Letters

RESEARCH LETTER

Pulmonary Embolism and Deep Venous Thrombosis in Patients Hospitalized With Syncope: A Multicenter Cross-sectional Study in Toronto, Ontario, Canada

The prevalence of pulmonary embolism (PE) among patients hospitalized with syncope is uncertain. The recently published Pulmonary Embolism in Syncope Italian Trial (PESIT)[1] systematically evaluated patients hospitalized with a first episode of syncope and determined that 17.3% had a PE. It is not known how commonly patients hospitalized with syncope are investigated for PE or deep venous thrombosis (DVT) in routine practice.

Methods | We conducted a retrospective cross-sectional study at 4 hospital sites in Toronto, Ontario, Canada, that were participating in the General Medicine Inpatient (GEMINI) cohort study. The GEMINI study has linked electronic clinical data from hospital information systems with administrative data to study patients cared for by general medicine services in hospitals affiliated with the University of Toronto. We applied the same inclusion and exclusion criteria as PESIT in all general medicine patients hospitalized through the emergency department between April 1, 2011, and March 31, 2015. In Canada, hospitals use *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10),* codes to designate 1 primary diagnosis for the emergency department visit and 1 primary diagnosis at hospital discharge for mandatory reporting to the Canadian Institute for Health Information. The emergency department and hospital discharge diagnoses are not necessarily the same. We included patients if their primary diagnosis was syncope in either the emergency department or at hospital discharge, using the *ICD-10* code R55. We excluded patients who were receiving anticoagulation at admission, had prior syncope, or were pregnant.

The main outcomes were the occurrence of investigation for venous thromboembolism (VTE) during hospitalization, defined as testing with a plasma D-dimer level, compression ultrasonography of the upper or lower limbs, computed tomographic pulmonary angiography (CTPA), or ventilation perfusion (V/Q) scan, and the diagnostic yield of these investigations. Because there is substantial overlap in the investigation and management of DVT and PE, we examined a composite of all investigations for VTE. The GEMINI study received research ethics board approval from all participating hospitals.

Results | Of the 1650 patients hospitalized with syncope, 345 were excluded (179 with preadmission anticoagulation and 166 with previous syncope), and the final cohort included 1305 patients. At least 1 investigation for VTE was performed in 146 patients (11.2% [95% CI, 9.6%-13.0%]) (**Table 1**), including 120 who received imaging with CTPA, V/Q scan, and/or compression ultrasonography (9.2% [95% CI, 7.8%-10.9%]).

Pulmonary embolism was diagnosed in 11 of the 73 patients who received a CTPA or V/Q scan, and DVT was diagnosed in 10 of the 67 patients who received ultrasonography, representing a diagnostic yield of 15.1% (95% CI, 8.6%-25.0%) and 14.9% (95% CI, 8.3%-25.4%), respectively. The prevalence of VTE in the cohort was 1.4% (95% CI, 0.9%-2.2%) (**Table 2**).

Discussion | In a large observational study, VTE was investigated in 11.2% of patients hospitalized with syncope. The diagnostic yield for VTE was 15.0% and the prevalence was 1.4%, not 41.9% and 17.1%, respectively, as found in the PESIT study.[1] Our findings call into question the generalizability of the PESIT results. The 1.4% prevalence of VTE we found is consistent with previously published estimates, which range from 0.9% to 2.8%.[2-4] Unlike the case in PESIT, all patients were not screened for VTE in our study or in these previous studies; thus, the prevalence may have been underestimated. A more illuminating comparison, however, is to examine the diagnostic yield of imaging for VTE. We expected that thrombosis would be more likely in the selected patients who received imaging for VTE based on clinical judgment in our study, not in the large proportion (40.9%) of patients who received imaging based on screening, as was the case in PESIT. The reverse was true, highlighting the differences in the study populations.

