unit						
Conti et al., 2012a (12)	NR	RR = 0.66 (95% CI 0.59–0.74); significant decrease	NR	RR = 1.05 (95% CI 0.95–1.15); no difference	NR	NR
Conti et al., 2012b (12)	NR	RR = 0.44 (95% CI 0.39–0.50); significant decrease	NR	RR = 1.19 (95% CI 1.09–1.29); significant increase	NR	NR
Decker et al., 2008 (11)	Median hospital LoS—I: 10.1 h; C: 25.2 h ($p < 0.001$); significant decrease	NR	MI—RR = 0.35 (95% CI 0.01–8.37); no occurrences of CHF or stroke; no difference	RR = 1.17 (95% CI 0.99–1.38); no difference	0 events	Recurrent AF—RR = 1.04 (95% CI 0.41–2.63) Recurrent ED visit—RR = 0.96 (95% CI 0.62–1.50); no difference

(Continued)

Table 2. Continued

Study	Secondary Outcomes					
	LoS	Disposition (Admissions)	Adverse Events	Conversion to Sinus Rhythm	Mortality	Relapse
Post-ED TIC interventions						
Patient education and referral						
Carter et al., 2016 (26)	NR	NR	Stroke—RR = 0.62 (95% CI 0.19–2.01) Minor/major bleeding—RR = 0.70 (95% CI 0.21–2.37); no difference	NR	RR = 0.14 (95% CI 0.01–2.52); no difference	AF-related—RR = 0.69 (95% CI 0.42–1.13); no difference
Fuenzalida et al., 2015 (14)	NR	NR	RR = 0.57 (95% CI 0.33–0.99); significant decrease	NR	RR = 0.71 (95% CI 0.26–1.94); no difference	No difference in ED visits at 90 days (values not reported); no difference
Fuenzalida et al., 2017 (20)	NR	NR	Heart failure—RR = 0.66 (95% CI 0.48–0.91); significant decrease Stroke and systemic embolism—RR = 1.07 (95% CI 0.22–5.19) Antidysrhythmic treatment—RR = 0.80 (95% CI 0.18–3.51) Anticoagulation complications—RR = 1.07 (95% CI 0.52–2.21) Hospitalizations—RR = 0.77 (95% CI 0.52–1.13); no difference	NR	RR = 0.74 (95% CI 0.43–1.28); no difference	AF-related—RR = 0.84 (95% CI 0.64–1.09); no difference

AF = atrial fibrillation; C = control; CHF = congestive heart failure; ED = emergency department; I = intervention; LoS = length of stay; MD = mean difference; MI = myocardial infarction; NR = not reported; RR = risk ratio; SD = standard deviation TIC = transition in care.

