

Yearly trend of acute venous thromboembolism in patients admitted with heart failure in the United States

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ABSTRACT

Introduction: Heart failure (HF) patients are at risk for venous thromboembolism (VTE) during the hospital stay. We aim to study the recent trend of deep vein thrombosis (DVT), pulmonary embolism (PE), and VTE in heart failure patients from years 2000–2013.

Methods: We utilized the National (Nationwide) Inpatient Sample database and selected non-pregnant patients over the age of 18 years for this purpose. We selected HF, DVT, PE, and VTE based on International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM). We used STATA for analysis.

Results: We noted an increase in prevalence of DVT, PE and composite VTE among HF hospitalizations from 0.55%, 0.17% and 0.76% in 2000 to 0.96%, 0.4% and 1.46%, respectively, in 2013 and a decrease in trend of mortality among HF hospitalizations associated with DVT, PE and VTE from 8.95%, 16.36% and 10.80% in 2000 to 6.78%, 7.92% and 7.20%, respectively, in 2013.

Conclusion: Increasing prevalence of VTE is concerning and suggests that we still need to work on delivering prophylaxis to all HF inpatients.

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1. Introduction

Hospitalized heart failure (HF) patients are at risk for development of venous thromboembolism (VTE) [1]. The American College of Chest Physicians Consensus Conference on Antithrombotic Therapy recommends VTE prophylaxis in all inpatients diagnosed with HF [2,3]. However, previous studies have shown low rates of VTE prophylaxis use in this population [4]. Imaging modalities for VTE have greatly expanded in use in the past two decades, increasing detection rates with a reported decrease in overall mortality [5]. Faced with these competing trends, we sought to study DVT/PE incidence among hospitalized HF patients in a nationwide database.

2. Methods

2.1. Study population

We utilized the National (Nationwide) Inpatient Sample database from years 2000–2013. We selected non-pregnant patients over the age of 18 admitted with HF in US hospitals over the specified period. We chose records with HF in the primary diagnosis position to increase the specificity of the hospitalization being due to HF. We selected patients with DVT or PE based on International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)

and Clinical Classification Software-Diagnoses codes supplied by the Healthcare Cost and Utilization Project (HCUP). We created a composite of all patients with diagnosis of DVT, PE or both diagnoses, which we called ‘VTE’ in our analysis.

2.2. Statistical analysis

We used STATA version 13.0 (College Station, TX) for database analysis and Joinpoint Regression Program version 4.5.0.1 to plot yearly trends of prevalence and mortality with DVT, PE or VTE among hospitalized HF patients. Descriptive data were expressed as percentages and the change in yearly trend was expressed as an annual percentage change (APC) with a significance level of $p < 0.05$.

3. Results

We identified a total of 3,154,121 patients coded with HF in primary diagnosis position from 2000 to 2013. Among them, 36,445 (1.2%) had an associated diagnosis of VTE (DVT: $n = 25,624$; PE: $n = 8,505$; both DVT and PE: $n = 2,316$). The prevalence of DVT, PE and composite VTE among HF hospitalizations increased from 0.55%, 0.17% and 0.76% in 2000 to 0.96%, 0.4% and 1.46%, respectively, in 2013 (Figure 1). The yearly trend of mortality among HF hospitalizations associated with DVT, PE and

