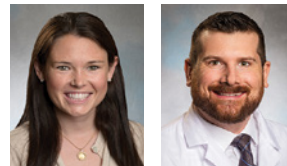


Following Hearts

Emergency Department Observation of Cardiovascular Disorders

LESSON 8



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Reviewed by John C. Greenwood, MD

OBJECTIVES

On completion of this lesson, you should be able to:

1. Determine which patients presenting with AF, VTE, and CHF will succeed in the EDOU.
2. Describe the typical EDOU pathway for observation, diagnosis, and treatment of patients with AF, VTE, and CHF.
3. List the clinical end points for disposition of patients with AF, VTE, and CHF from the EDOU.
4. Identify which patients require a cardiology consultation or inpatient admission after their EDOU stay.

FROM THE EM MODEL

- 3.0 Cardiovascular Disorders
- 3.4 Disturbances of Cardiac Rhythm

CRITICAL DECISIONS

- Which common cardiac complaints can be managed in the EDOU?
- What EDOU pathway should be established for the evaluation and treatment of AF?
- What EDOU pathways should be established for the evaluation and treatment of VTE and CHF?
- What are the advantages and disadvantages of managing cardiac patients in the EDOU?
- What clinical end points must be met before successfully discharging a cardiac patient from the EDOU?

Emergency department observation units (EDOUs) are being used with increasing frequency for patients with cardiac complaints. Given the high costs of inpatient admission and hospital crowding, such units can provide a safe, efficient, and feasible alternative for care. While chest pain is among the most common presentations managed with observation, patients with other cardiovascular disorders, such as atrial fibrillation (AF), venous thromboembolism (VTE), and congestive heart failure (CHF), can be effectively managed in an EDOU and be discharged home at near benchmark rates (~80%).¹ Recent evidence shows that, in such cases, observation may be safer and more efficient than inpatient care.²⁻⁴

CASE PRESENTATIONS

■ CASE ONE

A 74-year-old man with a history of hypertension presents with palpitations and light-headedness. His symptoms began 2 days ago, while walking his granddaughter to school, and he has been fatigued over the last 5 days. He has no history of an irregular heartbeat, and he is independent and active. He has no chest pain or associated shortness of breath. He reports feeling slightly nauseated but has had no vomiting or diarrhea.

The patient's vital signs are blood pressure 126/82, heart rate 145, respiratory rate 18, and temperature 37.1°C (98.8°F). His examination reveals AF with a rapid ventricular response, but no murmur and no evidence of fluid overload.

■ CASE TWO

A 32-year-old woman, who smokes and takes oral contraceptives, presents with shortness of breath and palpitations. She lives with her husband, sees her primary care physician regularly, and has no known allergies or personal or family history of blood clots. The patient recently returned 5 days ago from a work trip, which required a 6-hour flight across the country. Over the last 2 days, she has had increased shortness of breath with intermittent palpitations and chest pain with deep breathing.

The patient's vital signs are blood pressure 118/76, heart rate 110, and oxygen saturation 96% on room air. The emergency physician notes right, greater than left, lower-extremity swelling with mild right-calf tenderness to palpation.

■ CASE THREE

A 67-year-old man with a history of CHF, with an ejection fraction (EF) of 40%, presents after 5 days of dyspnea on exertion and increased bilateral lower-extremity edema. He has been traveling for work and forgot his medications at home. He has not taken his blood pressure medications or diuretics for the last 7 days. He also ate at restaurants more frequently and has gained 2 to 3 lbs. He has no chest pain, cough, fever, or chills.

The patient's vital signs are 180/90, heart rate 80, and oxygen saturation 93% on room air. The clinician notes a mildly elevated jugular venous distention (JVD), bibasilar crackles, and 2+ symmetric lower-extremity edema to the mid-calf. He is scheduled to see his cardiologist in 1 week.

Carefully designed EDOU protocols not only can reduce the significant costs of medical treatment, but also can help vulnerable patients avoid the hazards of hospitalization.

AF, the most common clinically significant arrhythmia, is projected to afflict more than 5 million patients by 2050.^{2,5} Approximately 60% of those who present with AF are admitted to the hospital.⁶ VTE, another common presentation, accounts for approximately 1% of inpatient hospital admissions in the US.⁷ Those admitted for VTE have an average length of stay of more than 6 days, with significant cost and no better outcomes than patients admitted to the EDOU.⁸ In addition, the prevalence of CHF is rising and costly, with an annual expenditure exceeding \$60 billion.⁹ One-third of patients with the diagnosis receive inpatient care each year, and at least 80% of those who present to the emergency department with a CHF complaint are hospitalized.³

CRITICAL DECISION

Which common cardiac complaints can be managed in the EDOU?

