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Vascular dementia encoding in the French nationwide discharge summary database (PMSI): variability over the 2007-2017 period

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ABSTRACT

Objective. Vascular dementia (VaD) is the second leading cause of dementia. Diagnostic criteria have evolved from the concept of multiple infarctions to different subtypes: acute onset VaD, subcortical VaD, mixed cortical and subcortical VaD. Our aim was to analyze the evolution in the coding of these different subtypes of VaD in the French nationwide exhaustive hospital discharge database (PMSI) between 2007 and 2017.

Method. We included all principal diagnoses of VaD in the PMSI hospital stays from 2007 to 2017.

Results. Between 2007 and 2017, we show a relative decrease in the number of hospital stays for VaD compared to all hospital stays (0.0437% to 0.0404%). The 11,654 hospital stays for VaD in 2017 represent 13.5% of mental organic disorders. Subtype analysis shows a decrease in hospital stays for multiple infarctions between 2007 and 2017 (-50%), an increase for subcortical or mixed VaD (+20%), acute onset VaD (+184%) and an increase in "other VaD" (+85%).

Conclusion. These data suggest a slight decrease in hospital stays for VaD, possibly related to better control of cardiovascular risk factors. They also suggest that the coding should be consistent with the evolution of diagnostic criteria.

RÉSUMÉ

Objectif. Les démences vasculaires (DV) représentent la deuxième cause de démence. Les critères diagnostiques ont évolué du concept d'infarctus multiples vers différents sous-types : DV aiguë à déclenchement rapide, DV sous-corticale, DV corticale et sous-corticale. Notre objectif était d'analyser l'évolution dans le codage de ces différents sous-types de DV dans la base du Programme de Médicalisation du Système d'Information (PMSI) entre 2007 et 2017.

Méthode. Nous avons inclus tous les diagnostics principaux de DV parmi les séjours hospitaliers du PMSI entre 2007 à 2017.

Résultats. Entre 2007 et 2017, nous montrons une diminution relative du nombre de séjours hospitaliers pour DV par rapport à l'ensemble des séjours hospitaliers (0,0437 % à 0,0404 %). Les 11 654 séjours hospitaliers pour DV en 2017 représentent 13,5 % des troubles organiques mentaux. L'analyse des sous-types montre une diminution des séjours hospitaliers pour infarctus multiples entre 2007 et 2017 (- 50 %), une augmentation pour les DV sous-corticale ou mixte (+ 20 %), des DV aiguë à déclenchement rapide (+ 184 %) et une augmentation des « autres DV » (+ 85 %).

Conclusion. Ces données suggèrent une légère diminution globale des séjours hospitaliers pour DV, possiblement en lien avec un meilleur contrôle des facteurs de risque cardiovasculaires. Ils suggèrent également une adéquation des codages avec l'évolution des critères diagnostiques.

Keywords: dementia, vascular ; database ; clinical coding ; diagnosis

Mots-clés : démence vasculaire ; base de données ; codage clinique ; diagnostic

1. Introduction

In France, dementia affected 1 to 1.2 million people directly and 3 million relatives indirectly in the early 2010's [1,2]. Several predictive scenarios have been carried out, estimating a prevalence of 1.75 million in 2030 [3] and 1.81 million in 2050 [4]. Cerebrovascular disease are the most common causes of dementia after Alzheimer's disease: vascular dementia (VaD) is estimated to be about 15% of dementias [5]. The management of vascular dementia is based on the effective control of cardiovascular risk factors: hypertension, smoking, ischaemic heart disease, atrial fibrillation, diabetes, obesity, etc. [5]

In 1993, the National Institute of Neurological Disorders and Stroke with support from the *Association Internationale pour la Recherche et l'Enseignement en Neurosciences* (NINDS-AIREN) proposed criteria for the diagnosis of VaD [6]. In 2000, Erkinjuntti et al. proposed a modification of the NINDS-AIREN criteria as a new research criteria for subcortical VaD [7]. In 2005, two reviews highlighted the importance of poststroke VaD [8,9]. Advances in brain imaging, genetics and the evolution of the concept of dementia have led to the individualization of different subtypes of VaD in ICD-10: multiple infarctions, subcortical VaD, acute onset VaD, mixed types. Recently, the VASCOG statement proposed new criteria for vascular cognitive disorders [10].

