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General review

# Detection of adult attention deficit hyperactivity disorder with cognitive complaint: Experience of a French memory center

suppl. Informations

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ABSTRACT

*Introduction.* – Attention deficit hyperactivity disorder (ADHD) is a frequent neurodevelopmental mental disorder. It can persist in adulthood and be expressed as a cognitive complaint.

*Methods.* – We conducted a descriptive study in a French memory center concerning patients seen over a period of two years. All patients for whom the final diagnosis was ADHD were included. All patients benefited from standard neuropsychological tests and a psychiatric specific consultation.

*Results.* – Thirteen patients were included with an average age of 50.2 ± 19 years. Main complaints related to memory, attention, focusing and organizational functioning. These difficulties had negative social, professional and academic consequences. ADHD history in descendants was noted in 46% of patients. More than 20% of subjects had motor, verbal or mental restlessness. Neuropsychological assessment highlighted impaired performances in executive functions (38%), sustained attention (67%), divided attention (45%), working memory (46%) and information processing speed (75%). A psychiatric history or comorbidities were present in 85% of patients, mostly of the anxio-depressive type. The more prevalent presentations of ADHD were the combined (38%) and inattentive (38%) types.

*Discussion.* – Adult ADHD can masquerade as a cognitive impairment, including a stable cognitive complaint from infancy to old age. Inattentive, hyperactive and impulsive symptoms change with time and become more internalized (such as concentration difficulties or mental restlessness). No neuropsychological pattern has been reported but fluctuating

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deficits in sustained, divided attention, working memory and information processing speed are frequently observed in adult ADHD. A specific psychiatric expertise is essential in diagnosis and care for ADHD and its commonly associated psychiatric comorbidities.



## 1. Introduction

The American Psychiatric Association Diagnostic and Statistical Manual of Mental Disorders [1] (DSM-V) defines attention deficit disorder with or without hyperactivity (ADHD) as a syndrome occurring during childhood and which consists of three symptoms: hyperactivity, inattention and impulsivity. In the absence of a specific biomarker, this triad is the sole element for the diagnosis of ADHD. The variable combinations of these symptoms, their educational and social repercussions, are the cause of the different clinical presentations: a predominantly attentional subcategory, a predominantly hyperactive subcategory and finally a mixed subcategory that associates both inattention and hyperactivity symptoms. ADHD is the most frequent neurodevelopmental disorder with an estimated global prevalence in children of between 5 and 6% which has been steadily increasing (an increase of 33% between 1997–1999 and 2006–2008) [2,3].

Historically described as a disorder restricted to the childhood period, its diagnosis in adulthood was long controversial [3]. Many longitudinal studies have now confirmed the chronic nature of ADHD symptoms throughout life, including at an older age [4]. The persistence of the symptoms after adolescence is observed depending on the clinical form considered, in 50% to 80% of the cases [3,5]. Thus, the prevalence of ADHD in adulthood is estimated between 2–5% and 3–4% worldwide [3,6]. The typical presentation of ADHD in adults meets different criteria from those observed in children. Symptoms associated with hyperactivity/impulsivity decrease and are expressed by disorganization and restlessness (motor or mental), while those associated with an attention deficit persist and now tend to become more prevalent [5,7]. Over time, the target symptoms of ADHD thus become more ''cognitive'' than ''behavioral''.

Compared to healthy young adults, these patients appear to exhibit more attentional, executive and/or memory difficulties [8,9]. Probably because of the age of the subjects, these anomalies are not found in common practice and there is currently no specific neuropsychological pattern for adult patients with ADHD [10]. Moreover, depending on the personal environment, more frequent comorbidities in this population and compensatory strategies spontaneously implemented, certain signs can be integrated into the overall functioning of the patient and make the diagnosis procedure more complex. Although it is not uncommon today for psychiatrists to make late diagnosis, it is, on the contrary, little known by other adult care centers, particularly for memory [11,12]. Yet the predominant cognitive expression can be the reason for seeking care in a memory center. In this study, we wanted to evaluate specifically the clinical and neuropsychological elements allowing memory-based screening of adults with ADHD.