Atrial Fibrillation

In the US, most patients who present with a primary diagnosis of AF are admitted to the hospital. However, in Canada and Australia, most patients with AF are safely discharged home, with very low rates of stroke and death at 30 days.^{5,10} This practice variation increased interest in the development of EDOU protocols for the management of patients with AF in the US.^{2,5}

The key to the successful EDOU management of the disorder is appropriate patient selection. The best candidates are normotensive without evidence of concomitant illness (eg, acute coronary syndrome, heart failure) and a clear onset of AF within the last 48 hours.¹¹ Emergency physicians should check the patient's thyroid-stimulating hormone (TSH) when initiating laboratory tests to rule out a primary thyroid disorder.¹²

It is also important to determine the patient's clinical stability.⁷ Generally, patients are considered stable if they have

no chest pain, no ST-segment changes on ECG concerning for ischemia, no respiratory distress or evidence of fluid overload, no hypoxia or hypotension, and no simultaneously decompensated comorbid conditions complicating their AF, including sepsis, a gastrointestinal bleed, or other life-threatening conditions that require inpatient admission.^{6,13}

Patients being placed in the EDOU should have a systolic blood pressure (SBP) of 90 mm Hg or above and a heart rate below 130 beats per minute (bpm) after rate control with intravenous (IV) medications.⁵ Relative contraindications to observation include new-onset renal insufficiency or failure (especially if the clinician anticipates initiating anticoagulation), pregnancy, and poor health literacy. Other patients who may not succeed in the EDOU include those who lack close follow-up care, patients unable to adhere to a treatment plan, and those with challenging social situations that might complicate their care (eg, barriers to medication compliance and outpatient discharge follow-up).¹⁴

Patients with an unknown or delayed onset of symptoms can be managed in the EDOU using a modified pathway.

These patients should be rate controlled and anticoagulated with overnight cardiac monitoring. They may convert spontaneously to normal sinus rhythm, achieve adequate rate control on a new oral nodal blockade regimen, or require cardioversion (accompanied by transesophageal echocardiogram [TEE] to exclude mural thrombus) while in the EDOU.¹⁴

Venous Thromboembolism

VTE, a relatively common condition with an annual incidence of about 1 per 1,000 adults, poses a significant clinical burden on the individual and the health care system.^{15,16} Historically, patients with VTEs have been admitted to the hospital for close monitoring, given the concern for clinical deterioration and for the initiation of anticoagulation.¹⁷ The Pulmonary Embolism Severity Index (PESI), which was first published in 2005, uses 11 routinely available clinical predictors with different prognostic weights to determine the severity of a patient's pulmonary embolism (PE) (Table 1).^{18,19}

Using the PESI score, patients can be divided into one of five classes with a 30-day mortality rate ranging from 1.1% to 24.5%.¹⁸ Patients are considered low risk if they receive a PESI class I or II

score; such cases can be managed in the EDOU. Higher-risk patients, including those with evidence of right ventricular strain on their echocardiogram, elevated troponin or brain natriuretic peptide (BNP) levels, new hypoxemia, or dyspnea, should be admitted to the hospital, not placed in the EDOU.²⁰

A recent European clinical trial determined that patients with low-risk PE (PESI class I) can be safely discharged home on anticoagulants.¹⁷ However, since this practice has not yet been accepted by US providers as the standard of care, a well-designed EDOU protocol can provide monitoring and treatment, while obviating the need for unnecessary and lengthy inpatient admissions.^{4,17} An EDOU protocol is a prudent compromise between discharging patients home and admitting them to inpatient service; the approach allows for an extended period of monitoring, additional education, and an observed response to therapy.

Patients with a VTE must be appropriately selected for the EDOU protocol to be successful. After diagnosis, multiple factors can help determine an individual's risk for adverse events. Those who are hemodynamically stable and have normal blood pressure, no significant increased work of

breathing, and no new oxygen requirements are good candidates for observation.²¹ Abnormal vital signs, the presence of right-heart strain on echocardiography or CT, complicated residual deep vein thrombosis (DVT) (eg, free-floating thrombus, extension into the iliac or pelvis, or signs of vascular insufficiency), and elevated biomarkers, including BNP and troponin, have all been associated with increased adverse events and mortality at 5 days.^{21,22} Patients with these findings should not be moved to the EDOU.

Additionally, patients with recent hospitalizations for a CHF exacerbation or severe coronary artery disease with recent symptoms (within 30 days) have been shown to have an increased 30-day mortality rate after a PE. These cases require inpatient admission.²¹ Lastly, patients in high-risk social situations, including those with a history of drug or alcohol abuse or homelessness, prisoners, or patients with diminished mental capacity should be admitted to inpatient service.²¹

Congestive Heart Failure

CHF is a challenging, expensive, and deadly disease with a 2-year mortality rate of 35%.²³ The pathology is characterized by frequent, recurring symptoms of shortness of breath and volume overload, followed by frequent inpatient hospital admissions.²³ With appropriate patient selection and collaboration with the patient's outpatient providers, EDOU protocols have proven to reduce 90-day rates of rehospitalization and death in patients with CHF.²³ Additionally, EDOU protocols for low- to moderate-risk CHF cases are safe and more cost-effective than inpatient admission.³ In one study, the observation protocol produced a cost savings of \$3,600 per patient.³