The application of these different criteria to diagnose VaD in France is not known. The French *Programme de Médicalisation du Système d'Information* (PMSI) database gives access to the evolution of diagnoses over all hospital stay. Our aim was to analyze the evolution of VaD ICD-10 coding in France between 2007 and 2017.

2. Methods

2.1. Study design

This study consists of a retrospective cohort, based on secondary use of the PMSI database (presented below). We included all the inpatient stays from 2007 to 2017, from the website ScanSanté (Technical agency for Hospital Information).

2.2. Data source

The PMSI database is the French nationwide exhaustive hospital discharge database [11]. The database used in this study comprehends all the inpatient stays, from nonprofit and for-profit acute care hospitals (medicine, surgery and obstetrics), excluding psychiatric hospitals and rehabilitation care centers. This database includes administrative data (admission and discharge dates and modes), demographic data (age, gender, geographic area), diagnoses encoded in the International Classification of Diseases and Related Health Problems, 10th edition (ICD-10) [12] and other pieces of information [14]. This information is anonymized and can be reused for research purposes [15].

2.3. Inclusion criteria

Dementia and related diseases encoding rules have been defined in 2006 [16]. In accordance with those rules, we included inpatient stays having one of the following

ICD-10 codes as principal diagnosis: acute onset vascular dementia (F010*, 21 codes), multiple infarctions (F011*, 21 codes), subcortical vascular dementia (F012*, 21 codes), mixed vascular dementia cortical and subcortical (F013*, 21 codes), other vascular dementia (F018*, 21 codes), unspecified vascular dementia (F019*, 21 codes).

In comparison, we noted the number of organic mental disorders, including symptomatic disorders: dementia of Alzheimer's disease, VaD, dementia during other diseases classified elsewhere, unspecified dementia, organic amnesia syndrome, non-induced delirium, other mental disorders, personality and organic behaviour disorders, organic mental disorder (codings from F00 to F09).

3. Results

3.1. Evolution of VaD

From 2007 to 2017, the number of inpatient stays with a principal diagnosis of organic mental disorders has followed the increase in the number of stays: 70,145 in 2007 (0,301% of inpatient stays) and 86,421 in 2017 (0,300%).

Over the same period, the number of inpatient stays with a principal diagnosis of VaD remained stable: 10,204 in 2007 (0,0437% of inpatient stays) and 11,654 in 2017 (0,0404% of inpatient stays). Among inpatient stays for organic mental disorders, VaD accounted for 14,5% in 2007 and 13,5% in 2017 (Table 1).

Table 1: Number of inpatient stays for vascular dementia in France

3.2. Evolution of subtypes of vascular dementias

Inpatient stays for other VaD increased over 11 years (+85%), while inpatient stays for unspecified VaD remained stable (+3%) (Table 1).

Among inpatient stays with specific codes in 11 years, there were fewer multiple infarctions (-50%) and a globally unchanged number of inpatient stays for mixed VaD (+9%). Number of inpatient stays for acute onset VaD increased between 2007 and 2013 (+228%) and then decreased between 2013 and 2017 (-13%). Number of inpatient stays for subcortical VaD followed the same pattern: + 77% until 2012 and then -11% until 2017 (Figure 1).

In 2017, inpatient stays for mixed VaD represented 34.6% of inpatient stays for VaD, unspecified VaD 27.2%, subcortical VaD 13.6%, other VaD 11.9%, acute onset VaD 6.6% and multiple infarctions 6.1%.

