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Hospital incidence and annual rates of hospitalization for venous thromboembolic disease in France and the USA

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Abstract

Objective: The study was designed to describe the hospital incidences and annual hospitalization rates for venous thromboembolic disease by age and sex in France and the United States on the closest possible methodological bases.

Methods: French statistics are from the PMSI MCO (Programme de médicalisation des système d'information de médecine, chirurgie et obstétrique (French national hospital discharge register)) national database. These are compiled for each calendar year by collating résumé de sortie anonymisé (RSA, anonymous discharge summary) files forwarded and validated by health establishments with admissions in medicine, surgery, obstetrics, and odontology. They are compared to the data issued from the US National Hospital Discharge Survey which is equivalent to the PMSI in France and uses the International Classification of Diseases-9 for encoding the data. These data were published in the Morbidity, Mortality Weekly Report of the Centre for Disease Control.

Results: In the US, 547,996 hospital stays involve venous thromboembolic diseases, 348,558 deep venous thrombosis (DVT), and 277,549 pulmonary embolism (PE). Of these 78,511, or 14%, include a diagnosis of both DVT and PE. The hospital incidence of venous thromboembolic disease is 1.4%, DVT 0.9%, and PE 0.7%. In France, of the 26,658,228 annual hospital stays, 273,931 include venous thromboembolic disease, 179,286 DVT, and 139,345 PE while 44,700, i.e. 16.3%, include both DVT and PE. The hospital incidence of venous thromboembolic disease is thus 1.0%, DVT 0.6%, and PE 0.5%. The overall annual hospitalization rates for venous thromboembolic disease, DVT, and PE are respectively 274, 179, and 139 per 100,000 inhabitants in France and 239, 146, and 121 per 100,000 inhabitants in the US.

Conclusion: Venous thromboembolic diseases occur in France and the US in 1% of all hospital stays and are responsible for an annual hospitalization rate that exceeds 200 per 100,000. The scale of these annual incidences should prompt us to question the quality of prevention put in place and/or its efficacy.

Keywords

Venous thromboembolism, incidence, pulmonary embolism, deep venous thrombosis

Introduction

Venous thromboembolic diseases (VTEs) include deep vein thrombosis (DVT) and its complications in the form of pulmonary embolism (PE) for which the death rate is high; PE is estimated at 7% to 25% depending on the context in which it occurs and the duration for which patients were monitored in studies.[1–3] The annual rate is high and VTEs occur in 1% of hospital stays[4] whether as the reason for hospitalization (40%) or because they arose in the course of a hospital stay (60%).[5] These recently published data provide a benchmark that should be taken into account by policies for preventing VTE and especially VTE occurring during hospital stays, the number of which could probably be easily reduced if more systematic prophylactic measures were put in place. In the United States, a new program has been introduced to reduce the number of VTEs and the Center for Disease Control (CDC) and prevention has reviewed the position in US hospitals in order to judge progress made, and has established the

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annual hospitalization rates for 100,000 inhabitants for hospitalizations including a VTE diagnosis by patient sex and age.[6] This paper draws a parallel between these data and those describing the situation in France. It shows the urgency of implementing a proper plan for preventing VTE. Such annual hospital incidences and rates of hospitalization for VTE, now refined by age and sex, are reliable and reproducible indicators for monitoring progress that might be made in preventing VTE in general practice and hospital care.

Methodology

Study objectives

The study was designed to describe the hospital incidences and annual hospitalization rates for VTE by age and sex in France and the United States on the closest possible methodological bases.

Hospitalization data

French statistics are from the PMSI MCO national database. These are compiled for each calendar year by collating RSA (anonymous discharge summary) files forwarded and validated by health establishments with admissions in medicine, surgery, obstetrics, and odontology (MCO). The anonymous summaries were encoded using the 10th edition of the International Classification of Diseases (ICD). The codes used to characterize VTE are codes I801 to I809 for DVT and I260 and I269 for PE.