Due to the complexity of the disease, strict inclusion and exclusion criteria are required to ensure that emergency physicians select the correct patients for observation. Those who present with complaints of orthopnea, dyspnea on exertion, shortness of breath, lower-extremity edema, or weight gain with known heart failure can be considered for the EDOU.^{3,23} Additionally, patients

TABLE 1. Pulmonary Embolism Severity Index¹⁹

Predictors	Score
Demographic characteristics	
Age	Age in years
Male sex	+10
Comorbid illnesses	
Cancer	+30
Heart failure	+10
Chronic lung disease	+10
Clinical findings	
Pulse ≥ 110 bpm	+20
Systolic blood pressure < 100 mm Hg	+30
Respiratory rate ≥ 30 breaths per minute	+20
Temperature $< 36^\circ\text{C}$ (96.8°F)	+20
Altered mental status*	+60
Arterial oxygenation saturation $< 90\%$ †	+20
Total Score**	

* Defined as lethargy, stupor, coma, or disorientation.

† With and without the administration of supplemental oxygen.

** Total score is obtained by adding the patient's age in years and the points for each applicable predictor. Total points correspond with the following risk classes: ≤ 65 class I, very low risk; 66-85 class II, low risk; 86-105 class III, intermediate risk; 106-125 class IV, high risk; ≥ 126 class V, very high risk.

with physical examination findings consistent with CHF, including extremity edema, JVD, S₃ gallop, and/or crackles heard on the lung examination may be considered. Patients with laboratory findings suggestive of CHF, including an elevated BNP level with radiological evidence of pulmonary edema and cardiomegaly, should also be included in the EDOU protocol.³

Patients who likely require inpatient admission, and are thus excluded from EDOU admission, include those with unstable vital signs, especially a SBP above 220 mm Hg or below 100 mm Hg, respiratory rate above 25, heart rate above 130 bpm, and fever. Patients with hypoxia or newly required supplemental oxygen to keep their O₂ saturation greater than 90% also require inpatient care.^{3,23} In addition, patients with an ECG showing ischemia or with laboratory values, including an elevated troponin level, indicating cardiac ischemia should not be admitted to the EDOU.²³

Relative contraindications include patients with a creatinine level above 3 mg/dL or BUN above 40 mg/dL and those with a sodium level below 135 mEq/L.²⁴ Cases of new-onset CHF require a more extensive diagnostic evaluation and new medication initiation and titration beyond the scope of an EDOU visit.³ Again, patients with difficult social situations that prevent them from following up should not be admitted to the EDOU.²⁵ Ideal observation patients with CHF are those whose exacerbation has a known trigger (eg, dietary indiscretion or missing medications), who are not in extremis but demonstrate mild volume overload and would benefit from diuresis.^{24,26}

CRITICAL DECISION

What EDOU pathway should be established for the evaluation and treatment of AF?

Atrial Fibrillation

Once an otherwise stable patient is determined to be in AF, the next step is to decide whether the heart rate should be controlled or converted to a normal sinus rhythm. Opinions differ as to which strategy to pursue, so the EDOU

protocol should clearly recommend a specific approach based on local institution resources and input from key hospital leaders.

Several studies have shown no differences in 5-year outcomes of stroke or death with rate versus rhythm control in patients older than 65 years; when managing the elderly, the rate should be controlled first.¹³ Once the patient's rate is controlled on oral medications, anticoagulation, if indicated, can be initiated. The patient's rhythm can be converted on a later date after anticoagulation.²⁷

Patients who are 65 years of age or younger, who present with a clear time of onset of less than 48 hours, appear to benefit from conversion to a normal sinus rhythm and should be considered for medical or electrical cardioversion.¹³ Before cardioversion, the clinician must consider the patient's risk of immediate stroke. Risk factors for stroke after conversion from AF to a normal rhythm include unknown time of AF onset, a history of transient ischemic attack or stroke in the last 6 months, a mechanical heart valve, or rheumatic heart disease.²⁷ Patients who are at higher risk of poor outcomes should be managed with a focus on rate rather than rhythm control.

In addition, patients with electrolyte disturbances, such as hypokalemia or digoxin toxicity, are at high risk of poor outcomes with rhythm conversion and should be managed initially with rate control.¹³ Those without these risk factors, who present within 48 hours

of AF or have already been adequately anticoagulated for more than 4 weeks before presentation, can be cardioverted with a pharmacological agent or with electrical cardioversion.^{14,27}

Pharmacology

If the decision is made to control the patient's rate, the EDOU protocol should guide the clinician on which pharmacological agent to use. Beta-blockers (most commonly metoprolol) and nondihydropyridine calcium-channel blockers (most commonly diltiazem) are the most frequently used medications for AF rate control.²⁸ The decision as to which drug to use is dependent on patient-specific factors and provider preference.

