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Cardiac and pulmonary emergencies: Protocols for effective management and treatment via pharmacists, emergency medical services, and the role of health informatics in future responses

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Abstract--Background: The aging population in the U.S. is rapidly increasing, with those aged 65 and older expected to reach 95 million in the next 40 years. This demographic shift leads to a higher prevalence of cardiopulmonary emergencies, which are commonly encountered in emergency departments (EDs). This paper explores four prevalent conditions—atrial fibrillation (AF), congestive heart

failure (CHF), pulmonary embolism (PE), and pneumonia—and their specific considerations in elderly patients. **Aim:** To review the management protocols for these cardiopulmonary conditions in older adults and to highlight the unique challenges and considerations associated with their treatment and management via pharmacists and ED. The review also focus on the main role of health information system in the future responses to cardiac and pulmonary conditions. **Methods:** The study involves a comprehensive review of current literature on the epidemiology, pathophysiology, and management of AF, CHF, PE, and pneumonia in elderly patients. The focus is on treatment protocols, diagnostic strategies, and the impact of age-related factors on disease management. **Results:** Effective management of these conditions requires tailored approaches due to age-related physiological changes. For AF, anticoagulation therapy is crucial but must be carefully balanced against bleeding risks. CHF management often involves diuretics and vasodilators, with a need for careful monitoring. PE diagnosis and treatment are complicated by atypical presentations and increased bleeding risks. Pneumonia remains a significant cause of mortality and requires prompt, effective treatment due to altered respiratory function in older adults. **Conclusion:** Managing cardiopulmonary emergencies in the elderly requires a nuanced approach that considers the increased risk of complications. Emergency protocols should integrate age-specific considerations to optimize outcomes for this vulnerable population.

Keywords---Atrial fibrillation, congestive heart failure, pulmonary embolism, pneumonia, elderly care, emergency medicine.

Introduction

The population of Americans aged 65 and above is projected to almost double, reaching 95 million within the next 40 years. As individuals grow older, they experience physiological changes that increase their vulnerability to specific health conditions. This article examines four prevalent cardiopulmonary conditions that are frequently encountered in emergency departments (EDs), with a focus on the distinct considerations for elderly patients. These conditions include atrial fibrillation (AF), congestive heart failure (HF), pulmonary embolism (PE), and pneumonia [1].

Atrial Fibrillation

Epidemiology and Pathophysiology:

Atrial fibrillation (AF) represents the most prevalent cardiac arrhythmia, impacting approximately 2.5 million individuals in the United States. This condition disproportionately affects older adults, with 70% of all AF cases occurring in patients aged 65 to 85 years [2]. As people age, the heart undergoes structural remodeling and alterations in neural regulation. Enlargement of the left atrium, dysregulation of the autonomic nervous system, ion channel dysfunction,

and diminished left ventricular diastolic filling due to hypertrophy all contribute to an increased risk of AF in older adults [3]. Individuals with AF face a heightened risk of stroke, especially in older populations, where the risk can be as high as 23.5% in patients aged 80 to 90 years [4]. Additionally, older patients are more likely to experience severe functional impairments following a stroke, which can significantly affect their ability to perform daily activities and increase their susceptibility to falls. Anticoagulation therapy is the primary preventive measure for thromboembolic stroke; however, the risks of bleeding, frequent falls, and drug interactions are critical considerations for elderly patients [5].

Management:

In the emergency department (ED), the approach to treating older AF patients with rapid ventricular rates is similar to that for other patients. For unstable individuals presenting with hypotension, altered mental status, chest pain, shortness of breath, or acute congestive heart failure, the priority is to stabilize the patient through synchronized electrical cardioversion. If the patient is stable, treatment options include rate control (with beta-blockers or calcium channel blockers) or rhythm control (via chemical or electrical cardioversion). Studies have shown that both approaches are similarly effective, but patients who undergo cardioversion tend to have shorter ED stays [6,7]. The duration of AF symptoms is another key factor to consider in ED patients. Historically, patients in rapid AF for less than 48 hours were thought to have a low risk of venous thromboembolism (VTE) within 30 days after electrical cardioversion, with a risk of 1.1% [8]. However, more recent research suggests an even shorter window for electrical cardioversion—less than 12 hours—with a VTE risk of only 0.3% [8]. Additionally, calculating the CHA2DS2-VASc score (which accounts for congestive heart failure, hypertension, age, diabetes mellitus, prior stroke or thromboembolism, vascular disease, and sex) helps determine the risk of VTE following cardioversion and guide decisions on anticoagulation in AF patients. Lip and colleagues [9] found that patients with a CHA2DS2-VASc score of 0 experienced no thromboembolic events, while those with scores of 1 had less than a 1% risk, and those with scores of 2 to 5 had a risk ranging from 1.9% to 3.9%.

