JAMDA 14 (2013) 578–584

JAMDA

journal homepage: www.jamda.com

Original Study

Incidence of Venous Thromboembolism in Nursing Home Residents

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Keywords:
Venous thromboembolism
deep vein thrombosis
pulmonary embolism
nursing home
incidence

A B S T R A C T

Objective: Venous thromboembolism (VTE) is common in the elderly, but its epidemiology in nursing home residents remains unclear. This study estimated rates of VTE recorded on nursing home admission and incidence during residence.
Design: Retrospective analysis of AnalytiCare long term care (LTC) database for the period January 2007 to June 2009.
Setting: 181 nursing homes in 19 US states.
Participants: Eligible residents had 1 or more admission Minimum Data Set (MDS) 2.0 assessment(s) over the study period. All VTE cases were extracted if MDS indicated deep vein thrombosis or pulmonary embolism. The number of admissions and days at risk were estimated from a random sample (n = 1350) of all residents.
Measurements: The earliest admission was identified as the admission index date. VTE cases were classified as either "On Admission" (VTE coded on admission index date) or "During Residence" (coded afterward). Residents were followed from admission index date until censoring.
Results: A total of 2144 VTE admission cases (3.7% of all admissions) were identified. A further 757 cases of VTE occurring during residence were identified, yielding an incidence of 3.68 cases of VTE per 100 person-years of postadmission residence. VTE admission rates were highest for residents younger than 50 years (4.8%, confidence interval [CI]: 3.9%–5.9%) and 50 to 64 years (5.1%, CI: 4.6%–5.7%) but similar for those aged 65 to 74 (3.6%, CI: 3.3%–4.0%), 75 to 84 (3.6%, CI: 3.3%–3.9%), and 85 years or older (3.1%, CI: 2.9%–3.4%). The incidence of VTE during residence was similar among these age strata.
Conclusion: Approximately 1 in 25 nursing home admissions had a VTE diagnosis. VTE incidence during residence was higher than reported in earlier nursing home studies. These incidence rates merit further investigation because diagnostic improvements may be driving greater recognition of VTE in LTC.

Deep vein thrombosis (DVT) and pulmonary embolism (PE) are separate but related aspects of the disease process of venous thromboembolism (VTE).[1] DVT of the lower extremities is the most-frequent manifestation,[2] whereas PE, the most urgent and serious, typically results from sudden occlusion of pulmonary arteries by a thrombus originating in the pelvis or calf.[1] VTE has been described

G.R. and N.P. were consultants to Janssen Scientific Affairs, LLC (a Johnson & Johnson company). E.A.N. was a consultant to, received grant support from, and served on a speaker forum for Janssen Scientific Affairs, LLC. J.L., C.V.D., J.S., and B.B. are employees of Janssen Scientific Affairs, LLC and shareholders of Johnson & Johnson. B.B. works in the Health Economics and Outcomes Research department of Janssen Scientific Affairs, LLC.

Author contributions: G.R. (study design and analytical plan, literature search, statistical analysis, manuscript production and rewrite); B.B. (study concept and design, data analysis, interpretation of findings, manuscript production and rewrite); N.P., E.A.N., J.L., C.V.D., J.S., B.B. (study design and analytical plan, interpretation of findings, manuscript rewrite and review).

The current study was sponsored by Janssen Scientific Affairs, LLC. Four of the coauthors (J.L., C.V.D., J.S., and B.B.) were employed by the sponsor at the time of this study and contributed to the design/methodology, interpretation, manuscript production, and review. The sponsor provided full funding for use of the study AnalytiCare database and for editing and journal submission services of this author-prepared manuscript. The involvement of the study sponsor in the collection, analysis, and interpretation of data; in the writing of the manuscript; and in the decision to submit the manuscript for publication was limited to the contribution, as noted above, of coauthors J.L., C.V.D., J.S., and B.B., who were employees of the study sponsor.

An earlier analysis of study data was presented at the Annual Scientific Meeting of the American Geriatrics Society in Seattle, Washington, on May 4, 2012: Reardon G, Pandya N, Nutescu EA, Lamori J, Damaraju CV, Schein J, Bookhart B, "Incidence of Venous Thromboembolism in Nursing Home Residents."

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1525-8610/$ - see front matter
http://dx.doi.org/10.1016/j.jamda.2013.02.003

as a "silent killer"; most DVT cases are asymptomatic, and PE is often undetected until an autopsy is performed.[3] Postevent mortality rates of 7% and 13% have been reported at 1 month[4] and 11% and 15% at 6 months for DVT and PE, respectively.[5]

Acquired risk factors for VTE include previous VTE, frailty, cancer, hospitalization, surgery, advanced age, venous trauma, immobilization, estrogen therapy, inherited/acquired hypercoagulable state, acute medical illness, pregnancy, antiphospholipid antibodies, and several other implicated factors.[6–11] Silverstein et al[6] found that in the community, the incidence of VTE appears similar in magnitude to that of stroke: 0.117 per 100 person-years (PY). The incidence of DVT appears to increase markedly with age.[12] Heit et al[13] found that institutionalization (current or recent hospitalization or nursing home residence) was independently associated with 21.72 odds (among those with recent surgery) and 7.98 odds (without recent surgery) of having VTE. In another study, Heit et al[14] found that 59% of VTE cases in the community could be attributed to institutionalization: hospitalization for surgery accounted for 24%; hospitalization for medical illness 22%; and nursing home residence 13%. To facilitate risk assessment for the unique characteristics of nursing home residents, a literature-based long term care (LTC) risk stratification tool for VTE has recently been developed by Zarowitz et al.[15]