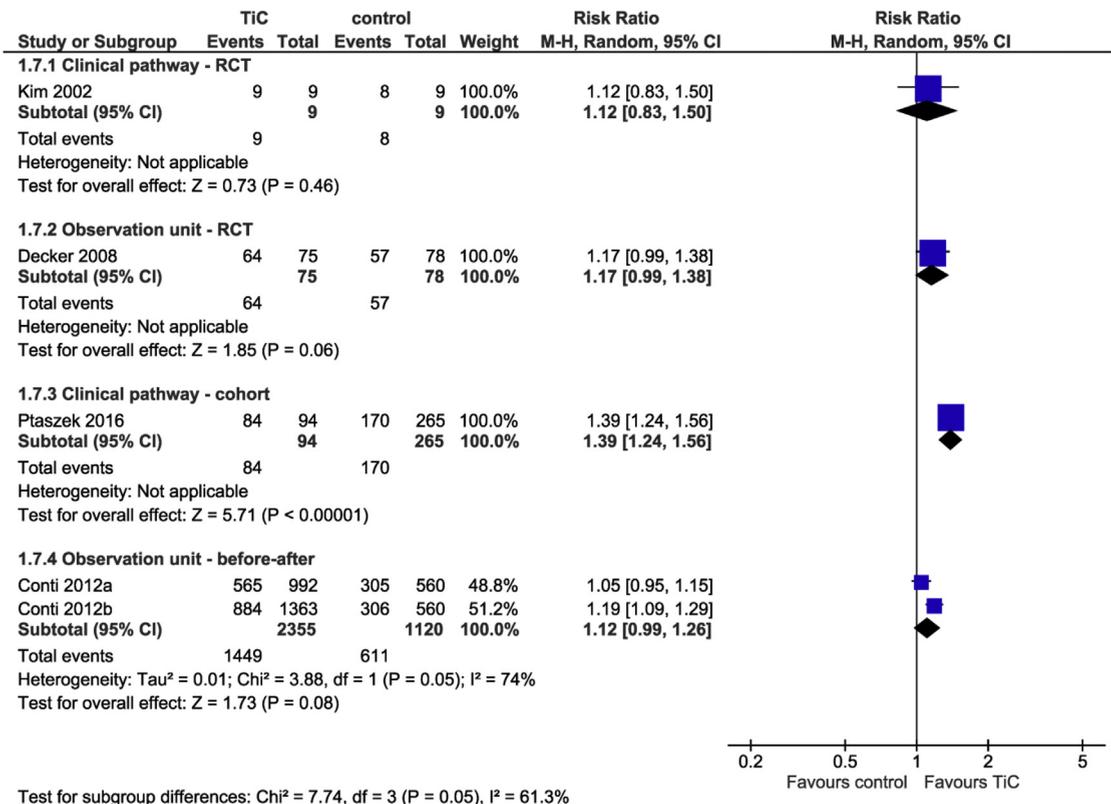


Figure 2. Forest plot comparing the conversion to sinus rhythm between patients who were allocated to within-ED TiC interventions and patients who received usual care. ED = emergency department; CI = confidence interval; RCT = randomized control trial; TiC = transitions in care.

Relapse/reoccurrence of AFF. Within-ED TiC interventions. No differences in AFF-related return visits to the ED between intervention and control patients was reported among any of the studies assessing within-ED TiC interventions (Table 2) (11,21,25).

Post-ED TiC intervention. There was no difference in the proportion of patients returning to the ED after the implementation of post-ED TiC interventions (Table 2) (14,20,26).

Communication/medication errors. None of the included studies reported on the impact of the TiC interventions on communication or medication errors.

DISCUSSION

This systematic review identified comparative studies assessing the effectiveness of interventions to improve transitions for patients presenting to the ED with acute AFF. While 1 previous systematic review conducted a broad evaluation of within-ED management strategies, that review included noncomparative studies and did not identify several intervention studies identified in this review (27). Overall, there is some evidence—albeit of low to

moderate quality—to suggest that within-ED TiC interventions can decrease hospitalizations and hospital LoS as well as demonstrate increased conversion to NSR. Moreover, the use of these interventions appears to be at least as safe as usual ED care in terms of patient mortality, complications, and relapse. The impact of TiC interventions specifically on ED LoS appears to be mixed because only 1 study assessing clinical guidelines reported a significant decrease in time spent in the ED among intervention patients (21). Moreover, the within-ED interventions identified in this review consisted of clinical pathways and ED observation units that aimed to help standardize care and criteria for disposition and did not attempt to establish any criteria for handovers or consultations. The confidence in the evidence identified in this review is further limited by significant heterogeneity and poor reporting of important clinical outcomes among studies. As a result, this review is unable to make any conclusions on the ability of these interventions to attenuate the risk for potential communication and coordination errors that may occur as a result of patient handovers and changes in providers or settings.