Anticoagulation Considerations in Older Patients:

The use of anticoagulation to prevent VTE in AF patients has been a controversial issue, particularly in older adults who have higher risks of falls and bleeding. The two primary options for anticoagulation therapy are vitamin K antagonists (VKAs) such as warfarin, which require regular monitoring of the International Normalized Ratio (INR), and direct oral anticoagulants (DOACs) like rivaroxaban, apixaban, and dabigatran. A key age-related factor is the decline in renal function, which can impair the elimination of VKAs and DOACs, increasing the risk of bleeding. This is captured in bleeding risk prediction tools such as the HAS-BLED score (which accounts for factors like hypertension, renal or liver dysfunction, stroke history, and medication use) or the HEMORR2HAGES score (which considers hepatic or renal disease, ethanol use, malignancy, age, reduced platelet function, and fall risk) [10,11]. Cost is another critical factor in selecting anticoagulation therapy, as DOACs are considerably more expensive than warfarin. However, the need for frequent transportation to laboratory facilities for

INR monitoring must also be considered. For low-risk patients with a CHA₂DS₂-VASc score of 0 or 1, aspirin (81 mg) is a viable alternative. Multiple clinical trials and meta-analyses have demonstrated a 21% relative risk reduction when comparing aspirin to placebo, while an even greater reduction of 62% was observed with warfarin compared to placebo [12,13]. However, older patients carry a higher risk of life-threatening or fatal bleeding, with an anticoagulation intensity-adjusted relative risk of 4.6 for individuals over the age of 80 [14].

Clinicians should exercise caution when prescribing anticoagulation therapy for patients at high risk of falls, engaging in a thorough risk-versus-benefit discussion with all individuals. Recent research on fall-related hemorrhages in patients on VKA has been mixed, with some studies reporting no differences in acute intracranial hemorrhage rates, while others indicate increased bleeding risks. Patients with a higher CHA₂DS₂-VASc score of 2 or more, signaling an elevated risk of stroke or myocardial infarction (MI), appear to derive overall benefit from anticoagulation, even with a heightened hemorrhage risk [15]. A meta-analysis by Deng and colleagues [16] examined five phase III randomized controlled trials to assess the efficacy and safety of VKAs versus DOACs for stroke or systemic embolism prevention in older adults (aged >75 years). The findings revealed that DOACs were associated with a lower incidence of stroke/systemic embolism and major bleeding compared to warfarin (hazard ratio: 0.71; 95% confidence interval: 0.33–1.50), with apixaban ranking as the most effective (71.4% rank probabilities) [16].

Summary:

Atrial fibrillation (AF) is a common condition in elderly patients, and treatment strategies vary based on symptom duration and clinical presentation. Acute treatment may involve either electrical cardioversion or medical management with rate or rhythm control. A critical consideration for newly diagnosed patients in the emergency department is the use of anticoagulation to prevent VTEs and stroke. Given that older adults are often at a higher risk of falls or significant bleeding events, it is essential for physicians to have a risk-benefit discussion with patients and use clinical decision-making tools. Treatment options include VKAs (such as warfarin) or DOACs, with the latter generally offering a safer bleeding profile. Ultimately, care should be individualized, with decisions made collaboratively between the patient and clinician.

The HAS-BLED scoring system:

The HAS-BLED scoring system is a clinical tool used to assess the risk of major bleeding in patients on anticoagulation therapy. It assigns points based on various risk factors, each contributing to a cumulative score. The factors include uncontrolled hypertension (systolic blood pressure >160 mm Hg), renal disease (dialysis or creatinine levels above 2.26 mg/dL), and liver disease (cirrhosis or abnormal bilirubin or liver enzymes). A history of stroke or major bleeding, labile INR (with less than 60% time in the therapeutic range), age over 65 years, excessive alcohol use (over 8 drinks per week), and the use of medications such as aspirin, clopidogrel, or NSAIDs, which increase bleeding risk, each add one

point to the score. The maximum possible score is 9, indicating the highest bleeding risk.