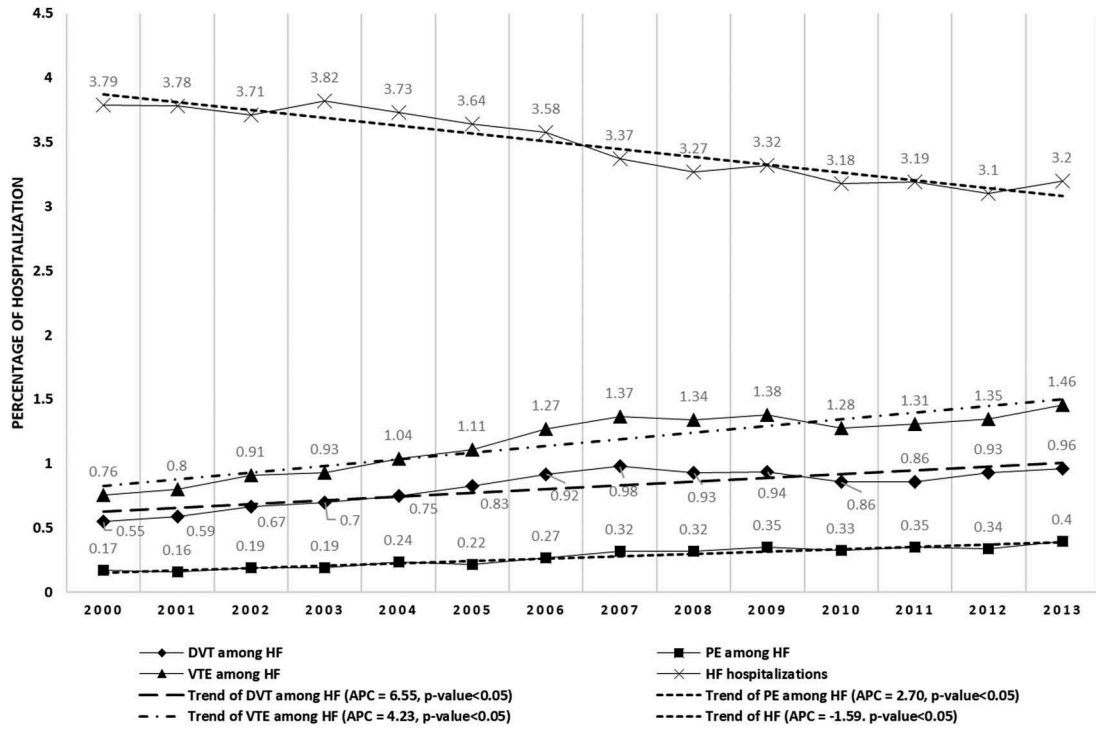


Figure 1. Yearly trend of overall hospitalizations, HF hospitalizations, and prevalence/proportion of HF with DVT, PE, and VTE – results from Joinpoint Regression Analyses.

* APC = Annual Percentage Change, DVT = Deep vein thrombosis; HF = Heart Failure; PE = Pulmonary embolism; VTE = Venous thromboembolism.

VTE decreased from 8.95%, 16.36% and 10.80% in 2000 to 6.78%, 7.92% and 7.20%, respectively, in 2013 (Figure 2). Inpatient mortality was higher in patients with heart failure as compared to all other admissions, but higher

still for patients with HF was associated with DVT or PE throughout the time studied (Figure 2). Trend analysis for all HF hospitalizations showed that total hospitalizations decreased over the time of the study (APC: -1.59,

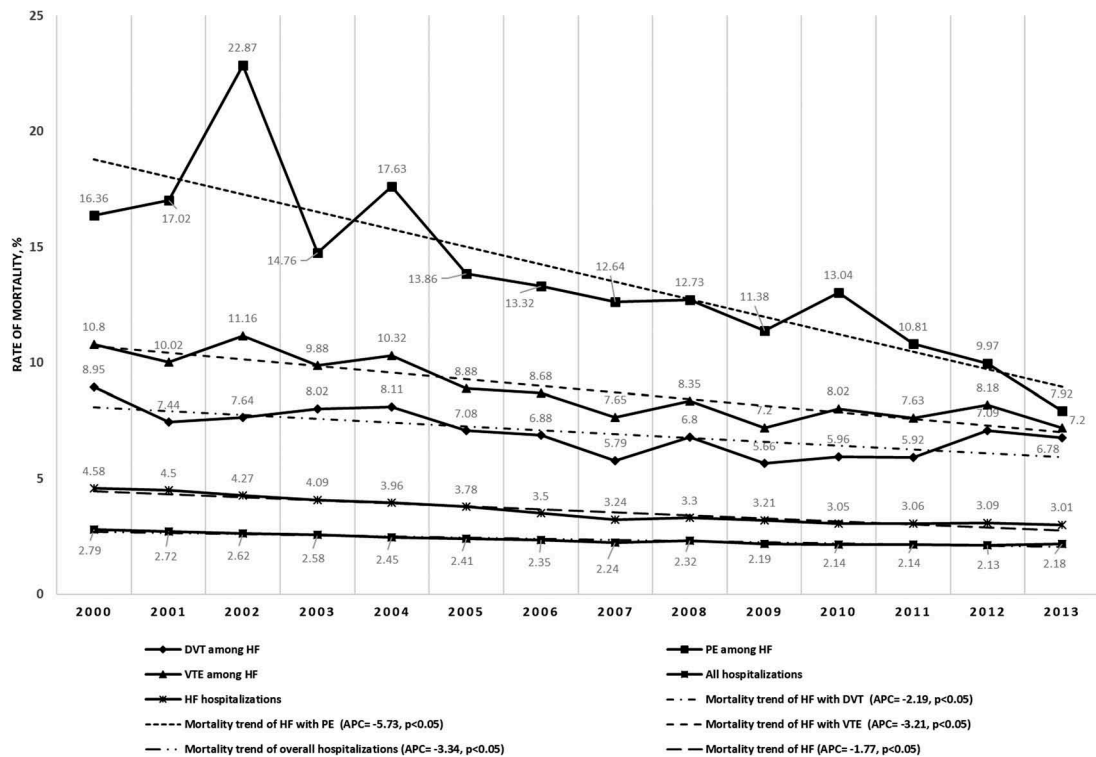


Figure 2. Yearly trend of mortality among overall hospitalizations, HF hospitalizations, HF with DVT, PE, and VTE – results from Joinpoint Regression Analyses.