Despite several studies that incorporated post-ED referrals to a PCP or outpatient clinic, none of those studies assessed whether or not patients attended these follow-up

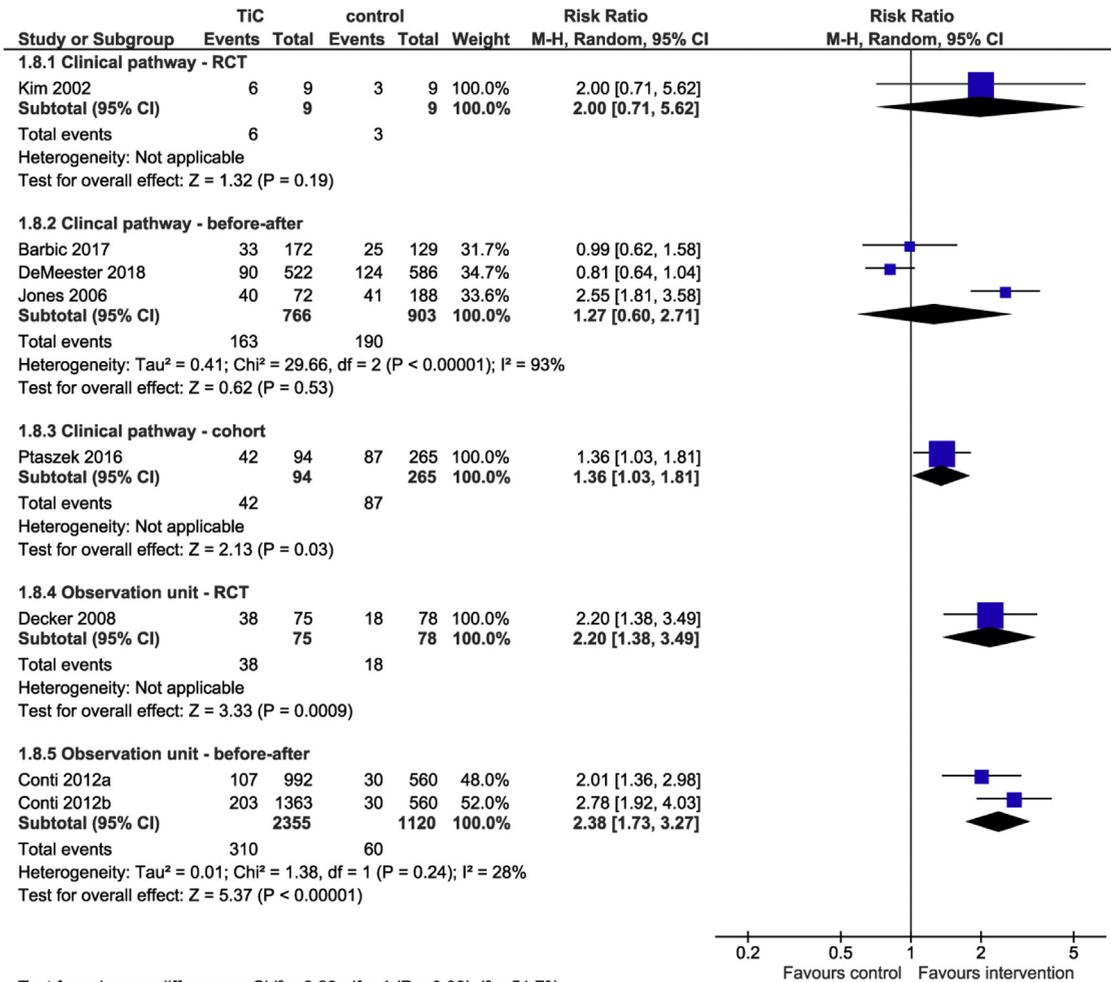


Figure 3. Forest plot comparing electric cardioversion between patients who were allocated to within-ED TiC interventions and patients who received usual care. ED = emergency department; CI = confidence interval; RCT = randomized control trial; TiC = transitions in care.

appointments. The effectiveness of post-ED interventions was lacking, and this effort may be less important than what is done in the ED. Overall, additional and higher-quality research is needed to further understand the comparative effectiveness of ED-related TiC interventions for patients presenting to the ED with acute AFF.

