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RESEARCH ARTICLE

Coordination of Atrial Fibrillation Management in the Emergency Department and Outpatient Settings

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ABSTRACT

Historically, a majority of patients presenting to the Emergency Department (ED) with a primary diagnosis of atrial fibrillation (AF) have been admitted to an inpatient unit. Treatment protocols for AF management in the ED have been shown to reduce the need for inpatient admissions and improve adherence to treatment guidelines for the administration of oral anticoagulation (OAC) therapy. Establishment of outpatient follow-up is a necessary part of discharging patients with AF from the ED. Follow-up planning can present a challenge for clinicians in the ED setting, as many patients who present to the ED with AF do not have an established cardiologist or cardiac electrophysiologist. Inability to arrange timely outpatient follow-up can therefore represent a barrier to discharge from the ED. The presence of outpatient clinics dedicated to AF management can help clinicians in the ED to manage patients with AF more efficiently. In this review, we describe the components of dedicated AF clinics. We also describe aspects of patient care that can be improved through implementation of dedicated AF outpatient clinics. These improvements include enhanced adherence with OAC therapy, reduced hospital re-admissions, improved patient outcomes, and reduced healthcare costs.

Introduction:

Atrial fibrillation (AF) is responsible for nearly 1% of all emergency department (ED) visits.¹ Retrospective studies have revealed that most patients presenting to the ED with AF are admitted to inpatient care units.¹⁻³ The progressive increase in the prevalence of AF has the potential to create an unsustainable increase in the demand for inpatient care resources.²⁻⁶ The increase in health care resources dedicated to AF management in the ED has motivated the creation of dedicated treatment pathways designed to provide comprehensive AF care without requiring inpatient admission.

Many of the earliest studies of treatment pathways for AF in the ED focused on early restoration of sinus rhythm with anti-arrhythmic drugs (AADs) or electrical cardioversion (DCCV).⁷⁻¹⁴ These studies demonstrated that a rhythm control strategy for AF management, including cardioversion, could be safely and effectively initiated in an ED setting without admission to an inpatient care unit. The treatment arms of many of these early studies mandated an attempt at restoration of sinus rhythm with either anti-arrhythmic drugs (AADs) or electrical cardioversion (DCCV). Subsequently published treatment pathways for AF in the ED have not mandated specific treatment strategies and have instead allowed individual clinicians to tailor the care strategy according to the needs of individual patients.¹⁵⁻¹⁸ In some cases, early rate control with return for cardioversion on an outpatient basis (if the patient does not convert on their own) has been implemented. These later iterations of AF treatment pathways in the ED were shown to reduce admissions to inpatient units and to enhance adherence with guidelines for utilization of oral anticoagulation (OAC) therapy in patients with AF.^{15, 16, 19-23}

Arranging for outpatient AF management from the ED is challenging and can be a barrier to hospital discharge.²⁴ Many of the patients who present to the ED with AF as the primary problem do not have a history of cardiac problems and therefore do not have an established relationship with a cardiologist. Moreover, treatments for AF that may be initiated in the ED, including AAD and OAC therapy, require close outpatient follow-up.

One previously published treatment pathway for AF in the ED addressed the transition to outpatient care by involving a cardiac electrophysiology consultant as soon as possible after the patient arrived in the ED.^{15, 16} This cardiac

electrophysiology consultant was available not only during the patient's hospital stay but was also available to coordinate outpatient follow-up visits, testing, and procedures. This support for the transition from ED to outpatient care could have been responsible for at least part of the reduction in inpatient admissions associated with utilization of this treatment pathway. Subsequently reported AF treatment pathways that involve referral to an AF "transitions of care" clinic have been shown to increase the rate of discharge from the ED.¹⁸

Our objective was to describe the data pertaining to atrial fibrillation transitions clinics. We performed a literature review. By using various keywords, data published up to 2023 in different databases namely PubMed, Cochrane Library, ResearchGate were searched and identified. The search terms were atrial fibrillation, transitions clinic, atrial fibrillation clinic and other relevant terms. This review article is of interest as it details potential optimised treatment to a disease burden that is progressively placing a toll on healthcare systems.