Calcium-channel blockers can be a more effective initial choice for achieving adequate rate control.²⁸ However, beta-blockers are preferred in patients with a decreased EF and in those already taking beta-blockers.²⁹ After the administration of the IV agent in the emergency department (but prior to arrival in the EDOU), the patient should receive the equivalent oral dose of the medication to maintain adequate rate control (defined as <100 bpm-110 bpm at rest and <110 bpm-120 bpm when ambulatory).¹⁴

If a patient is a candidate for rhythm control, the EDOU protocol should specify the options for rhythm conversion, as determined by the institution.¹⁴ A synchronized electrical cardioversion at 150 joules to 200 joules of energy with anterior posterior

TABLE 2. CHA₂DS₂-VASc Score to Assess Stroke Risk in Patients with Nonvalvular AF

Risk Factor	Score
Congestive heart failure	1
Hypertension	1
Age ≥75 years	2
Diabetes mellitus	1
Stroke/TIA/thromboembolism	2
Vascular disease	1
Age 65-74 years	1
Female sex	1
Total Maximum Score	9*

*Patients with a score of <1 require no anticoagulation. Patients with a score of 1 should be considered for an oral anticoagulant, aspirin, or no treatment. Patients with a score of ≥2 should be considered for treatment with an oral anticoagulant.

**Table adapted from *Short Stay Management of Atrial Fibrillation* by Peacock et al.¹¹

pad placement has been shown to successfully convert patients 90% of the time.^{13,27,30} For those who are poor sedation candidates, chemical cardioversion may be preferred. The most common pharmacological antiarrhythmic agents for AF in the US are oral flecainide (class Ic) or IV ibutilide (class III).^{13,27} Decisions about how to convert patients to a normal sinus rhythm should be made when establishing an AF EDOU pathway and should involve experts from both emergency medicine and cardiology.¹⁴

Following cardioversion or rate control, the next step of the EDOU protocol should help the provider determine the patient's need for long-term anticoagulation.¹¹ The most commonly used and validated clinical tool to determine if a patient with AF requires anticoagulation is the CHA₂DS₂-VASc score, which calculates the risk of stroke and thromboembolism in patients with AF.¹¹ This scoring system assigns points for each of the major risk factors for stroke in patients with AF (Table 2).^{11,31}

The American Heart Association (AHA) recommends oral anticoagulants for a score of 2 or above.¹³ In addition to calculating the patient's stroke risk, providers must assess the patient's bleeding risk. One validated scheme is the HAS-BLED score (Table 3).¹¹ A score of 3 or above indicates a high risk for bleeding.¹³ If the patient is also at high risk for stroke, the decision to prescribe anticoagulants should be made in collaboration with the patient, patient's advocate, and outpatient providers, weighing the risks and benefits of anticoagulation and using shared decision making to come to a conclusion.³⁰

The choice of which anticoagulation method to use should be predetermined by the EDOU treatment algorithm. Historically, warfarin has been the most commonly used agent. However, the drug interacts with numerous foods and other medications, and requires routine blood draws to monitor the

TABLE 3. HAS-BLED Score for Bleeding Risk in Patients with AF****

Risk Factor	Description	Score
Hypertension	Systolic blood pressure >160 mm Hg	1
Abnormal liver or renal function	Renal disease,* liver disease**	1
Stroke	History of stroke	1
Bleeding	Predisposition or prior major bleeding episode	1
Labile INRs	Inconsistent INR lab values	1
Elderly	Age >65 years	1
Drugs/alcohol	Medications that increase risk of bleeding and excessive alcohol use	1
Total Maximum Score		9***

* Renal dialysis, renal transplant, or creatinine level >2.6 mg/dL.
 ** Cirrhosis, bilirubin >2X normal, or ALT/AST/ALP >3X normal.
 *** Score ≥3 indicates a high risk of bleeding.
 **** Table adapted from *Short Stay Management of Atrial Fibrillation* by Peacock et al.¹¹

therapeutic window.¹¹ Direct oral anticoagulants (DOACs) have become increasingly popular and are generally preferred to warfarin in patients with nonvalvular AF (AF in the absence of rheumatic mitral stenosis, a mechanical or bioprosthetic heart valve, or a mitral valve repair) because DOACs are more convenient for patients and are equally safe and effective.^{11,27}

Additionally, there is no required bridge with unfractionated heparin (UFH) or low-molecular-weight heparin (LMWH) when initiating rivaroxaban or apixaban, as there is with warfarin. DOACs are also preferred in situations where the patient cannot reliably get their international normalized ratio (INR) blood levels checked or adhere to the diet restrictions required when taking warfarin.^{11,13}

Follow-Up Care

Regardless of the anticoagulant, patients require education prior to discharge regarding the potential medication and diet interactions, proper self-administration, and signs and symptoms of bleeding. Patients with renal failure, new acute renal insufficiency, or hepatic disease might require a consultation with a cardiologist or vascular medicine specialist regarding appropriate anticoagulation methods.^{21,32} Since many important factors must be considered when initiating a new anticoagulation regimen, a checklist or other decision tool to help guide

clinicians is very useful and should be embedded in the EDOU protocol.

CRITICAL DECISION

What EDOU pathways should be established for the evaluation and treatment of VTE and CHF?