The current review suggests that implementing simplified AFF management guidelines could positively impact overall hospital LoS and reduce hospitalization by streamlining and standardizing patient management through the ED. It is important to note, however, that variation in the guidelines themselves, and what the studies considered as “usual care,” likely impacted the results of the included studies (25). There was a trend toward increased conversion to NSR across the studies, which could be attributable to an emphasis on early electrical cardioversion as part of the clinical care pathways used by the included studies (11,12,15,24). For patients with AF, success of electrical cardioversion in restoring NSR

has been reported to be as high as 90% (28). The impact of ED-related interventions to improve TiC for patients with AFF on patient/ED staff satisfaction, quality of life, disposition, and adverse events remains unclear.

Limitations

As with any systematic review, there is a risk of publication and selection bias. Publication bias could not be formally assessed because of an insufficient number of included studies (29). To mitigate the risk for publication and selection bias, a comprehensive literature search was conducted without restrictions, and studies were selected by 2 independent reviewers. There are several other limitations with regard to the generalizability of the review results. First, there was a relative paucity of high-quality research identified. Only 3 RCTs were included, with none demonstrating a low risk of bias. Second, the sample sizes of most studies were small and additional

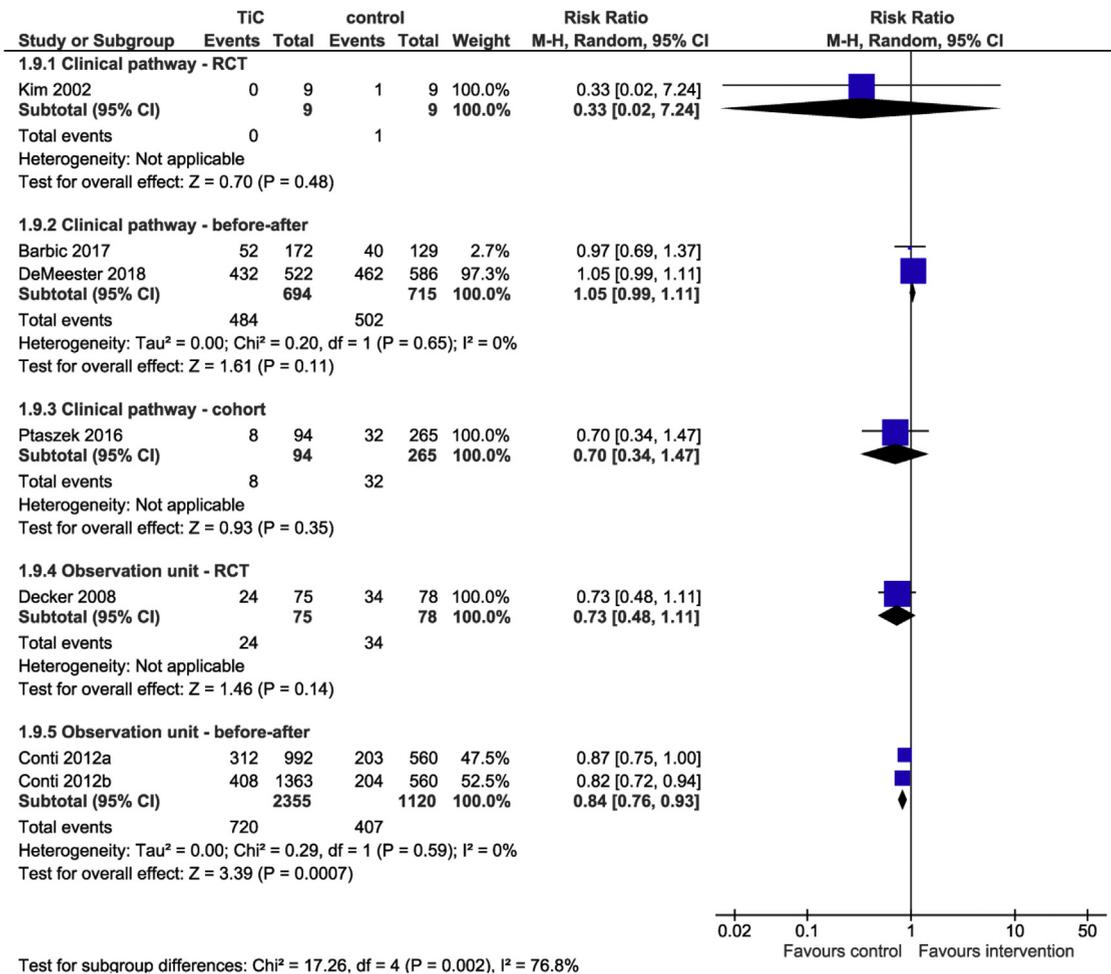


Figure 4. Forest plot comparing medical cardioversion between patients who were allocated to within-ED TiC interventions and patients who received usual care. ED = emergency department; CI = confidence interval; RCT = randomized control trial; TiC = transitions in care.

studies with larger patient populations are needed. Third, because of variability among the TiC interventions and inconsistent and incomplete outcome reporting, the majority of outcomes could not be pooled into a meaningful meta-analysis. Most studies lacked control arm descriptors beyond statements of “usual care” and had variable follow-up periods for reporting adverse outcomes. Similarly, AFF subtyping was poorly documented and only 1 of the 11 interventions reported associated costs (15). Fourth, it is important to recognize that these studies