Structure of dedicated atrial fibrillation clinics:

Dedicated AF clinics are defined here as being outpatient clinics optimized for management of patients with AF, including patients without previously established cardiac care. Several organizational frameworks for transitional AF clinics have been described (Table 1). Some dedicated AF clinics described in published studies were "transitional" clinics that received patient referrals directly from ED clinicians.²⁵⁻³⁰ One described AF clinic received referrals from cardiology and non-cardiology clinicians on an outpatient basis.^{31,32} Yet another AF clinic recruited patients at the time of hospital discharge.³³

Most of the dedicated AF clinics described in the literature were staffed by multi-disciplinary teams that included nurse practitioners and clinical pharmacists who were supervised by cardiologists or cardiac electrophysiologists.^{25-27, 29-32} Clinic sessions were structured to address matters critical to AF management, including: initiation of OAC therapy when appropriate, screening for comorbid conditions, and review of data from clinical studies (e.g., ambulatory arrhythmia monitors). Education of patients and patient family members was performed by nursing staff with supervision from physicians. Clinical pharmacists were included in the clinic staff of many of these clinics to facilitate discussions of drug dosing and potential drug-drug interactions.

Structured care pathways for atrial fibrillation in the emergency department that include a transitional atrial fibrillation clinic can reduce the number of patients who require hospital admission:

An AF “transitions” clinic was established at an academic hospital in the United States to receive patients with AF discharged from the ED.¹⁸ This dedicated AF clinic was part of a structured AF care pathway within the ED that involved patient risk stratification. This dedicated AF clinic was staffed by clinical pharmacist practitioners who were supervised by cardiologists or cardiac electrophysiologists. Availability of this AF clinic was found to increase the likelihood of ED discharge from 19 to 43%.

Utilization of dedicated atrial fibrillation clinics can improve adherence to guidelines for OAC therapy:

Initiation of OAC therapy in qualifying patients is recommended by multiple AF management guidelines.^{22, 23} In the NCDR Pinnacle-AF registry, less than two-thirds of patients who met criteria for anticoagulation were prescribed an OAC drug.³⁵ Reluctance to initiate anticoagulation can be related to adverse clinical events associated with OACs, notably bleeding events.³⁶

Utilization of dedicated AF clinics has been demonstrated to improve adherence to guidelines for OAC therapy. One retrospective cohort study of a transitional AF clinic conducted in the United States evaluated adherence to ACC/AHA measures for patients presenting to an ED for AF.²⁵ This study compared outcomes in patients discharged with a standard outpatient appointment versus a specialized, nurse practitioner-led AF clinic. Patients who attended this AF clinic were more likely to have stroke risk assessed and documented than those who received standard outpatient care (99% vs 26%, $P<0.01$). In addition, patients in the dedicated AF clinic were more likely to be appropriately prescribed OACs (97% vs 88%, $P=0.03$) than patients in standard outpatient clinics. Inappropriate co-administration of OAC and antiplatelet medications was also less common for patients in the transitional AF clinic than in standard outpatient clinics (1% vs 9%, $P<0.01$).

Impact of a dedicated AF clinic in the Netherlands was assessed with a randomized clinical trial.³¹ Outpatients with AF, referred by either general practitioners or non-cardiology specialists, were randomized to receive care either in a nurse-led AF clinic or to receive routine care. In this study, enrollment in a nurse-led AF clinic was associated with better adherence to OAC

guidelines than standard outpatient care (99% vs 83% at the time of the first visit).

Utilization of dedicated atrial fibrillation clinics can decrease hospitalization and mortality rates:

The impact of dedicated AF clinics on mortality was described in a randomized clinical trial conducted in the Netherlands by the Maastricht group. Cardiovascular death and hospitalization were >30% lower for patients treated in a nurse-led, cardiologist-supported AF clinic than for patients who received standard outpatient care (hazard ratio (HR): 0.65; 95% confidence interval (CI) 0.45-0.93; $P=0.02$). This effect was attributed by the authors to an improvement in guideline adherence and patient education.³¹ This dedicated AF clinic was also found to positively impact patients' reported quality of life.³²

A Canadian cohort study examined outcomes for patients with new-onset AF who presented to an ED and were subsequently referred to a nurse-run, physician-supervised AF clinic.²⁶ Patients in this study received a telephone call 48-72 hours after ED discharge and were offered a group AF educational encounter prior to the first visit in the outpatient clinic. The primary outcome for this study was a composite that included death from any cause, cardiovascular hospitalization, and AF-related ED visits. The composite outcome was observed less frequently in patients referred to the dedicated AF clinic than in patients who received routine care (17% vs 26%, $P=0.05$).