* APC = Annual Percentage Change, DVT = Deep vein thrombosis; HF = Heart Failure; PE = Pulmonary embolism; VTE = Venous thromboembolism.

p-value<0.05), but the proportions of DVT, PE and VTE among HF hospitalizations increased over this time (APCs 2.70, 6.55 and 4.23, respectively, $p < 0.05$ for all) (Figure 1). In contrast, we found an overall decreasing trend in mortality among all HF hospitalizations (with or without VTE) (APC: -1.77 ; p-value<0.05) and among HF hospitalizations associated with any VTE (APC = -3.21 ; p-value<0.05), PE (APC = -5.73 ; p-value<0.05) or DVT (APC = -2.19 ; p-value<0.05). Mortality among HF patients with heart failure and concomitant PE had the largest decrease of any of the trends studied. The mortality among hospitalizations of all diagnoses also had a decreasing trend over the same period (APC: -3.34 ; p-value<0.05) (Figure 2).

4. Discussion

In a large US inpatient database sample over 14 years, we identified an increasing prevalence of DVT, PE or VTE among HF hospitalizations but a decreasing rate of inpatient mortality among all groups. Our findings mirror those of a prior study by Huang et al. [6] in which the incidence rate of VTE among an unselected population was found to have increased over the past 30 years. However, a separate study by Beemath et al. [1] on a population of HF inpatients identified increased incidence of DVT but decreasing rates of PE between 1979 and 2003, while a second study by the same author identified a decreasing rate of PE mortality in HF inpatients (5% in 1980 to 1.6% in 1998) [7]. We found a similar reduction in mortality among HF hospitalizations not only with PE but also with DVT and overall VTE. These decreasing mortality rates could be due to improvement in management of inpatient VTE but also could be due to increasing utilization of highly sensitive imaging modalities leading to over-detection of non-fatal DVTs and smaller burden PEs [3]. However, given the reduction in mortality among overall hospitalizations, this raises a question as to whether the noted decrease in mortality with DVT, PE or VTE among HF hospitalizations is simply reflective of overall improved inpatient survival.

4.1. Strengths and limitations

The NIS database is the largest all-payer database representing the largest number of hospitalizations in the US. Thus, it is a more real-world representation of the inpatient care. However, the database is comprised of discharge-level information which may be subject to coding errors. Our study is also limited by the inability to separate VTE that may have developed during prior hospitalization because the

diagnosis can be carried into the current admission as patient may still be receiving treatment.

5. Conclusion

Patients with HF and VTE have a higher inpatient mortality than those without VTE, and rates of HF patients with VTE appear to be increasing. This raises an important concern whether current systems for delivering VTE prophylaxis are adequate in HF populations or whether better delivery of that prophylaxis could affect rates of VTE in this population.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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References

- [1] Beemath A, Stein PD, Skaf E, et al. Risk of venous thromboembolism in patients hospitalized with heart failure. *Am J Cardiol.* 2006;98(6):793–795.
- [2] Kahn. Antithrombotic therapy for VTE disease: antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence ... – PubMed – NCBI. [cited 2017 Mar 26]. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/22315268>
- [3] Geerts WH, Pineo GF, Heit JA, et al. Prevention of venous thromboembolism: the seventh ACCP conference on antithrombotic and thrombolytic therapy. *Chest.* 2004;126(3Suppl):338S–400S.
- [4] Jois-Bilowich P, Michota F, Bartholomew JR, et al. Adhere scientific advisory committee and investigators. Venous thromboembolism prophylaxis in hospitalized heart failure patients. *J Card Fail.* 2008;14(2):127–132.
- [5] Stein PD, Fowler SE, Goodman LR, et al. Multidetector computed tomography for acute pulmonary embolism. – PubMed – NCBI. [cited 2017 Mar 27]. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/16738268>
- [6] Huang W, Goldberg RJ, Anderson FA, et al. Secular trends in occurrence of acute venous thromboembolism: the Worcester VTE study (1985–2009). *Am J Med.* 2014;127(9):829–839.e5.
- [7] Beemath A, Skaf E, Stein PD. Pulmonary embolism as a cause of death in adults who died with heart failure. *Am J Cardiol.* 2006;98(8):1073–1075.