## 2. Patients and methods

### 2.1. Outline of study

We carried out a retrospective descriptive study in a French MRRC (Memory Resources and Research Center) between January 1st, 2013 and December 31st, 2015. We included consecutively all patients for whom the diagnosis retained at the end of the investigations concluded an attention deficit disorder with or without hyperactivity. We excluded patients diagnosed with ADHD since childhood. Patients were initially evaluated by one of the three neurologists working in the memory center and all underwent neuropsychological assessment. The neurologist determined what complementary examinations were appropriate. After neurological disease was excluded, all patients were referred to the referral psychiatrist for diagnostic confirmation.

### 2.2. Data collection

Using a standardized sheet for data collection, we found and gathered the following demographic data: age at first appointment, gender, family status, level of education as defined by French institute for national statistics (INSEE), family history (including occurrences of ADHD). Elements related to childhood development, presence of motor restlessness or attention disorders during this period were also noted.

We collected the data concerning the reason for seeking care: existence of a cognitive complaint, duration of disease course and presence of a triggering factor, domain concerned by the complaint (memory, attention, concentration, organization, language, sleep, and emotion), repercussions (school, professional, social, acts of everyday life). Clinical examination and interrogation sought the existence of motor, mental or verbal restlessness.

In terms of neuropsychological evaluation, verbal episodic memory was measured by the French version of the Free and Cued Selective Reminding Test (RL-RI16) or the California Verbal Learning Test (CVLT) and visual episodic memory using Recall of the Complex Figure of Rey-Osterrieth (ROCF). ThExecutive functions were evaluated using the Wisconsin card sorting test: flexibility by the number of categories completed and the number of persistent errors, inhibition by the number of perseverative errors and maintenance of set.

Concerning attention mechanisms: working memory was evaluated using digit-spans and the Brown-Peterson paradigm, K-T test sustained attention, Brown-Peterson paradigm divided attention, and K-T test information processing speed. Language, more specifically the creation of categories, was

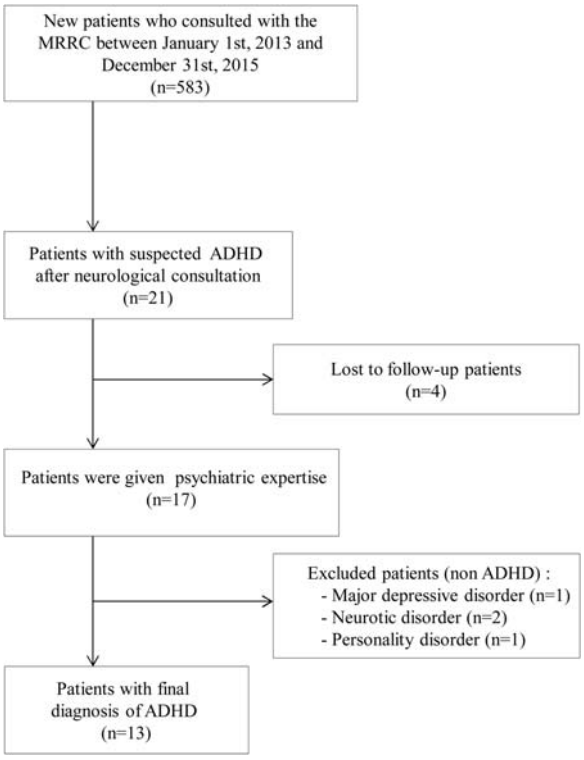


**Figure 1 – Flowchart of patient selection.**

evaluated using semantic and formal verbal fluencies. Visio-constructive capacities were evaluated using a copy of the Complex Rey-Osterrieth Figure. We noted impaired performances and defined as "frailty" in subjects for whom the results were within age and level standards but nevertheless showed qualitative abnormalities.

The psychiatric analysis sought the presence of comorbidities and psychiatric antecedents: addiction, mood disorders, anxiety and neurotic/psychotic disorders.

Screening for ADHD was conducted using two questionnaires. The Adult Self-Report Scale (ASRS-v1.1) [13] (Appendix A) is a self-report scale of symptoms very similar to ADHD which are present at the time of consultation. The short version consists of six questions. If at least four answers were in line with an ADHD symptom, a long 18-item version was systematically suggested.