Figure 1: Evolution of subtypes of vascular dementia among the principal diagnosis of inpatient stays in France between 2007 and 2017

4. Discussion

Between 2007 and 2017, we show a slightly relative decrease in the number of hospital stays for VaD compared to all hospital stays (0.0437% to 0.0404%). This result can be

explained by a lower identification of vascular dementias, a decrease in hospital stays for vascular dementia or a better control of cardiovascular risk factors [17–21]. In our study, vascular dementias accounted for about 14% of hospital stays for organic disorders; in the literature, VaD is estimated to account for about 15% of dementias [5]. About subtypes of VaD, we describe two trends: first, the increase in "other VaD" diagnoses; second, a shift from multiple infarct inpatient stays to acute onset VaD and subcortical VaD inpatient stays, particularly between 2007 and 2012. The respective proportions of different VaD subtypes remained stable between 2013 and 2017. Over 10 years, it is unlikely that diagnostic rates could have changed as much; rather, our results reflect changes in coding patterns between 2007 and 2012.

Dementia diagnosis is a clinical syndromic diagnosis, which requires fulfilling diagnostic criteria. Such criteria exist for Alzheimer's disease [22,23], frontotemporal dementia [24] and dementia with Lewy bodies [25,26]. About VaD, it was initially thought that cerebrovascular disease caused dementia when there were many large cortical infarcts [27,28]. Fourth revision of Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) and ICD-10 used this concept of multiple infarctions to define VaD [5,29]. In 1992 and 1993, Alzheimer's Disease Diagnostic and Treatment Centers (ADDTTC) and then the NINDS-AIREN proposed criteria for the diagnosis of vascular dementia (VaD) [6,30]. These criteria were compared: because of their high specificity, the NINDS-AIREN criteria have been preferred in most relevant studies [5,31]. They also expanded the idea to include not only multiple cortical and/or subcortical infarcts, but also strategic single infarcts, non-infarction white matter lesions, hemorrhages, and hypoperfusion as possible causes of VaD.

Thus, in our study, analysis of the subtypes shows a trend in line with the literature and diagnostic criteria: VaD by multiple infarction accounted for 13.8% of vascular dementias in 2007 and only 6.1% in 2017. Also, the increase in "other VaD" suggests a lack of precision among ICD-10 proposals.

We do not observe any change in the distribution of the various subtypes of VaD after 2014, which could be linked to the VASCOG statement [10].

Principal strength of our study is to study all hospital stays in France over 11 consecutive years, for a total of 285,748,938 stays.

Our study has potential limitations. The inpatient stays ICD10 codes were registered for billing purposes, and we did not confirm them versus clinical records. The use of the PMSI for activity-based payment of hospital services can lead to under-coding diseases that have no financial impact. However, the coding as the main diagnosis of vascular dementia (regardless of the precision) or Alzheimer's dementia is associated with the same homogeneous group of stay, and with the same pricing for stays from 3 to 20 days. The pricing of the stay will increase by coding the associated diagnoses (undernutrition, decubitus ulcer, bedridden patient, etc.); thus, there is no financial inducement to use precisely one code of dementia rather than the other.

Since 2012, government agency in charge of the PMSI database has been working on the Ovalide tool, a PMSI data validation tool, which will make it possible to identify low quality in PMSI data. Use of hospital coding to define the diagnosis is a recognized way of counting dementia [32]. We study here the number of hospital stays; some patients may have had several stays. Besides, we interested in the evolution of coding, and there is no

reason to believe that the annual number of stays of patients with VaD may have changed between 2007 and 2017. Defining and identifying dementias in the major French administrative databases is an issue of interest: a recent review proposed several algorithms, two of which have been validated [33].

5. Conclusion

The number of hospital stays for vascular dementia has remained stable over 11 years. This represents a slight relative decrease in proportion to the total number of hospital stays. One possible explanation is the improved control of cardiovascular risk factors. These data can be useful to encourage good control in patients at risk.

We also showed a decrease in hospital stays for imprecise diagnoses of "multiple infarction", associated with an increase in the number of diagnoses of "subcortical or mixed VaD", "acute onset VaD" and "other VaD". Finally, these data suggest an adequacy with the evolution of diagnostic criteria. Improvement in the coding quality of VaD is engaging for future studies with the PMSI database.

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Conflicts

The authors do not have any conflict of interest to declare.