Venous Thromboembolism

Once a patient has been selected for the EDOU, the protocol for monitoring and treatment of a VTE should include telemetry, initiation of anticoagulation, performance of an echocardiogram and/or bilateral lower-extremity duplex ultrasound, if indicated, and a consultation with case management or the hospital thrombosis service to help arrange outpatient follow-up.²⁰

Historically, any patient with a VTE was started on UFH as a bridge to a long-term oral vitamin K antagonist, most commonly warfarin, and admitted to the hospital.^{32,33} In the late 1990s, multiple studies proved that LMWH is as safe and effective as UFH for the treatment of acute VTE, with lower costs to both the hospital and patient and an improved quality of life.^{34,35} Fondaparinux, an antithrombin III-mediated selective inhibitor of factor Xa, is an alternative parenteral option to LMWH.¹⁷

In the last decade, several DOACs have been approved in the US and Europe for the treatment of VTE in adults, including three direct factor

Xa inhibitors (rivaroxaban, apixaban, and edoxaban) and a direct thrombin inhibitor (dabigatran).¹⁷ The starting dose of rivaroxaban is 15 mg twice daily with food for 21 days, followed by 20 mg by mouth daily after 21 days and continued for 3, 6, or 12 months, depending on the patient's risk factors.^{21,32}

Apixaban is dosed at 10 mg twice daily for the first 7 days, followed by 5 mg daily thereafter.¹⁷ Edoxaban dosing is weight based with an initial dose of 30 mg or 60 mg daily, after 5 to 10 days of therapy with a parenteral anticoagulant (most commonly fondaparinux or LMWH).¹⁷

The advantages of DOACs are that they can be given orally (unlike LMWH, UFH, and fondaparinux, which must be given parenterally), they have a rapid onset of action with predictable effects, and they do not require laboratory tests or monitoring, which makes them more convenient for patients and increases patient medication compliance.^{17,18} However, DOACs have not been approved for use in pregnant patients, as they cross the placenta, and data on their use in patients with active cancer are limited.¹⁷

Pregnant patients and those with cancer are generally managed with enoxaparin 1 mg/kg, injected into the subcutaneous tissue twice daily.^{17,32} DOACs are also not approved for patients with extreme body weights (low or high), severe renal impairment with a creatinine clearance (CrCl) below 30, known antiphospholipid antibody syndrome, or liver cirrhosis.¹⁷ These special populations should receive heparin with at least a 5-day bridge to warfarin.^{21,32} Caution should be used when prescribing DOACs in patients with new renal insufficiency or with a CrCl between 30 and 60; these patients might require renally adjusted dosing.³²

Patients must receive close follow-up in an anticoagulation clinic after their emergency department observation.⁴ Additionally, education should be provided on the risks of bleeding while taking anticoagulants.²⁰ The reason for the VTE should also be considered. If the disorder is unprovoked (ie, the patient had no risk factors for VTE),

the EDOU protocol should provide recommendations for obtaining a hypercoagulability panel, including but not limited to, beta-2 glycoproteins, an antiphospholipid panel, and prothrombin gene mutation testing.²¹ These laboratory tests should be ordered in coordination with the hospital thrombosis service to ensure appropriate follow-up.²⁰ Education is a key part of any EDOU stay; this is particularly true for patients taking anticoagulant medications.

Congestive Heart Failure

To reap the rewards of an EDOU program, emergency departments should create clear CHF treatment guidelines in collaboration with the hospital's cardiology division.²³ Generally, the patient should undergo continuous cardiac and pulse oximetry monitoring, with a full set of vital signs obtained every 4 hours.²⁶ Nursing staff should closely monitor the patient's intake and output, and a no-salt-added diet should be followed.²³ A predetermined diuresis plan should also be designed, with input from the cardiology department.²⁴

For example, Peacock et al created a furosemide algorithm with instructions to double the patient's daily 24-hour dose, given as a single IV bolus (180 mg maximum), followed by a doubling of the previously administered dose if the 2-hour urine output goal was less than 0.5 L for a creatinine level less than 2.5 mg/dL, or less than 0.25 L for a creatinine level above 2.5 mg/dL. The goal should be for the patient to diurese at least 1 L during the EDOU stay, or until there is symptomatic improvement or weight loss after diuresis.²⁴

Additional EDOU interventions include serial troponin tests, a basic metabolic panel every 6 hours, an echocardiogram if the patient's EF is unknown or not up-to-date, and the initiation and titration of an angiotensin-converting enzyme (ACE) inhibitor.^{23,24} Vasodilators should be considered in the form of sublingual or topical nitroglycerin for hypertensive patients.²⁴

Once again, patient education and care coordination are essential to a successful EDOU visit. Patients should receive information about their heart failure, discuss dietary triggers with a nutritionist or educated nursing staff member, and schedule a home health visit.²³

CRITICAL DECISION

What are the advantages and disadvantages of managing cardiac patients in the EDOU?