The Wender Utah Rating Scale (WURS) [14] (Appendix B) is a scale that retrospectively assesses the presence of symptoms during childhood according to four criteria (emotional and affective, impulsivity-conduct disorders, impulsivity/hyperactivity and attention deficits.). The scores can vary between 0 and 100. A critical threshold of 46 has been suggested by some authors but remains only a possibility [15].

The diagnosis of ADHD was based on a structured interview tool, either the WSR (Weiss Symptom Record) [16], or the DIVA 2.0 (Diagnostic Interview Voor ADHD) [17]. These two interviews allowed the assessment of the presence or absence of the 18 diagnosis criteria according to DSM-IV. At the end of the psychiatric assessment, patients were prescribed medication or not.

**Table 1 – Demographic and general data of patients.**

| | |
|---|---|
| Demographic data | |
| Age at first consultation (mean ± SD) [min; max] | 50.2 ± 19 [22; 75] |
| Sex (M/F) | 3/10 |
| Marital status *n* (%) | |
| Married | 11 (85) |
| Divorced | 1 (8) |
| Single | 1 (8) |
| Education level – Insee (mean ± SD) | 4.2 ± 0.8 |
| Family history: dementia, psychiatric disorders *n* (%) | 7 (54) |
| Including ADHD *n* (%) | 6 (46) |
| Reason for consultation | |
| Cognitive complaint *n* (%) | 13 (100) |
| Duration *n* (%) | |
| < 5 years | 3 (23) |
| 5–10 years | 4 (31) |
| > 10 years | 6 (46) |
| Triggering factor *n* (%) | 5 (38) |
| Domain concerned *n* (%) | |
| Memory | 11 (85) |
| Attention | 9 (69) |
| Concentration | 10 (77) |
| Organization | 7 (54) |
| Language | 6 (46) |
| Sleep insomnia | 4 (31) |
| Emotional regulation | 1 (8) |
| Clinical sign | |
| Motor restlessness *n* (%) | 3 (23) |
| Verbal restlessness *n* (%) | 3 (23) |
| Excessive mind-wandering *n* (%) | 4 (31) |
| Childhood | |
| Motor restlessness *n* (%) | 6 (46) |
| Attentional disorders *n* (%) | 5 (38) |
| Repercussions | |
| Academic *n* (%) | 11 (79) |
| Professional *n* (%) | 10 (71) |
| Social *n* (%) | 7 (50) |
| Acts of everyday life *n* (%) | 4 (29) |
| Sleep insomnia *n* (%) | 4 (31) |
| Emotional instability *n* (%) | 1 (8) |

## 3. Results

Of the 583 new patients who consulted with the MRRC over a period of three years, 13 were diagnosed with ADHD after explorations (Fig. 1). Their demographic and general data are presented in Table 1. The sample consisted of 10 women and three men, with an average age of 50.2 ± 19 years with values ranging from 22 to 75 years. A family history of ADHD was present in 46% of them, in all cases of offspring (children or grandchildren). The reason for consultation was a cognitive complaint in the 13 patients. This complaint affected memory for 85% of them. Attention difficulties were noted in 69% of the cases, 77% exhibited a lack of concentration, and 54% a lack of organization. An important change in work or family life for two and three of them respectively was the factor revealing the cognitive complaint. Motor, verbal or mental restlessness was noted in more than 20% of patients at the time of the memory consultation. Cerebral magnetic resonance imaging was performed in six patients and CT in two patients; none showed any abnormality that could explain the symptomatology.