made clear distinctions between the timing of primary presentations and secondary presentations. For example, rhythm control strategies were restricted to primary presentations of recent onset (<48 h duration) AFF with limited comorbidities. Given the expected adverse effects associated with efforts to restore NSR in patients with delayed (>48 h duration) or secondary (e.g., those related to metabolic, pulmonary, or cardiac causes) presentations, these studies used conservative strategies (e.g., rate con-

trol and anticoagulation) in such cases. Finally, it should be noted that all of the within-ED TiC intervention guidelines included were conducted in the United States, where hospital admission proportions for ED presentations of AFF (~64%) have been shown to be significantly higher than other countries, potentially limiting wide-spread applicability of these guidelines (30,31).

CONCLUSION

There is evidence to suggest that ED clinical pathways and specialized observation units may reduce both within-ED and overall hospital LoS, increase the likelihood of successful cardioversion, and decrease hospitalizations for patients with AFF. They also appear to be no less safe than usual ED care in terms of patient mortality, complications, and relapse. Additional comparative effectiveness studies, however, are needed before wide-spread implementation.

Acknowledgments—This study was funded by a clinical research grant from the Emergency Strategic Clinical Network. James Gilbertson received a summer studentship from the Respiratory Health Strategic Clinical network. Retha Moghrabi received a summer studentship from the Northern Alberta Clinical Trials and Research Centre. Dr. Rowe's research was supported by a Tier I Canada Research Chair in Evidence-based Emergency Medicine (2011–2018) from the Canadian Institutes of Health Research (Ottawa, Ontario). The sponsors take no responsibility for the conduct, results or reporting from this review. We thank Mrs. Diana Keto-Lambert for her assistance with the literature search. Special gratitude to Dr. Ratika Parkash for corresponding to information requests. We would also like to thank Dr. Daniela Junqueira for her feedback.

SUPPLEMENTARY DATA

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.jemermed.2019.06.002>.

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Appendix A. Descriptive Characteristics of Within-Emergency Department Transition in Care Intervention Studies Included in this Systematic Review