The International Normalized Ratio (INR):

The International Normalized Ratio (INR) is a standardized measurement used to assess how long it takes for blood to clot. It is primarily used to monitor patients who are on **anticoagulant therapy**—medications like warfarin that reduce blood clotting. The INR is based on a **prothrombin time (PT)** test, which measures how quickly blood forms a clot. Since different laboratories might use slightly different methods to measure PT, the INR helps standardize results so they can be compared accurately, regardless of where the test is conducted. For most people not on anticoagulants, a normal INR is around **1.0**. For those on warfarin, the target INR range is usually between **2.0 and 3.0**, depending on the condition being treated. Higher INR values indicate **thinner blood** (taking longer to clot), while lower values suggest **thicker blood** (clotting faster). Maintaining the right INR range is crucial because an INR that's too low increases the risk of clots (such as strokes), while an INR that's too high increases the risk of bleeding.

The HEMORR2HAGES scoring system:

The **HEMORR2HAGES** scoring system is a clinical tool used to evaluate a patient's risk of bleeding while on anticoagulation therapy. Each clinical characteristic is assigned a score, contributing to a total that reflects bleeding risk. The factors include hepatic or renal disease, ethanol abuse, a history of malignancy, being older than 75 years, reduced platelet count or function, rebleeding risk, uncontrolled hypertension, anemia, genetic factors, excessive fall risk, and a history of stroke. Each factor, except for rebleeding risk, which is assigned 2 points, is given a score of 1. The maximum possible score is 12, indicating a high risk for bleeding.

Congestive Heart Failure (CHF):

Congestive heart failure (HF) remains a leading cause of hospital admissions and readmissions among older adults. The prevalence of acute HF has grown due to higher survival rates from myocardial infarction (MI) and the increasing geriatric population. Despite advancements in diagnostic and therapeutic interventions, survival rates for patients with decompensated HF have not significantly improved over the years [17]. Aging contributes to decreased vascular elasticity, which elevates afterload, promotes left ventricular hypertrophy (LVH), and increases coronary oxygen demand. When oxygen requirements are unmet, ischemia and fibrosis can occur, resulting in systolic and diastolic HF. Additionally, reduced cardiac output diminishes renal perfusion, triggering the renin-angiotensin system, which leads to elevated catecholamine levels, causing vasoconstriction and increased renal absorption, further worsening HF.

HF is generally categorized into two types: diastolic HF (HF with preserved ejection fraction, HFpEF) and systolic HF (HF with reduced ejection fraction, HFrEF), with HFpEF being the most prevalent form in older adults, accounting for around 50% of all HF cases [18]. Classic symptoms include shortness of breath,

leg swelling, abdominal distension, orthopnea, and dyspnea during exertion, but older patients often exhibit atypical symptoms like fatigue, confusion, and decreased appetite. Infection, noncompliance with medications or diet, cardiac arrhythmias, and anemia are common triggers of decompensated HF. Additionally, aortic stenosis is a significant concern in older adults, with severe cases affecting 2% to 7% of individuals aged 65 years and older. This condition, often caused by widespread atherosclerotic disease, is characterized by late-stage symptoms such as dyspnea, angina, and syncope, which are often mistaken for other comorbidities [19]. Caution is advised with vasodilators and fluid resuscitation, especially when a systolic murmur is present, as it may be the only indicator of the condition. Definitive treatment for symptomatic patients includes either surgical or transcatheter aortic valve replacement [20].

Diagnosis:

The diagnosis of acute heart failure (HF) is primarily clinical, relying on the patient's history and physical examination. Patients may show signs of volume overload, such as abdominal distension and leg edema, or they may present with symptoms like tachypnea, shortness of breath, bibasilar rales, wheezing, diminished breath sounds, and jugular venous distension. Point-of-care ultrasonography (POCUS) is a valuable tool for assessing heart function, including the detection of reduced ejection fraction, a dilated and minimally collapsible inferior vena cava (greater than 2.5 cm with less than 50% diameter change), pericardial effusion, or left ventricular hypertrophy (LVH). Thoracic ultrasound at the bedside can help differentiate between volume overload and primary pulmonary issues like obstructive lung disease. The presence of diffuse pulmonary B lines may indicate an acute interstitial condition, such as pulmonary edema associated with HF. Additionally, pleural effusions at the lung bases are more accurately detected through ultrasound than chest X-rays. A study by Zanobetti and colleagues demonstrated excellent agreement between POCUS and emergency department diagnoses in acute HF cases, with a kappa value of 0.81 [22,23]. Laboratory evaluations can aid diagnosis, including age-adjusted pro-brain natriuretic peptide (pro-BNP) levels, which for patients over 85 years old, have a gray zone range of 250 to 590 pg/mL. Comparing these levels to the patient's baseline is key for accurate interpretation. High-sensitivity troponin levels may also be elevated, typically due to myocardial ischemia resulting from HF rather than an acute coronary syndrome. Many of these patients also experience acute renal failure.

In acute heart failure (HF), transaminitis can result from cardiorenal and cardiohepatic syndromes, which are caused by cardiac congestion and reduced blood flow to vital organs. Prompt diagnosis and treatment are critical to improving mortality and morbidity in older patients, as repeated decompensations worsen their long-term prognosis. Patients should be positioned upright to aid respiration, with oxygen therapy reserved for those with oxygen saturation below 90%. Noninvasive positive pressure ventilation (NIPPV) is recommended for those in acute respiratory distress due to pulmonary edema, as it reduces intubation rates and improves early outcomes. Vasodilators like nitroglycerin are the first-line treatment for decompensated HF and should be titrated to reduce afterload. Nitroglycerin can be administered sublingually or intravenously, but it should be

avoided in patients on phosphodiesterase inhibitors, those with severe aortic stenosis, or those experiencing an acute inferior myocardial infarction (MI). Angiotensin-converting enzyme (ACE) inhibitors are helpful in managing chronic HF, although their role in acute decompensation remains debated. Inotropes should only be used in cardiogenic shock due to their association with increased mortality, while morphine has also been linked to increased mortality.

For patients with fluid overload, intravenous loop diuretics like furosemide should be administered. The Diuretic Optimization Strategies Evaluation trial found that while there was no difference in symptom improvement between bolus and continuous infusion dosing, higher doses provided greater relief from dyspnea, fluid loss, weight loss, and fewer serious adverse events. In patients with advanced HF, palliative care focuses on symptom management rather than prolonging life, using oxygen therapy for hypoxia and small doses of opioids to relieve breathlessness. In summary, acute HF remains a leading cause of hospitalizations among older adults. Treatment typically involves the reduction of blood pressure through vasodilators, diuresis, and oxygen supplementation in hypoxic patients. NIPPV is especially beneficial for those in severe respiratory distress, and palliative care should be considered for frail patients with frequent HF readmissions.

Pulmonary Embolism: Pathophysiology

Venous thromboembolism (VTE) arises from a triad of factors: venous stasis, activation of the coagulation cascade, and endothelial injury to veins. Elderly individuals face a heightened risk of VTE, likely due to enhanced coagulation activation, the prevalence of comorbid conditions, and increased periods of immobility [31].

Clinical Presentation:

In older adults, the manifestation of pulmonary embolism (PE) can be atypical. Syncope is frequently observed, whereas symptoms such as pleuritic chest pain and dyspnea are less common. Some individuals may remain asymptomatic, which can lead to delayed diagnosis [32][33]. Tachycardia and tachypnea are less frequently seen in this population, and leg pain and edema are also less prevalent [34]. Other diagnostic indicators, including hypoxia, right heart strain observed on electrocardiogram, and findings on chest radiographs, lack both sensitivity and specificity for diagnosing PE.

Diagnostic Testing:

The Wells score for VTE is applicable in older patients, categorizing thrombus probability as low, intermediate, or high. D-dimer testing remains highly sensitive for excluding clots in patients with a low pretest probability. Historically, a cutoff of 500 mg/L was used for low-risk patients; however, recent research indicates that an age-adjusted D-dimer cutoff, with higher thresholds for patients over 50 years old (e.g., age 10 mg/L for those over 80 years), improves specificity without significantly impacting sensitivity [34]. The definitive diagnostic test for PE is a

chest computed tomography (CT) angiogram. It is essential for clinicians to consider renal function in older patients, as a normal creatinine level does not necessarily reflect normal creatinine clearance. Ventilation and perfusion scans have limited utility due to their requirement for intact lung tissue, which may be compromised in older patients [35].