Atrial Fibrillation

Care for patients with AF in the EDOU is a safe, cost-effective strategy, compared to the alternative of inpatient admission. One advantage is a shorter length of stay, as demonstrated by the results of one randomized trial, in which patients managed in the EDOU had a mean length of stay of 13 hours compared to 50 hours when admitted to an inpatient service.² The same study also demonstrated that patients in the EDOU experience similar levels of rate and rhythm control compared to patients admitted to inpatient service.² In addition, patient satisfaction scores improved, primarily due to the shorter length of stay.³⁰

Pearls

- Stable patients with clear treatment and discharge plans, as well as close outpatient follow-ups, are the best candidates for EDOU care.
- Patients can be discharged from observation if their vital signs have normalized, their serial cardiac enzymes are negative, their prescriptions have been filled, and they have a scheduled outpatient appointment.
- When creating a protocol, ensure that the departments of cardiology, medicine, and hematology are involved and that a clear mechanism is established to transfer patients to the inpatient team when deemed necessary by EDOU providers.



A disadvantage of the EDOU management of AF is that not every patient will be able to avoid inpatient admission. The way in which the clinical course will develop is not always predictable; therefore, the EDOU protocol must include a contingency plan to expedite hospital admission that clearly articulates the criteria for admission and how to facilitate the transition of care. The EDOU must contain trained nurses and providers who can respond if a patient's clinical status deteriorates.¹¹ Studies reveal inpatient admission rates for AF cases managed in the EDOU to be near benchmark levels of about 20%. This is an expected outcome for a population that has an uncertain need for inpatient care at the outset of the observation stay.¹

Venous Thromboembolism

In Europe and Canada, patients with VTE are more often discharged from the emergency department and managed in the outpatient setting.¹⁷ This practice has not been universally adopted in the US because providers are concerned about clinical deterioration at home, despite ample evidence that outpatient therapy is safe.^{4,17} While select, low-risk patients should be discharged home from the emergency department, others require more testing, additional education on VTE, and anticoagulation. Overall, EDOUs reduce costs, decrease hospital length of stay, and ease emergency department and hospital crowding.¹⁷

One of the barriers to the observation of VTE patients comes with familiarizing clinicians with the

EDOU protocol; it is important for providers to feel comfortable with the strategy and use it appropriately.²⁰ The unit must be staffed with knowledgeable case managers who can help identify financial constraints or insurance issues that can prevent patients from filling prescriptions.¹⁷

Patients who require hospital admission should not stay in the EDOU for longer than 24 hours.¹⁷ One study demonstrated that despite a detailed EDOU protocol for VTE, approximately 25% of eligible patients eventually required inpatient admission.⁴ This result means that 75% of patients were discharged home; if there had been no EDOU protocol, these individuals may have otherwise been admitted to the hospital.⁴

Congestive Heart Failure

Unlike the other cardiac complaints, CHF lacks a prospectively derived "risk score," a drawback that places the burden of risk stratification on the individual clinician.³ Studies have demonstrated that patients with a negative initial troponin level and a SBP above 160 mm Hg at presentation have fewer adverse events, including fewer arrhythmias, myocardial infarctions, and deaths.²⁵ However, emergency physicians often default to admitting patients, given the acute presentation and social risk factors, or the provider's previous clinical experience.³

The advantage of the EDOU is that it functions as a bridge for further testing and objective risk stratification in the form of serial cardiac markers and echocardiography, if indicated. It also

allows time for treatment modalities such as diuretics to take effect.³ Time in the EDOU also provides the opportunity for additional patient education and coordination of home care.^{3,23}

The potential disadvantages are similar to those for other cardiac complaints, in that the EDOU protocol requires nurses trained in cardiac care, case managers familiar with the needs of patients with CHF, and a clear mechanism for admission if the patient fails the EDOU protocol at 24 hours. CHF has a more subjective end point based on how the patient feels, a variability that can lead to more inpatient admissions. Patients with CHF also tend to have comorbid illnesses, such as diabetes and ischemic heart disease; this can make it more difficult to complete discharge within the 24-hour or two-midnights timeframe of a typical EDOU stay. As a result, subsequent inpatient admission is expected for this patient population.

CRITICAL DECISION

What clinical end points must be met before successfully discharging a cardiac patient from the EDOU?

Atrial Fibrillation

Patients managed in the EDOU for AF must meet specific end points prior to discharge. Patients must have their AF rate controlled or their rhythm converted to normal sinus rhythm for at least 1 to 2 hours prior to discharge.⁵ Most EDOU protocols also require negative serial cardiac biomarker tests prior to discharge, although an evaluation for acute coronary ischemia should only be pursued if a clinical concern exists.⁵ Patients must also have an outpatient follow-up appointment established within 3 to 5 days. Creating a reliable system to accommodate this request, especially outside of regular clinic hours, is typically a challenge that requires support from senior administrative leadership.

In addition, a 30-day prescription for the selected method of anticoagulation, if indicated, should be given.⁶ Case management should be engaged if



Pitfalls

- Selecting patients for the EDOU who do not meet protocol inclusion criteria, which can lead to an increased rate of inpatient admissions and a decrease in the cost-effectiveness of observation.
- Failing to properly train emergency department providers, nurses, and case managers on the appropriate use of the EDOU, which can lead to inappropriate admissions and/or underutilization of the observation protocol.
- Failing to arrange outpatient treatment for patients prior to discharge, which can lead to medication and treatment nonadherence.

there is any concern that a patient's pharmacy benefit might prevent filling a discharge prescription. Any patient who has not been cardioverted but is being discharged on rate-control medications should be prescribed the lowest, long-acting oral dose equivalent to what was administered in the EDOU.¹⁴ Finally, patients and their families should be provided with strict return instructions, so they understand when symptoms necessitate a return to the emergency department.