The analyses differentiate among all of VTE, i.e. the DVT and PE. An earlier work differentiated DVT without PE (DVT) and PE with or without previous/associated DVT diagnosis, but as this difference was not taken into account by the CDC, we relinquished it to allow for a comparison with the US situation on a similar basis. Similarly, we omitted populations aged under 18 years who were not included in the CDC study, which explains the slightly different prevalences from those published in earlier works.[4,5] The study data cover the period 2010–2011, the stays are for Principal Diagnosis of Medical Unit Summaries (RUM), the reason for admission to the medical unit and no longer the diagnosis that mobilized the most resources in the medical unit. This change makes it possible to distinguish between pathologies for which the patients were admitted to hospital and pathologies that appeared in the course of a hospital stay. Any stay with a mention of one of the selected ICD-10 codes whatever the RUM and whatever the position (principal diagnosis, related diagnosis, significant associated diagnosis) unless it was the principal diagnosis of the first rum of the stay was considered to be a thrombosis acquired in hospital.

The CDC study relates to data from the National Hospital Discharge Survey (NHDS) which is equivalent to the PMSI in France and uses the ICD-9 for encoding the data. Hospitalizations of people aged over 18 years including a DVT or PE diagnosis were included in their analyses.[6] A DVT diagnosis was defined by the presence of a code 451.1x, 451.81, 451.83, 453.2, 453.4x, 671.3x, or 671.4x and an EP diagnosis by a code 415.1x or 673.2x. Patients presenting with a DVT or PE were counted among patients presenting with a VTE. Unlike the French PMSI, the US system cannot differentiate between whether the VTE was present upon admission or occurred during the hospital stay, which explains why we have not indicated this in the French statistics. The US data relate to the years 2007–2009.

Statistical analyses

The results are annualized and presented in the form of percentages for qualitative variables and by means and standard deviations for quantitative variables. Because the data are for the entire population and not a sample from a survey, the notion of 95% confidence interval is uncalled for. Similarly, the millions of patients in the French and US database confer such power on the statistical tests that the slightest variation, however tiny, becomes statistically significant and so it was pointless indicating them. SAS version 9.3 software was used for the French PMSO MCO database.

Results

Annual hospital incidence of VTE, DVT, and PE

In the United States, from the NHDS data, 547,996 hospital stays involve VTE, 348,558 DVP, and 277,549 PE. Of these 78,511, or 14%, include a diagnosis of both DVP and PE. The CDC does not indicate a number of annual hospitalizations but this can be estimated at about 39,000,000 by reference to the Agency for Healthcare Research and Quality report on the strength of 2010 figures. On this basis, the hospital incidence of VTE is 1.4%, DVP 0.9%, and PE 0.7%.

In France, from PMSI MCO data, of the 26,658,228 annual hospital stays, 273,931 include VTE, 179,286 DVT, and 139,345 PE while 44,700, i.e. 16.3%, include both DVP and PE. The hospital incidence of VTE is thus 1.0%, DVT 0.6%, and PE 0.5%.

Annual hospitalization rates for VTE, DVT, and PE by age and sex

Tables 1 to 3 show the annual rates of hospitalization for VTE, DVT, and PE according to age and sex for

Table 1. Annual hospitalization rates with VTE as diagnosis depending on age and sex in France and the USA.

	France			USA		
	VTE total	VTE men	VTE women	VTE total	VTE men	VTE women
18–39 years	56	46	67	60	53	67
40–49 years	115	117	113	143	154	132
50–59 years	192	230	156	200	226	176
60–69 years	318	369	271	391	405	379
70–79 years	737	746	729	727	720	732
80 years and +	1136	1053	1181	1134	1153	1123
All ages	274	256	290	239	226	252

Note: DVT and PE diagnoses are not mutually exclusive. A total of 78,511 US patients and 44,700 French patients were diagnosed with both DVT and PE. VTE include all patients diagnosed with DVT or PE.
VTE: venous thromboembolic disease.