Ultrasonography Findings:

Point-of-care ultrasonography (POCUS) is a valuable diagnostic tool for critically ill patients. A meta-analysis reveals that transthoracic echocardiography demonstrates high specificity (83%) but lower sensitivity (53%) for diagnosing PE [36]. Key ultrasonography findings related to PE are summarized in Box 1.

Management:

Patients with a low Pulmonary Embolism Severity Index (PESI) score (<85 points) are at reduced risk for severe outcomes and may be candidates for outpatient management with anticoagulation. Given that each year of age adds 10 points to the score, older individuals are typically not classified within this low-risk category. Anticoagulation remains the primary treatment for VTE/PE. Outpatient options include low-molecular-weight heparin (LMWH) in patients without chronic renal impairment, LMWH bridging to vitamin K antagonists (VKAs) (which requires frequent INR monitoring), and direct oral anticoagulants (DOACs). For unstable patients, intravenous (IV) heparin is commonly used for expedited clot resolution, with possible consideration for intracatheter thrombolysis or clot retrieval [37]. Despite the elevated bleeding risk in older patients due to comorbidities and fall risk, the advantages of anticoagulation outweigh the risks associated with PE (2.2% risk of fatal bleeding compared to 5.9% risk of fatal PE) [38]. Prior to initiating treatment, creatinine clearance should be assessed due to potential renal insufficiency affecting the clearance of LMWH, VKAs, and DOACs [39][40]. For patients contraindicated for anticoagulation (e.g., intracranial hemorrhage, significant acute stroke, severe bleeding), an inferior vena cava filter may be employed to prevent the migration of clots from the lower extremities to the heart and lungs [41].

Pneumonia: Epidemiology

Over a century ago, Sir William Osler referred to pneumonia as a “friend of the aged” due to its rapid progression and limited treatment options, often leading to a swift and painless death. Despite significant progress in vaccines and antimicrobial treatments, community-acquired pneumonia (CAP) remains the fourth leading cause of mortality among older adults. The incidence of pneumonia in the elderly is four times higher than in younger individuals, with one in twenty adults aged 85 and older being diagnosed with CAP annually [42]. Furthermore, older adults are five times more likely to be hospitalized for CAP compared to their younger counterparts [43][44]. This increased risk in the geriatric population is attributed to both the physiological changes associated with aging and the presence of underlying comorbidities.

Pathophysiology:

Age-related reductions in chest wall compliance and diaphragm strength lead to diminished respiratory reserve. Additionally, changes in lung parenchyma and function result in what is termed senile emphysema [45]. These age-related alterations make older adults more prone to respiratory failure during acute illnesses. Preceding viral infections, particularly influenza A, are known risk factors for bacterial pneumonia. Comorbid conditions such as cardiovascular disease, chronic lung disease, malignancy, and diabetes further elevate the risk of pneumonia in the elderly [46]. Neurological disorders, including Parkinson's disease, stroke, or dementia, may impair cough reflexes, contributing to silent aspiration. Polypharmacy, prevalent in older adults, also plays a role, with certain medications like antipsychotics, anticholinergics, and inhaled corticosteroids being associated with an increased risk of pneumonia [47][48][49].

Clinical Presentation:

Common symptoms of pneumonia include fever, chills, and shortness of breath, though these are not always present. The onset of symptoms can be gradual or sudden. In older patients, atypical symptoms such as fatigue, vomiting, diarrhea, or delirium may be observed, and they may present with hypothermia rather than fever [50][51]. A cough may or may not be present.

Diagnostic Testing:

Chest radiography is essential for detecting focal opacities indicative of pneumonia. However, opacities may be subtle due to suboptimal imaging techniques, positioning difficulties, or underlying lung disease and chest wall abnormalities. Research by Haga and colleagues indicates that CT scans can identify up to 47% of pneumonia cases missed by chest radiographs [52]. Additionally, another study found that up to one-third of patients admitted with clinical signs of pneumonia lacked radiographic evidence of the disease [53]. Although CT is more sensitive, its cost and potential incidental findings may limit its use in diagnosing CAP. Furthermore, severely ill patients who are hypoxic may not tolerate lying flat for CT imaging.