Venous Thromboembolism

As with EDOU patients with AF, patients with VTEs must meet certain clinical criteria prior to discharge. Vital signs should be normal with a SBP above 100 mm Hg, heart rate below 110 bpm, and no supplemental oxygen requirement.²¹ Serial cardiac enzymes should remain negative; if they become positive, cardiology should be consulted.²¹ Prior to discharge, patients

must have a scheduled outpatient appointment within 72 hours with hematology, cardiology, or vascular medicine to manage anticoagulation, as designated by the individual hospital system. Patients must also receive their prescriptions and meet with a case manager to resolve potential insurance coverage problems to avoid missed medications.¹⁷

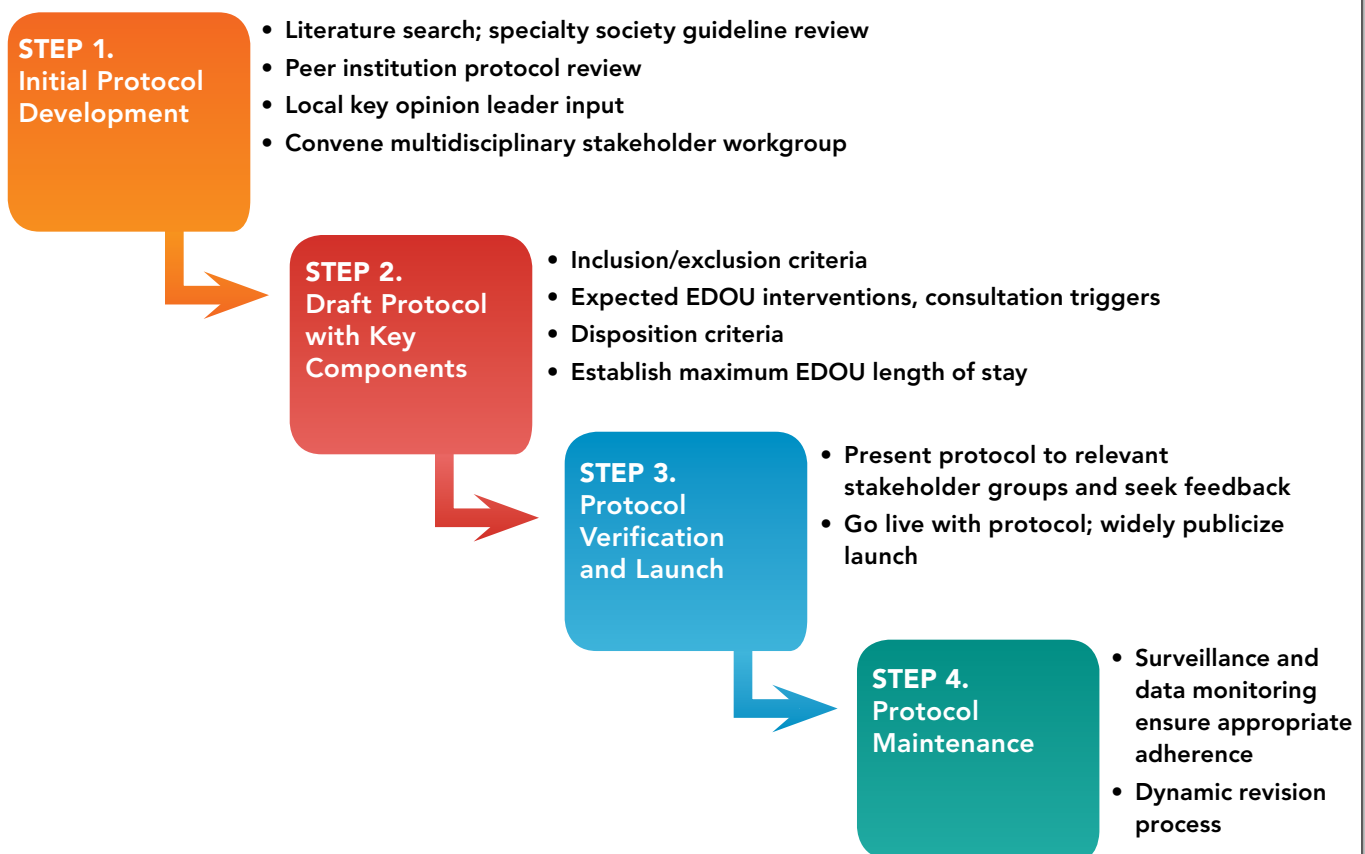
Congestive Heart Failure

Discharge criteria for the CHF EDOU protocol should be well defined with a specific time limit.^{3,23} Generally, patients who are ready to go home must have symptomatic improvement and not have any high-risk features, such as positive cardiac enzymes, ECG changes, severe electrolyte disturbances, or significant vital sign abnormalities.³ Unlike other cardiac complaints, the patient's subjective report of symptom improvement is essential to determining discharge

readiness in cases of CHF.²³ A secondary marker that indicates the patient is ready for discharge includes a normal lactate level (as a surrogate marker of tissue perfusion); however, there are no clearly defined treatment end points.³ That said, patients should demonstrate evidence of adequate diuresis in the form of 1 L urine output, weight loss, or a decreased JVD.²⁴