Author and Year of Publication	Investigations Ordered	Rhythm vs. Rate Control	AC	Disposition
Clinical Pathways Barbic et al., 2017 (21)	ECG, other investigations NOS	Rhythm control predominant (shock first or drug-shock strategies). For unstable patients with AFF <48 h without hx of heart disease, recent stroke, or TIA, electrical cardioversion should be used (if stable, also considered pharmacologic conversion). For stable patients with AFF >48 h with a history of heart disease or recent stroke, rate control should be used	Unless obvious AFF cause, AC therapy was initiated based on stroke and bleeding risk tool scores	Unstable patients: if AFF duration >48 h or unknown duration, hx of heart disease, recent stroke, or TIA, urgent CCU consultation advised before cardioversion and discharge
DeMeester et al., 2018 (22)	Electrolytes, thyroid studies, ECG, and CXR; BNP only with concerns for CHF, cardiac enzymes for ACS; echocardiogram or further advanced imaging deferred until OP cardiology F/U	Rate control predominant. Patients treated with oral BB or CCB. IV infusions discouraged. Lenient rate control was encouraged, including heart rate <110 bpm considered as ideal before DC	Recommended AC deferral until OP cardiology F/U. Ultimate decision left to the ED clinician	NOS. Algorithm outlined 4 high-risk features requiring admission: hemodynamic stability, acute heart failure, ACS, and syncope. Patients without high-risk features were considered candidates for ambulatory care. Patients discharged from the ED received Rx for rate-controlling agents and educational pamphlets
Gehi et al., 2018 (23)	NOS. Patients were stratified into low-, moderate-, and high-risk categories, which modified their care	Not reported	Not reported	Not reported
Kim et al., 2002 (15)	ECG; cardiac enzymes, thyroid studies, and additional testing left to ED provider discretion. TEE if AF >48 h, duration unknown, or <48 h but hx of stroke or TIA	Rhythm control predominant (shock first or drug-shock strategies). Patients provided with either IV/PO metoprolol/diltiazem or IV esmolol. Those still in AF were stratified to patients with AF <48 h or AF >48 h or unknown duration. Cardioversion if AF <48 h and no hx of stroke or TIA, or AF >48 h and negative TEE. Received either medical cardioversion (ibutilide) or electrical. If received medical and not in NSR after treatment, received electrical cardioversion	TiC grouping received SC dalteparin (200 IU/kg, 18,000-unit maximum) after randomization. Patients with AF >48 h or unknown duration, or hx of stroke or TIA with a positive result after TEE received dalteparin or warfarin with a repeat TEE in 4 weeks. Patients who either spontaneously converted to NSR or there were no plans for cardioversion received aspirin	Patients who returned to NSR and received AC received a referral to an AC clinic and F/U with OP cardiology

(Continued)

Appendix A. Continued

Author and Year of Publication	Investigations Ordered	Rhythm vs. Rate Control	AC	Disposition
Jones et al., 2006 (24)	ECG, CXR, and “relevant laboratory studies” NOS	Rhythm control predominant (shock first strategy). BB or CCB, specifically diltiazem or metoprolol/esmolol if no contraindications. If no return to NSR, patients with AF <48 h and lower thromboembolic risk received electrical cardioversion. Patients with AF >48 h and high risk underwent TEE. Patients who did not have thrombus or significant SEC underwent electric cardioversion or received ibutilide. Patients in which the TEE identified thrombus or significant SEC did not undergo electric cardioversion and instead received warfarin for 3–4 weeks followed by elective cardioversion post-DC	Patients with AF >48 h or >1 moderate risk or any high-risk factor for cardioembolism received UFH, warfarin, and consult to an AC clinic	At ED provider discretion. If admission warranted, the aim was to admit directly to an inpatient cardiology team within 2 h of ED presentation
Ptaszek et al., 2016 (25)	ECG, other investigations NOS	Rate or rhythm control (shock first or drug-first strategy). The choice or rate of rhythm control was left to the discretion of the ED provider. If the physician chose a rhythm control strategy, the pathway recommended starting anticoagulation (NOAC) and expedited cardioversion. If the physician chose a rate control strategy, the pathway recommended starting anticoagulation if indicated based on the CHADS ₂ VASC score (NOAC if possible) and initiating rate control	Regardless of whether physicians decided to adopt a rhythm or rate control strategy, AC were initiated within ED (NOAC if possible)	Stable patients DC with arrangements made for OP F/U and AC management. Unstable or continued symptomatic patients were hospitalized with inpatient F/U and outpatient management arranged post-DC
ED Observation Units Conti et al., 2012 (12)	ECG, troponin I, blood gas analysis, and blood gas analysis. Blood tests, chest CXR, and serial ECGs were performed during the initial 6 h within the ED. Patients with an unclear clinical history or presentation received an urgent ECG. Positive or unclear findings on the aforementioned investigations required referral to an intensive observation unit before addressing rate or rhythm control	Rhythm control predominant (drug-shock strategy). AF onset <48 h and without significant structural heart disease received IV medical cardioversion (flecainide, propafenone, or amiodarone). Patients who did not return to NSR were considered for a second regimen of rhythm control drugs. Patients who did not return to NSR after the first- and second-line approaches underwent electrical cardioversion if appropriate	Patients with AF >48 h received AC. AC included SC LMWH or oral warfarin	Stable patients were referred to an OP clinic for F/U post-ED observation unit