Lung Ultrasonography Findings:

Lung ultrasonography in pneumonia often reveals focal B-lines and is typically characterized by lung consolidation accompanied by dynamic air bronchograms (scattered, dot-like, and branching hyperechoic dots) [52]. Other ultrasonographic findings include the shred sign (or fractal sign), an irregular pattern indicative of non-translobar or small consolidations (Fig. 2) [55]. Point-of-care ultrasonography (POCUS) demonstrates high sensitivity (94%) and specificity (96%) for pneumonia when performed by an experienced practitioner, in comparison to chest radiography or CT [56].

Prognosis:

Not every elderly individual with pneumonia necessitates hospitalization. Severity prediction tools, such as the Pneumonia Severity Index score, can assist in identifying patients at low risk who may be safely discharged from the emergency department (ED) [57]. This score heavily factors in age and comorbid conditions and should be used in conjunction with clinical judgment to assess the need for hospital admission [57]. However, patients who cannot maintain adequate oral intake, those with severe comorbidities, impaired functional status, or psychosocial and cognitive challenges may require admission regardless of their severity score [58].

Management:

In older patients, the primary pathogens responsible for community-acquired pneumonia (CAP) are typically *Streptococcus pneumoniae* and *Haemophilus influenzae*. Additional treatment considerations may be necessary based on the risk of methicillin-resistant *Staphylococcus aureus* (MRSA) or *Pseudomonas aeruginosa*. Timely antibiotic administration is crucial [59]. Supportive care might include antipyretics, intravenous fluids, and vasopressors for septic shock [60]. The use of steroids is not advised [58].

Summary:

Pneumonia frequently affects older adults and can present with non-traditional symptoms. Initial evaluation typically involves a chest radiograph to identify focal opacities, with some patients potentially requiring further imaging with a CT scan. Bedside lung ultrasonography is a valuable tool for assessing lung abnormalities. Treatment should be individualized based on the patient's comorbidities and susceptibility to multidrug-resistant organisms.

Coronavirus Infectious Disease 2019 Considerations:

Coronavirus Infectious Disease 2019 (COVID-19) represents an ongoing pandemic that has rapidly evolved over the past year, particularly impacting the elderly population, who experience the highest mortality rates [60]. The incidence of COVID-19 in individuals aged 85 years or older is 1138 per 100,000, compared to 403 per 100,000 in the general population [61]. High-risk groups for severe illness include those with diabetes, hypertension, cardiovascular disease, and cerebrovascular disease [62]. A study involving 1099 patients with COVID-19 pneumonia found that 27% of those severely affected were aged 60 years or older [63]. Mortality rates are significantly elevated for patients over 60, with a rate of 5.3% compared to 1.4% in younger populations, accompanied by increased rates of hospitalization and intensive care unit admission [64]. Common symptoms in patients with COVID-19 include fever, cough, and increased sputum production. Long-term care facilities (LTCFs) have been severely impacted by COVID-19 outbreaks, presenting challenges due to the often impaired immune responses and comorbidities of older patients. These individuals may exhibit atypical symptoms compared to influenza, leading to delayed diagnoses and increased

transmission risks [65]. Additionally, over 50% of those who test positive may be asymptomatic, complicating the differentiation between symptomatic and asymptomatic cases [65]. Consequently, LTCFs have implemented stringent measures such as restricting nonessential visitors and enforcing universal masking. The pandemic has also highlighted the increased risk of delirium in older patients with cognitive impairments due to isolation, masking, and contact restrictions. As the COVID-19 situation continues to evolve, many hospitals have integrated palliative care early in the treatment of affected patients. Further research is needed to refine clinical practices.

Summary:

The proportion of older adults is rising globally, making them more susceptible to severe conditions such as atrial fibrillation (AF), congestive heart failure (CHF), pulmonary embolism (PE), and pneumonia. AF is the most prevalent arrhythmia in this demographic and can lead to complications such as stroke. Clinical tools like the CHA₂DS₂-VASc score, combined with patient-centered shared decision-making, should guide anticoagulation therapy for venous thromboembolism (VTE) prevention. Congestive heart failure is a leading cause of hospital admissions and readmissions among older adults; early diagnosis and treatment are crucial for reducing morbidity and improving survival. Palliative care should be considered early for patients with end-stage disease. Older adults are also at heightened risk for PE due to age-related physiological changes and comorbid conditions. Age-adjusted D-dimer levels are useful for identifying low-risk patients, and anticoagulation remains the standard treatment despite an increased risk of falls and bleeding. Pneumonia, a frequent and serious condition in older adults, requires prompt antibiotic therapy and supportive care, with attention to potential viral co-infections such as influenza and COVID-19. In summary, older adults necessitate special considerations for diagnosis and treatment. Informed discussions about care goals with patients and their families should be an integral part of any treatment plan.