Table 1: Number of inpatient stays for vascular dementia in France

Principal diagnosis	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Acute onset VaD	272	342	546	760	827	802	892	785	789	731	773
Multiple infarctions	1,410	1,367	1,226	1,104	1,035	932	791	712	767	734	709
Subcortical VaD	1,006	1,155	1,304	1,597	1,635	1,776	1,723	1,701	1,565	1,548	1,584
Mixed VaD (cortical and subcortical)	3,686	4,219	4,090	3,788	3,801	3,719	4,033	3,773	3,882	4,118	4,026
Other VaD	749	831	953	1,044	1,099	1,057	1,053	1,094	1,237	1,305	1,387
Unspecified VaD	3,081	3,031	2,655	2,419	2,540	2,853	2,749	2,863	2,853	3,073	3,175
Total (F01*)	10,204	10,945	10,774	10,712	10,937	11,139	11,241	10,928	11,093	11,509	11,654
Organic mental disorders (F00*-F09*)	70,145	75,685	76,021	78,464	82,176	83,417	83,728	83,079	84,193	87,628	86,421
Total inpatient stays	23,339,533	23,781,314	24,297,929	24,709,773	25,259,627	25,828,027	26,476,016	27,087,492	27,600,941	28,538,316	28,829,970

VaD: Vascular dementia

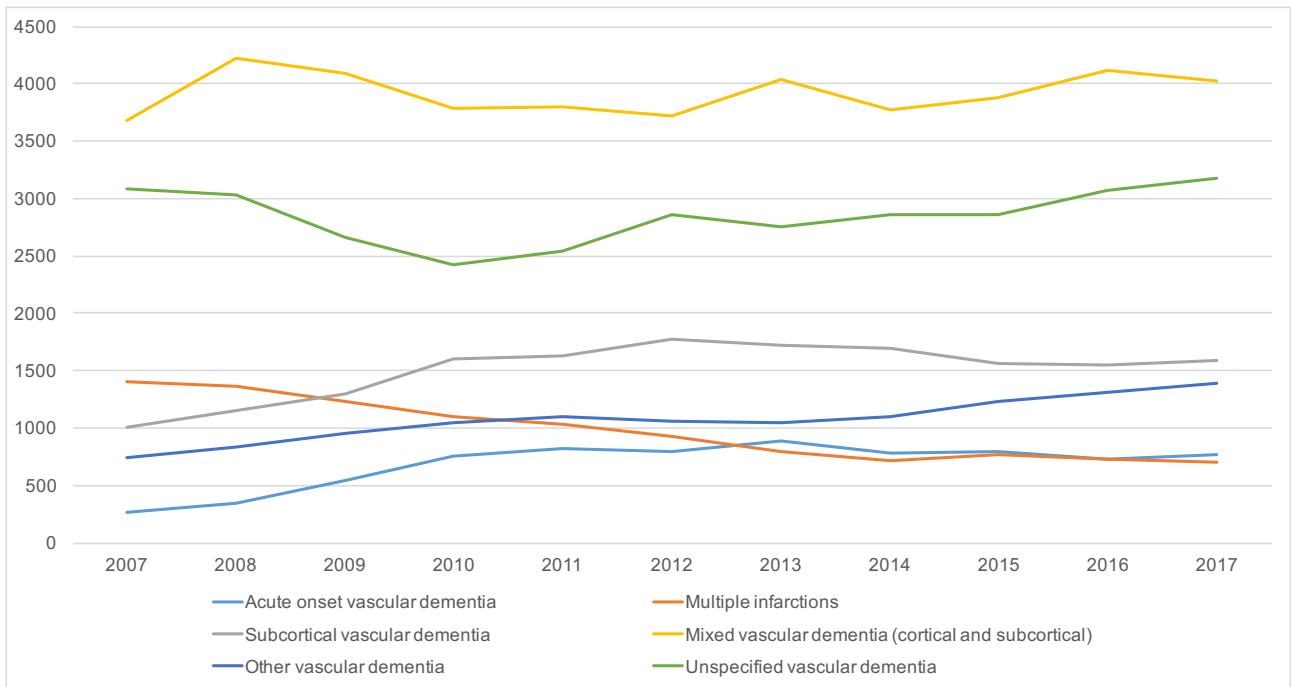


Figure 1: Evolution of subtypes of vascular dementia among the principal diagnosis of inpatient stays in France between 2007 and 2017