Table 2. Annual hospitalization rates for DVT diagnosis by age and sex, in France and the USA.

	France			USA		
	DVT total	DVT men	DVT women	DVT total	DVT men	DVT women
18–39 years	35	30	40	34	32	36
40–49 years	77	79	75	81	97	64
50–59 years	127	154	101	120	144	97
60–69 years	209	242	179	247	254	241
70–79 years	478	481	477	487	469	501
80 years and +	747	688	779	791	821	775
All ages	179	168	189	152	146	158

DVT: deep vein thrombosis.

Table 3. Annual hospitalization rates for PE diagnosis by age and sex, in France and the USA.

	France			USA		
	PE total	PE men	PE women	PE total	PE men	PE women
18–39 years	30	24	36	33	28	38
40–49 years	57	60	54	82	85	78
50–59 years	97	119	76	111	124	99
60–69 years	161	192	133	203	208	199
70–79 years	384	395	376	349	337	359
80 years and +	572	528	595	500	537	480
All ages	139	132	146	121	115	127

PE: pulmonary embolism.

French and US populations as a whole. The overall annual hospitalization rates are respectively 274, 179, and 139 per 100,000 inhabitants in France and 239, 146, and 121 per 100,000 inhabitants in the United States. In both countries and in comparable proportions, annual rates of hospitalization for VTE increase with age, rising respectively from 56 per 100,000 for France and 60 per 100,000 for the USA in the 18–39 age group to 192 and 200 between 50 and 59 years, 318 and 392 between 60 and 69 years, 737 and 727 between 70 and 79 years, and to 1136 and 1134 in subjects aged 80 and over. Comparable changes with age are identified in both countries for DVT and PE taken separately. The annual rates of VTE, DVT, and PE are similar for both sexes, overall and whatever the age range, again in both France and the United States.

Discussion

This study of hospital incidences and annual hospitalization rates for thromboembolic diseases by sex and age in France and the United States has certain methodological limits relative to both French and US data.

For the French data, the first limitation lies in the quality of the coding of VTE by the DCD-10 as part of the PMSI-MCO. One study has shown that sensitivity was high (89%) for PE encoding but relatively low (58%) for DVT, which could contribute to underestimating its incidence.[7] Conversely, it may be that the difference between superficial and deep phlebitis is not always observed and that conversely some cases of superficial phlebitis of the upper limbs are encoded I808 or I809, that is ''Phlebitis and thrombophlebitis of other or unspecified sites'' thus raising the number of DVTs. Conversely, PE may be underestimated in this study. In works on 1000 patients in an autopsy-based study, the cause of death is PE in 15.9% of cases.[8] Another autopsy-based study[9] shows that only 45% of cases of death by PE had been diagnosed before death. It may be therefore that our study slightly overestimates DVT and underestimates PE. Similar limitations are probably to be found with the NHDS data but have not been described in the Morbidity and Mortality Weekly Report.[6] This study like the CDC study can also be criticized for not making a distinction between the first episodes and the repeat episodes or recurrences of VTE. This bias may affect the epidemiological dimension of the incidences of VTE in the general population but not the incidence of VTE among the pathologies taken in charge at hospitals. It can also be argued, for the US and French data alike, that the evaluations relate to patient discharge codes for reasons that are essentially related to billing or activity statistics and not information directly from patients' medical records and duly supported by results of biological tests or

medical imaging. Against that argument, studies have shown that the ICD codes used in discharge notes used by the NHDS predict the actual pathology with 75–95% accuracy.[10] Two other remarks may also be made, on the one hand the use of ICD-9 in the US studies and ICD-10 in the French studies and the fact that in one instance the study was made between 2007 and 2009 and in the other between 2010 and 2011. The impact of these differences is probably slight, though: correspondence between ICD-9 and ICD-10 coding is a well validated domain and, alas, the findings in terms of thrombosis epidemiology are relatively stable, as shown by the result of a study for the period 2005 to 2011.[6]