Treatment of Pneumonia in Older Adults:

Outpatient Antibiotic Therapies

- **Patients without comorbidities or MRSA/Pseudomonas risk factors:** Amoxicillin, doxycycline, or azithromycin.
- **Patients with comorbidities (e.g., COPD, structural lung disease, immunosuppression, recent influenza-like illness) or MRSA/Pseudomonas risk factors (e.g., LTCF residents):** Amoxicillin/clavulanate or a cephalosporin (cefepodoxime or cefuroxime) plus doxycycline or a macrolide, or monotherapy with a respiratory fluoroquinolone (levofloxacin or moxifloxacin).

Inpatient Antibiotic Therapies

- **Patients to be admitted without MRSA/Pseudomonas risk factors:** Monotherapy with a respiratory fluoroquinolone (levofloxacin or moxifloxacin), or combination therapy with a β -lactam (ampicillin/sulbactam, cefotaxime, ceftriaxone, or ceftaroline) and a macrolide (azithromycin or clarithromycin), or a β -lactam with doxycycline (if fluoroquinolones or macrolides are contraindicated).

- **Patients with risk factors for multidrug-resistant organisms:** Vancomycin (for MRSA) and piperacillin-tazobactam, a fourth-generation cephalosporin, aztreonam, meropenem, or imipenem (for *Pseudomonas aeruginosa*).

Main Role of Health Informatics System:

The main role of health informatics in future responses to cardiac and pulmonary emergencies includes several critical aspects:

1. **Real-Time Data Access:** Health informatics enables rapid access to patient data, including medical history, diagnostic results, and treatment plans, ensuring that healthcare providers can make informed decisions quickly during emergencies like heart attacks or respiratory distress.
2. **Clinical Decision Support Systems (CDSS):** Informatics provides decision support tools that offer real-time recommendations based on clinical guidelines, helping healthcare professionals diagnose and manage cardiac and pulmonary emergencies more effectively and in line with best practices.
3. **Remote Monitoring and Telemedicine:** Through remote monitoring devices and telemedicine platforms, health informatics allows for early detection of warning signs in high-risk patients, facilitating timely interventions before an emergency occurs, and providing care to patients in remote areas.
4. **Coordinated Emergency Response:** Health informatics improves communication and coordination between different healthcare teams and emergency services, ensuring that care is streamlined from the moment a patient presents symptoms to their arrival at a healthcare facility.
5. **Data-Driven Protocols:** By analyzing large datasets, health informatics helps in developing and refining emergency protocols for cardiac and pulmonary conditions, making responses more precise, personalized, and effective based on evolving trends and patient outcomes.
6. **Post-Emergency Follow-Up:** Informatics supports the continuous tracking and follow-up of patients after a cardiac or pulmonary emergency, ensuring adherence to recovery protocols and preventing future events through better management of chronic conditions.

Conclusion

Cardiac and pulmonary emergencies in the elderly present unique challenges that necessitate specialized management protocols. Atrial fibrillation (AF), a common arrhythmia among older adults, requires careful consideration of anticoagulation therapy due to an elevated risk of stroke and bleeding. The choice between vitamin K antagonists (VKAs) and direct oral anticoagulants (DOACs) should be guided by individual patient factors, including fall risk and renal function. Recent studies suggest that DOACs may offer a safer profile compared to VKAs, though cost and monitoring requirements must also be considered. Congestive heart failure (CHF) remains a leading cause of hospital admissions among older adults. The management of acute CHF involves the use of diuretics to address fluid overload, vasodilators to reduce afterload, and oxygen therapy for hypoxic patients. Noninvasive positive pressure ventilation (NIPPV) has shown benefit in improving outcomes for patients with severe respiratory distress due to