A limitation of our study is the use of administrative data to identify patients with syncope. Thus, some patients who were hospitalized for syncope may have been missed. The *ICD-10* code for syncope is very specific, with a reported positive predictive value of 93% in the emergency department and 95% at hospital discharge.[5] Although the *ICD-10* code assigned at hospital discharge is only 63% sensitive for detect-

Table 1. Characteristics of the Study Populations in the GEMINI and PESIT Studies

Characteristic	GEMINI Study (n = 1305)	Patients Without VTE Investigations, in the GEMINI Study (n = 1159)	Patients With VTE Investigations, in the GEMINI Study (n = 146)	PESIT Study (n = 560)
Age, mean (SD), y	73.8 (16.0)	74.4 (15.8)	69.0 (16.7)	76 (14)
Female, No. (%)	713 (54.6)	633 (54.6)	80 (54.8)	337 (60.2)
History of VTE, No. (%)	6 (0.5)	0 (0.0)	6 (3.9)	31 (5.5)

Abbreviations: GEMINI, General Medicine Inpatient Cohort Study; PESIT, Pulmonary Embolism in Syncope Italian Trial[1]; VTE, venous thromboembolism.

Table 2. Investigations and Diagnostic Yield for Venous Thromboembolism (VTE) in Patients Hospitalized With Syncope

	No. (%) [95% CI]			
	GEMINI (n = 1305)		PESIT (n = 560)	
Investigation and Diagnosis of VTE	Patients Receiving Test	Patients With Positive Test Result	Patients Receiving Test	Patients With Positive Test Result
Any investigation for VTE[a]	146 (11.2) [9.6-13.0]	42[b] (28.8) [22.0-36.6]	560 (100)	230[c] (41.1) [37.1-45.2]
D-dimer	46 (3.5) [2.7-4.7]	27 (58.7) [44.3-71.7]	560 (100)	227 (40.5) [36.6-44.7]
Imaging for PE	73 (5.6) [4.5-7.0]	11 (15.1) [8.6-25.0]	229 (40.9) [36.9-45.0]	96 (41.9) [35.7-48.4]
CTPA	67 (5.1) [4.1-6.5]	11 (16.4) [9.4-27.1]	180 (32.1) [28.4-36.1]	72 (40.0) [33.1-47.3]
V/Q scan	6 (0.5) [0.2-1.0]	0 (0.0)	49 (8.8) [6.7-11.4]	24 (49.0) [35.6-62.5]
Imaging for DVT	67 (5.1) [4.1-6.5]	10 (14.9) [8.3-25.4]	NA	NA
Diagnosis of PE and/or DVT[d]	18 (1.4) [0.9-2.2]		97 (17.3) [14.2-20.5]	

Abbreviations: CTPA, computed tomography pulmonary angiography; DVT, deep venous thrombosis; GEMINI, General Medicine Inpatient Cohort Study; NA, not applicable; PE, pulmonary embolism; PESIT, Pulmonary Embolism in Syncope Italian Trial[1]; V/Q scan, ventilation-perfusion scan.

[a] Patients who received D-dimer, CTPA, V/Q scan, and/or compression ultrasonography.

[b] This includes patients with abnormal D-dimer result.

[c] This includes 227 patients with abnormal D-dimer result and 3 patients who were judged to have high clinical probability of PE without abnormal D-dimer and went on to receive a CTPA or V/Q scan.

[d] GEMINI identified patients diagnosed with PE and/or DVT, PESIT identified patients diagnosed as having PE only. One patient in PESIT was diagnosed as having PE on autopsy.

ing patients hospitalized with syncope,[5] we identified 590 patients (36% of participants in our study) with only an emergency department diagnosis of syncope. Thus, we included substantially more patients than if we had used hospital discharge diagnosis alone and improved the completeness of our cohort.

Assessing all patients hospitalized with syncope for VTE would represent a substantial departure from conventional practice. Based on the available data, there is little, if any, justification for routine testing for VTE in all patients hospitalized with a first episode of syncope.

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