Patients must be ambulatory without light-headedness, dizziness, or chest pain and have improved shortness of breath.²³ Other criteria that must be satisfied prior to discharge include a resting heart rate below 100 bpm, a SBP above 90 mm Hg, and a room air saturation above 90% (if not chronically on supplemental O₂).²³ Patients with poor urine output, persistent hypo- or hypertension, ongoing or worsening symptoms, and/or a serum sodium level below 135 mEq/L should be admitted.²⁴ Patients should also be educated about

FIGURE 1. EDOU Protocol Development Process*



*Allow 3-6 months from initial development to implementation of a new protocol.

CASE RESOLUTIONS

■ CASE ONE

Since the onset time of the elderly man's AF was unclear, he was rate controlled with diltiazem in the emergency department and then placed in the EDOU. Overnight, his rhythm spontaneously converted to a sinus rate in the 70s. Given the patient's low HAS-BLED score of 1 (for his age) and his CHA₂DS₂-VASc score of 2 (for his age and hypertension), he received rivaroxaban.

He was educated on his new diagnosis, the risk of stroke, and the potential complications of anticoagulation therapy. The case manager confirmed that the patient's insurance would cover a prescription for rivaroxaban, and he was discharged home with a plan to follow up with cardiology in 72 hours.

■ CASE TWO

The emergency physician initiated a CT PE study based on the young woman's symptoms, vital signs,

history of smoking, and use of oral contraceptives. The CT revealed a subsegmental PE with no concern for right-heart strain. The patient's PESI score placed her in class I, a low-risk group with a 0% to 1.6% rate of 30-day mortality. Rivaroxaban was prescribed, and she was placed in the EDOU, where she underwent bilateral lower-extremity ultrasounds, a formal cardiac echocardiogram, pain control, and anticoagulation.

Overnight, her pain was controlled with acetaminophen, and her heart rate normalized. Her laboratory tests were notable for two negative troponin results and a negative pregnancy test; a hypercoagulation panel was also ordered. The patient met with the case manager, who ensured that her insurance would cover her prescription and scheduled a follow-up appointment in the vascular medicine clinic in 72 hours. She was discharged within 12 hours of being placed in the EDOU.

■ CASE THREE

The elderly man with a history of CHF was placed in the EDOU and given 80 mg of IV furosemide, which produced 0.5 L of urine output in the first 2 hours. His renal function was normal; therefore, his other home medications, including lisinopril, were restarted. The patient's serial cardiac enzymes were negative, and he had no arrhythmias or vital sign abnormalities during the night. He was restarted on his home medication of 40 mg of oral furosemide with ongoing diuresis.

In the morning, the patient ambulated to the bathroom without shortness of breath or dizziness. His outpatient cardiologist was contacted, and an appointment was made for him to be seen in the clinic in 3 days. A care coordinator worked with the patient to acquire a travel pillbox, and the patient was educated on the importance of not missing his medications. He was discharged home 16 hours after presenting to the emergency department.

CHF and diet, and be provided with prescriptions for diuretics and an ACE inhibitor, if indicated. Outpatient follow-up must be established prior to discharge.²⁴ If a patient fails to meet the criteria for discharge to home within 24 hours or so, a clear mechanism for cardiology consultation and inpatient admission should be predetermined and included in the EDOU protocol.²³

Special Considerations

The EDOU guidelines for AF, VTE, and CHF should include a well-designed backup plan in the event the protocol fails, necessitating subsequent inpatient admission. The criteria for when a consultation is indicated and thresholds for admission should be established ahead of time. Figure 1 outlines the steps for protocol development and the need for multidisciplinary stakeholder engagement in the development phase. EDOU patients with AF, VTE, or CHF can be admitted to the department of

medicine or cardiology, depending on institution preference.¹¹

Summary

Care in the EDOU for common cardiac complaints, including AF, VTE, and CHF, is a safe and cost-effective alternative to inpatient admission.²⁻⁴ Protocols should be designed with specific inclusion and exclusion criteria, treatment algorithms, and discharge end points to ensure patient success. EDOU strategies should include input from hospital leadership, emergency physicians and leadership, the department of cardiology, the department of medicine and/or hematology, advanced-practice providers, and nursing and case-management leadership, as success is dependent on the participation of each group.¹⁴

A clear mechanism for facilitating a safe transition of care must be in place should a patient require transfer from the EDOU to an inpatient floor. All observation protocols require close

outpatient follow-up; therefore, those with unstable social circumstances or a lack of health literacy are poor candidates for the EDOU.

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