It is important to underscore for a proper understanding that, in both cases, the unit of analysis is the hospital stay and not the number of persons diagnosed with DVT or PE, which introduces a distortion compared with classical epidemiological data but does not represent a bias; the number of hospital stays for VTE being greater than the number of patients suffering from VTE since each stay of the same patient is counted. Lastly, the US data unlike the French data fail to identify situations for which VTEs were the reason for hospitalization, which is regrettable for evaluating the importance of potentially avoidable VTE. It should be recalled that in the French work on these same bases, the rate of VTE occurring over the course of a hospital stay is 60% of all VTE taken into account in hospitals.[6]

We may also regret that no data were available in the Morbidity and Mortality Weekly Report[6] concerning the department where the VTE were admitted or where the VTE occurred during the hospital stay. In France, VTE mainly occurred in medical departments and much less in surgery department. It may reflect that that prevention may be actively put in place for some pathologies where it has truly achieved the status of medico-legal obligation as in orthopedic or gynecological surgery but is still too often neglected for hospitalization of the elderly for downturns in their general condition or infectious or rheumatological syndromes and who are exposed to a major risk factor, namely bed rest.

With the proviso of these remarks, several results of this study are worth underlining. The first is the high hospital incidence and the very high annual rates of hospitalization for VTE in France and the US that make the prevention of these diseases a major public health challenge in both countries, but which seem to be currently a more important concern for the US authorities[11,12] than their French counterparts. A genuine prevention program in conjunction with patients has been set up in the United States since 2012,[13] and a similar determination on the part of the authorities in France is to be wished for. The stakes are high both in human terms and in health economics terms. The death rate from VTE in France is 6.6% and rises considerably when VTE occurs during a hospital stay[5] and data from INSERM (www.inserm.fr), which collects all the information from death certificates in France put the number of deaths related with the occurrence of venous thrombosis at 20,000 per year. As for the extra costs related to covering VTE and its complications, they are estimated in the US at between $30,000 and $38,000 per VTE.[14] This situation is all the more regrettable because many recommendations have been issued by international learned societies[15–17] and health authorities.[18] Unfortunately, no data concerning mortality were presented in the n the Morbidity and Mortality Weekly Report[6] and no comparison can be made.

The rate of VTE is very high in both countries and in any event too high to be compatible with properly conducted prevention with current means. One might look especially at the use of elastic compression stockings which are generally available in hospitals that fail to exert the required pressure to ensure effective prevention (minimum 15–20 mmHg) and the still limited use of anticoagulants whether of the low-molecular-weight heparin type, fondaparinux, or new oral anticoagulants the use of which is reserved primarily to certain particularly thrombogenic post-surgical situations.

The second result is the increased incidence of VTE with age, which is a familiar phenomenon, but for which the data provide a better indication of the amplitude, which is just as great in the US as in France. However, this increase with age must not hide the fact that a substantial number of VTE events occur even in young subjects and for whom the question must be asked of possible shortcomings in the prevention they benefit from.

The third finding is the absence of any marked differences in the annual hospitalization rates for VTE, DVT, and PE between men and women in France and in the US. This result confirms that this difference which is often evoked might not be a clinical reality,[19] the risk factors specific to women probably offsetting the more frequent risk factors in men.

Lastly, this convergence of our results in terms of hospital incidence and annual rate of hospitalization by sex and age with indicators used by the CDC in the US for monitoring progress thanks to the prevention program is an additional argument for using them to quantify progress that might also be achieved in France by bolstering thrombosis prevention policies.

Conclusion

VTEs occur in France and the US in 1% of all hospital stays and are responsible for an annual hospitalization

rate that exceeds 200 per 100,000. The scale of these annual incidences should prompt us to question the quality of prevention put in place and/or its efficacy in general practice but also in hospital care, and requires more determined and more systematic prevention policies be implemented both in the interest of people and of health economics. Their findings can be readily monitored on the basis of simple indicators developed in this article and form the benchmark for evaluating progress made.

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