(Continued)

Appendix A. Continued

Author and Year of Publication	Investigations Ordered	Rhythm vs. Rate Control	AC	Disposition
Decker et al., 2008 (11)	Electrolytes, CBC, glucose, ECG, and CXR	Rhythm control predominant (shock-first strategy). BB or CCB. Rate control was defined as a ventricular response <100 bpm at rest. All patients received continuous cardiac monitoring and were reassessed after 6 h. Patients still in AF after 6 h in the EDOU were sedated, electrically cardioverted, and observed for a further period of 2 h	Patients treated in the EDOU were not provided with any antiarrhythmic or AC on DC. Patients who were hospitalized after unsuccessful attempts to electrically cardiovert were provided with heparin upon admission to the cardiology service	Those in NSR after the 2-h observation period were DC home with cardiology F/U within 3 days. Patients enrolled in the study in the evening were observed overnight and cardioverted between 7 and 9 AM. Those remaining in AF after unsuccessful attempts to electrically cardiovert were admitted to an inpatient cardiology service

AC = anticoagulation; ACS = acute coronary syndrome; AF = atrial fibrillation; AFF = atrial fibrillation and flutter; BB = beta-blocker; BNP = brain natriuretic peptide; bpm = beats per minute; CBC = complete blood cell count; CCB = calcium channel blocker; CCU = coronary care unit; CHF = congestive heart failure; CXR = chest radiograph; D/C = discharge(d); ECG = electrocardiogram; ED = emergency department; EDOU = emergency department observation unit; F/U = follow-up; Hx = history; IV = intravenous; LMWH = low-molecular weight heparin; NOAC = novel oral anticoagulant; NOS = not otherwise specified; NSR = normal sinus rhythm; OP = outpatient; PO = per os; RCT = randomized controlled trial; Rx = prescription; SC = subcutaneous; SEC = spontaneous echo contrast; TEE = transesophageal echocardiogram; TIA = transient ischemic attack; TiC = transition(s) in care; UFH = unfractionated heparin.

ARTICLE SUMMARY

1. Why is this topic important?

Atrial fibrillation is the most common dysrhythmia presentation to the emergency department (ED), with patients often undergoing numerous transitions in care (TiC) and variable management. ED interventions targeting such TiC have been proposed to improve outcomes; however, no systematic reviews have examined this topic to date.

2. What does this review attempt to show?

This review summarizes the available evidence on the effectiveness of ED-based TiC interventions on length of stay, return to normal sinus rhythm (NSR), and other key health outcomes for adult patients with atrial fibrillation or flutter.

3. What are the key findings?

Patients involved in successful TiC interventions appear more likely to receive electrical cardioversion and convert to NSR than those receiving usual care. In addition, studies reported TiC interventions were associated with decreased length of stay and hospitalizations. Included studies, however, were of low to moderate quality and did not assess overall costs or patient satisfaction.

4. How is patient care impacted?

Emergency physicians may consider future implementation of standardized care pathways or protocols, with emphasis on electrical cardioversion, if the results reported in this review are applicable to their settings. Improvements in the quality of care, patient satisfaction, and other long-term outcomes remain unclear, meriting further clinical investigation.