An observational study performed at a teaching hospital in Italy assessed the impact of a structured AF care pathway in the ED involving observational units and an outpatient clinic.²⁹ This study included three cohorts. The first cohort received routine care. The second cohort received intensive observation within the ED, including placement in an observational unit. The third cohort received intensive observation within the ED and were also assigned to an outpatient clinic. More patients managed with routine care were admitted to inpatient units (50%) than patients managed with additional, intensive observation (38%) or patients managed with intensive observation plus outpatient clinic assignment (24%).

A multicenter randomized control trial conducted in Australia investigated the impact of an AF management program on patient outcomes following hospital admission.³³ In this study, patients assigned to an AF management program received a home visit and Holter monitoring 7-14 days after discharge. Outcomes of patients assigned to the dedicated AF management program were compared to outcomes of patients receiving routine

care. These outcomes were compared through clinical review 12 and 24 months after discharge. Median follow-up was 905 days. Assignment to the dedicated AF management program was associated with proportionally more days alive and out of the hospital than routine care. There was no difference between study cohorts with respect to prolonged event-free survival.

Dedicated atrial fibrillation clinics facilitate early substrate assessment and management of comorbid conditions:

Assessment of patient substrate is an important component of AF management.²³ Identification and treatment of risk factors in patients with AF is recommended in the latest European guidelines. Avoidance of AF triggers is known to be an important part of a rhythm control strategy. In addition, early imaging (echocardiography, cardiac CT, and cardiac MRI) facilitates identification of appropriate AADs as well as identification of patients who would benefit from expedited invasive therapy.

Dedicated AF clinics have been utilized to enhance screening for medical comorbidities that impact AF outcomes.²⁵ An observational study performed in an academic hospital in the United States demonstrated that tobacco use screening was better for patients assigned to a dedicated AF clinic after ED discharge than patients assigned to routine care (100% vs 14%, $P < 0.01$). Screening for alcohol use was also better for patients assigned to a dedicated AF clinic than to routine care (92% vs 60%, $P < 0.01$). In addition, screening for obstructive sleep apnea was better for patients receiving care in the dedicated AF clinic than routine care (90% vs 13%, $P < 0.01$).

Utilization of dedicated atrial fibrillation clinics can reduce health care costs:

Treatment of AF consumes a large amount of health care resources. One out of every three individuals of European ancestry have a lifetime risk of AF at index age of 55 years.³⁷ The proportion of health care resources devoted to AF management is projected to increase with the rise in the average age of the general population. Economic models predict the percentage of NHS expenditure related to AF to rise from predicted 0.9-1.6% to 1.4-4.3% over the next two decades.³⁸

Atrial fibrillation hospitalizations are associated with a high 30-day readmission rate. In the United States, 1 in 7 patients hospitalized for AF are readmitted within 30 days.^{39, 40} Hospital readmission is associated with a substantial increase in the cost of care.

The reduction in re-hospitalization rates associated with transitional AF clinics can translate into reduction in health care costs.²⁹ An observational study of 3475 patients in the United States demonstrated that in patients who underwent dedicated short-term outpatient clinic follow up following discharge were found to have significantly reduced hospitalization rates as compared to routine care. Another study described an AF treatment protocol emphasising appropriate cardioversion, use of oral rate-controlling medications, and expedited referral to an outpatient AF clinic. Utilization of this treatment protocol was associated with a decrease in the rate of hospital admission compared with standard care (from 74 to 38%).³⁴ Likelihood of return to the ED or re-admission within 30 days was not significantly different for patient who received care according to this treatment protocol and patients who received standard care. This translated into an average decrease in 30-day total direct health care costs of approximately USD\$1,400 per patient. Utilization of a treatment protocol for AF in the ED that involves direct referral to an outpatient AF clinic in Canada also produced a reduction in health care costs.²⁷ The average cost reduction in this Canadian program, which was implemented in three EDs, was CAD\$ 210.83 per patient.

Utilization of a dedicated AF clinic as part of a treatment protocol for AF management in the ED can increase the likelihood of patient discharge directly from the ED. One study describing an AF care pathway that included referral to a transitional AF clinic demonstrated improvement in ED discharge rate (as compared with routine care).³⁰ This increased ED discharge rate was not associated with an increase in repeat ED presentations for AF.