pulmonary edema. Additionally, palliative care strategies should be employed for those with advanced disease, focusing on symptom management and quality of life. Pulmonary embolism (PE) presents diagnostic and management challenges in the elderly, where symptoms can be atypical and less pronounced. The use of age-adjusted D-dimer levels and imaging techniques, such as chest CT angiography, are crucial for accurate diagnosis. Anticoagulation remains the cornerstone of treatment, though the increased risk of bleeding in older patients necessitates a careful risk-benefit analysis. For patients contraindicated for anticoagulation, inferior vena cava filters may be considered. Pneumonia continues to be a significant concern due to its high mortality rate among the elderly. Age-related changes in respiratory function and the presence of comorbidities increase susceptibility to severe outcomes. Despite advances in antimicrobial treatments, timely diagnosis and aggressive management are essential to improve prognosis. Overall, effective management of these cardiopulmonary conditions in older adults requires a tailored approach that addresses the specific physiological and clinical needs of this population. Emergency medical protocols should be adapted to ensure the best possible outcomes, considering the increased risks and potential complications associated with aging.

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الطوارئ القلبية والرئوية: بروتوكولات الإدارة والعلاج عن طريق خدمات الصيدلة وطب الطوارئ والحالات الحرجة ودور المعلومات الطبية في الاستجابة المستقبلية

الملخص :

الخلفية : يشهد عدد كبار السن في الولايات المتحدة زيادة سريعة، مع توقعات بأن يصل عدد الأشخاص الذين تتجاوز أعمارهم 65 عامًا إلى 95 مليونًا خلال الأربعين عامًا القادمة. يؤدي هذا التحول الديموغرافي إلى زيادة انتشار الطوارئ القلبية والرئوية، والتي يتم مواجهتها عادة في أقسام الطوارئ. تستكشف هذه الورقة أربع حالات شائعة - الرجفان الأذيني، قصور القلب الاحتقاني، الانصمام الرئوي، والالتهاب الرئوي - واعتباراتهم الخاصة في المرضى المسنين.

الهدف : مراجعة بروتوكولات الإدارة لهذه الحالات القلبية والرئوية في البالغين كبار السن وتسلط الضوء على التحديات والاعتبارات الفريدة المرتبطة بعلاجها وإدارتها من خلال خدمات الصيدلة وطب الحالات الحرجة في قسم الطوارئ. كما يهدف البحث لإبراز أهمية المعلومات الصحية ودورها في الاستجابات المستقبلية.

الطرق : تتضمن الدراسة مراجعة شاملة للأدبيات الحالية حول الوبائيات وعلم الأمراض وإدارة الرجفان الأذيني، وقصور القلب الاحتقاني، والانصمام الرئوي، والالتهاب الرئوي في المرضى المسنين. يركز البحث على بروتوكولات العلاج، واستراتيجيات التشخيص، وتأثير العوامل المرتبطة بالعمر على إدارة الأمراض.

النتائج : تتطلب الإدارة الفعالة لهذه الحالات نهجًا مخصصًا بسبب التغيرات الفسيولوجية المرتبطة بالعمر. بالنسبة للرجفان الأذيني، تعتبر المعالجة المضادة للتخثر أساسية، ولكن يجب موازنتها بعناية ضد مخاطر النزيف. إدارة قصور القلب الاحتقاني غالبًا ما تتضمن مدرات البول وموسعات الأوعية، مع الحاجة إلى مراقبة دقيقة. تشخيص وعلاج الانصمام الرئوي معقدان بسبب العروض غير النمطية وزيادة مخاطر النزيف. يظل الالتهاب الرئوي سببًا كبيرًا للوفيات ويتطلب علاجًا سريعًا وفعالًا بسبب التغيرات في وظيفة الجهاز التنفسي لدى كبار السن.

الخلاصة : يتطلب إدارة الطوارئ القلبية والرئوية لدى المسنين نهجًا دقيقًا يأخذ في الاعتبار زيادة مخاطر المضاعفات. يجب أن تتضمن بروتوكولات الطوارئ اعتبارات محددة للعمر لتحسين النتائج لهذه الفئة السكانية الضعيفة.

الكلمات المفتاحية : الرجفان الأذيني، قصور القلب الاحتقاني، الانصمام الرئوي، الالتهاب الرئوي، رعاية المسنين، طب الطوارئ.