In the nursing home setting, 3 studies evaluated the incidence of VTE diagnosed during facility residence,[16–18] and 1 study evaluated prevalence of asymptomatic disease.[19] Using Minnesota Case Mix Review Program (MCMRP) data for the period 1988 to 1994, Liebson et al[16] found a crude incidence rate of 1.2 (95% confidence interval [CI]: 0.9–1.5) to 1.5 (95% CI: 1.1–1.9) cases per 100 PY. In the same study, analysis of a second database (Rochester Epidemiology Project of Olmstead County, MN, 1998–1994) revealed a crude incidence rate of 3.6 (95% CI: 3.0–4.2) cases per 100 PY.[16] Gomes et al,[17] compiling Minimum Data Set (MDS) and Medicare records for residents in Kansas for the period 1997 to 1998, found a crude VTE incidence rate of 1.30 events per 100 PY (95% CI: 1.10–1.51) when excluding warfarin users. Gatt et al[18] evaluated VTE incidence for residents with a length of stay (LOS) of 3 months or longer in a nursing home in Jerusalem, Israel, during the period 1991 to 2001. The crude incidence rate of VTE was similar in both chronically immobilized and mobile cohorts: 1.39 and 1.58 per 100 PY, respectively ($P = .77$).[18]

Arpaia et al[19] recently concluded that "[d]ata on the frequency of VTE among nonacute patients nursed at home or in long term care residential homes are still scarce." The current study updates earlier US research regarding the incidence of VTE events that occur during nursing home residence[16,17] and introduces an analysis of the proportion of nursing home admissions that were coded for VTE.

Methods

Data for this study were extracted for the data collection period January 1, 2007, to June 30, 2009, from the AnalytiCare longitudinal LTC database (www.analyticare.com). This database included MDS 2.0 assessments, pharmacy dispensing records, and resident characteristics from 181 nursing home facilities across 19 states (29% of facilities had 0–100 beds, 70% 101–200 beds, 1% >200 beds). All data provided by AnalytiCare were de-identified before release for research in accordance with Health Insurance Portability and Accountability Act safe-harbor provisions and were exempt from the requirement for institutional review board review.

AnalytiCare provided data for all residents who had available MDS and pharmacy data and who had been identified as having either DVT ("DVT" checkbox in Section I1 or ICD-9-CM codes of 451.1x, 451.2, 453.2, or 453.4x in Section I3) or PE (415.1x in Section I3) in any MDS assessment over the study period. To estimate the number of admissions and days at risk of the total resident population, AnalytiCare separately provided a simple random sample of 1350 residents from the universe of residents (n = 74,019) who had available MDS and pharmacy data over the study period (reference sample).

Residents in both groups (census of those with VTE and reference sample) were considered eligible for analysis if they had 1 or more admission (or readmission) MDS assessment(s) over the study period; the earliest MDS admission (or readmission) over the study period was identified as the *admission index date*. Eligible residents were followed longitudinally from the admission index date until the end of follow-up (ie, censoring). Follow-up ended on the earliest occurrence of (1) an MDS assessment coded for VTE (follow-up equaled zero if VTE was coded on admission); (2) a postindex discharge that occurred wherein the resident was not readmitted to the facility within 30 days following discharge; (3) 90 days following the earliest MDS assessment for which a gap of 120 days or more occurred between successive MDS assessments; (4) date of death; or (5) the end of the data collection period.

Cases (eligible residents in the VTE census) were exclusively defined as either *VTE on admission* or *VTE during residence* depending on whether the date of the earliest VTE-coded MDS assessment occurred on or after the admission index date, respectively. Counts of cases were used to supply numerators for the rate of admissions coded for VTE and the incidence of postadmission VTE cases. The respective denominators—the total number of initial admissions and resident days at risk (sum of elapsed days from admission index date to end of follow-up)—were estimated from the reference sample.

Data for demographics were derived from the AnalytiCare resident characteristic data file. A set of 20 VTE risk factors was obtained from the risk stratification tool developed by Zarowitz et al[15] (5 other risk factors from this tool lacked available data for the current study: surgical resection of abdominal or pelvic cancer, central vein catheter, history of VTE, having first-degree relative with VTE, and treatment with erythroid-stimulating agents to hemoglobin greater than 12 g/dL). Comorbid and VTE risk factor data were obtained from the index admission MDS assessment and concurrent pharmacy records ($\leq$45 days of the index date) for those residents with *VTE on admission* and was obtained from the index and all postindex MDS assessments and pharmacy records until censoring for those residents with *VTE during residence* and for the reference sample. As a proxy for the Zarowitz et al[15] immobility risk factor checklist (not derivable from the MDS), immobility was defined as having a score of 24 or higher (where 0 = total independence and 28 = total dependence) using a single global score from 7 items of activities of daily living in the index MDS Section G1A, applying the algorithm of Carpenter et al.[20]

Results

From the sampling universe, a total of 58,009 eligible residents were estimated to have 1 or more admissions (or readmissions) over the data collection period. The total number of years at risk for a postadmission VTE (from admission index date until end of follow-up) across all eligible residents was estimated at 20,586 PY.

A total of 2901 eligible VTE cases were identified. Of these, 2144 (74%) had VTE identified on the admission index date. These accounted for 3.7% of the 58,009 estimated admissions (Table 1). The remaining 757 (26%) of the 2901 VTE cases occurred during residence in study facilities. For these cases, mean time from admission until occurrence of the VTE event was 116 days (SD = 162). This yielded a crude incidence rate of 3.68 VTE cases per 100 PY of postadmission follow-up (Table 1). Table 1 also shows VTE admission rates and incidence rates during residence separately by age and gender strata. Residents younger than 50 and 50 to 64 years of age had disproportionately higher rates of VTE-coded admissions (4.8% and 5.1%)