Dedicated atrial fibrillation clinics could enhance utilization of digital health tools:

During the COVID-19 pandemic, Maastricht University Medical Centre implemented a mobile health intervention in parallel with comprehensive AF care delivered by a multidisciplinary team.⁴¹ This photoplethysmography (PPG)-based technology facilitated rate measurement and rhythm identification. In addition, this system allowed patients to log symptoms and provided AF-related educational materials. This virtual strategy allowed for virtual continuation of multidisciplinary AF care and was implemented in multiple medical centers throughout Europe.

Conclusion:

Transitional AF clinics have been shown to enhance the effectiveness of structured AF management protocols in the ED. Utilization of transitional clinics as part of AF treatment protocols can enhance ED discharge rates and improve adherence with established AF treatment guidelines. In some studies, patient assignment to a transitional AF clinic is associated with lower mortality and AF re-hospitalization rates. Although some transitional AF clinics have demonstrated a

reduction in per-patient health care costs, establishment of such clinics can require significant resources. Further work will be required to determine cost-effectiveness of dedicated, multidisciplinary AF clinics.

Conflict of interest statement:

Praszek LM: consultant for Abbott, Bristol Myers Squibb, Medtronic, Moderna, NeuTrace, Pfizer, World Care Clinical; research grant from Anumana. Sharif Z: no conflict of interest to declare.

Table 1: Studies describing utilization of dedicated AF clinics.

Study	Intervention type	Study type	Number of patients	Primary outcome	Country	Findings
Abadie et al. ²⁵	Referral to AF transitions clinic post hospital discharge	Retrospective cohort study	N=238 -160 intervention -78 control	Adherence to ACC/AHA guidelines	United States	1. Improved stroke assessment and appropriate anticoagulation 2. Improved screening for co-morbidities
Gehi et al. ³⁰	Referral to AF transitions clinic post hospital discharge	Retrospective cohort study	N=198 -100 intervention -98 control	Discharge rate from emergency department	United States	1. Increased discharge intervention arm [43 vs 19%] 2. No increase in re-admission
Carter L et al. ²⁶	Referral to AF transitions clinic post hospital discharge -AF clinic nurse call pre clinic -Group education session	Retrospective cohort study, multicenter	N=433 -185 usual care -228 AF clinic group]	Composite endpoint of death, cardiovascular hospitalization and AF related ED visits.	Canada	Significant reduction in the composite endpoint [17 vs 26% P=0.05].
Conti A et al. ²⁹	Additional intensive inpatient observation with one arm undergoing referral to dedicated AF clinic	Retrospective observational study	N=3475 -1120 standard approach -992 additional inpatient observation -1363 referred to AF clinic in addition in inpatient observation	Hospitalization rate	Italy	Significantly reduced hospitalization rates compared to standard approach

Zimetbaum P et al. ³⁴	Expedited referral to outpatient AF clinic	Retrospective observational study		1. Cost-effectiveness 2. Hospitalization rate 3. Readmission rates	United States	1. Average decrease in 30-day total direct health care costs of approximately \$1,400 per patient 2. Decrease in hospitalization rate [74 vs 38%] 3. No difference in re-admission rates
Hendriks et al. ³¹	Standard care vs nurse led, guideline based, software supported AF care prior to 1 st outpatient clinic visit	Randomized control trial	N=712 -Final analysis 534 -248 usual care -286 intervention	1. Cardiovascular death and hospitalization 2. Adherence to guideline directed care	Netherlands	1. Significantly reduced composite of death and hospitalization 2. Improved adherence to guideline directed care
Hendriks et al. ³²	Standard care vs nurse led, guideline based, software supported AF care prior to 1 st outpatient clinic visit	Randomized controlled trial	N=712 -Final analysis 534 -248 usual care -286 intervention	1. Quality of life 2. AF-related knowledge level	Netherlands	1. Improved Quality of Life 2. Improved AF-related knowledge level
Stewart et al. ³³	Standard care vs Nurse home visit and subsequent AF clinic	Multicenter randomized controlled trial	N=335 - 167 standard approach - 168 intervention	Death and unplanned admissions	Australia	Post discharge AF management programme led to more days alive and out of hospital compared to standard management.
Saraswat MK et al. ²⁷	Standard outpatient care vs AF clinic after ED discharge	Multicenter before-and-after study	N=413 - 228 usual care - 185 AF clinic	Cost of care, QALY	Canada	Utilization of AF clinic after ED discharge led to average cost reduction of CAD\$210.83 and average QALY improvement of 0.0007 per patient.

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