**Table 2 – Neuropsychological test results of ADHD patients.**

| | |
|---|---|
| Episodic memory | |
| Verbal ($n$ = 17) | |
| Impaired $n$ (%) | 3 (23) |
| Frailty $n$ (%) | 1 (8) |
| Visual ($n$ = 17) | |
| Impaired $n$ (%) | 1 (8) |
| Frailty $n$ (%) | 2 (15) |
| Executive functions | |
| Flexibility ($n$ = 17) | |
| Impaired $n$ (%) | 4 (31) |
| Frailty $n$ (%) | 0 (0) |
| Inhibition ($n$ = 17) | |
| Impaired $n$ (%) | 5 (38) |
| Frailty $n$ (%) | 0 (0) |
| Maintenance of set ($n$ = 17) | |
| Impaired $n$ (%) | 4 (31) |
| Frailty $n$ (%) | 2 (15) |
| Attention | |
| Working memory ($n$ = 17) | |
| Impaired $n$ (%) | 6 (46) |
| Frailty $n$ (%) | 2 (15) |
| Sustained attention ($n$ = 13) | |
| Impaired $n$ (%) | 6 (67) |
| Frailty $n$ (%) | 2 (22) |
| Divided attention ($n$ = 15) | |
| Impaired $n$ (%) | 5 (45) |
| Frailty $n$ (%) | 1 (9) |
| Processing speed treatment ($n$ = 16) | |
| Impaired $n$ (%) | 9 (75) |
| Frailty $n$ (%) | 0 (0) |
| Language | |
| Verbales fluencies ($n$ = 9) | |
| Impaired $n$ (%) | 2 (13) |
| Frailty $n$ (%) | 0 (0) |
| Visuoconstructional abilities | |
| Copy of ROCF ($n$ = 16) | |
| Impaired $n$ (%) | 0 (0) |
| Frailty $n$ (%) | 0 (0) |

**Table 3 – Data collected after psychiatric expertise.**

| | |
|---|---|
| Psychiatric history and comorbidities | |
| Psychiatric history | 11 (85) |
| Depressive episode $n$ (%) | 7 (54) |
| Anxiety $n$ (%) | 5 (38) |
| Phobia $n$ (%) | 2 (15) |
| Psychiatric comorbidities | 11 (85) |
| Addiction $n$ (%) | 6 (46) |
| Depressive episode $n$ (%) | 6 (46) |
| Anxiety and neurotic disorders $n$ (%) | 4 (31) |
| Psychotic disorders $n$ (%) | 1 (8) |
| ADHD diagnosis | |
| ASRS-v1.1 (mean ± SD) | |
| Short version/6 | 4.54 ± 1.3 |
| Long version/18 | 12.3 ± 2.9 |
| WURSS 25 (mean ± SD) | 51.9 ± 18.7 |
| DSM-IV $n$ (%) | |
| Predominant attentional type | 5 (38) |
| Predominant hyperactive type | 2 (15) |
| Combined type | 5 (38) |
| Residual syndrome | 1 (8) |
| Therapeutics | |
| Methylphenidate $n$ (%) | 3 (23) |
| Psychoeducation $n$ (%) | 10 (77) |
| Cognitive behavioral therapy $n$ (%) | 3 (38) |

ASRS: Adult Self-Report Scale; WURSS: Wender Utah Rating Scale; DSM: diagnostic and statistical manual of mental disorders.

The data on the neuropsychological assessment are reported in Table 2. At the time of the tests, two patients were treated by antidepressants drugs (selective serotonin reuptake inhibitor), one receiving a benzodiazepine. Approximately 46% of the patients with ADHD exhibited at least one deficit score in one of the tests evaluating executive functions. In terms of attention, 46% had impaired performance in working memory, 67% in sustained attention, 45% in divided attention and 75% in information processing speed. Regarding episodic memory, three of them had impaired free recall to the RL/RI 16 or the CVLT; the effect of cueing was complete for one and incomplete for two.

The data collected after psychiatric consultations are presented in Table 3. All patients were referred to the psychiatrist for suspicion of ADHD except two for whom the depressive syndrome in the foreground masked ADHD. Of the 13 patients, 11 had a psychiatric history and/or psychiatric comorbidities. The main psychiatric comorbidities found were depressive disorders (46%) and addictive disorders (46%). According to the DSM-IV, 38% had a combined type of ADHD, 38% had a combined type and 15% had a predominantly hyperactive type. One patient had a probable residual syndrome. Therapeutically, 23% of patients received methylphenidate drug therapy, 38% cognitive behavioral therapy and 77% psychoeducation.

## 4. Discussion

The diagnosis of ADHD is based on exclusively clinical criteria well known to psychiatrists [1]. Due to the sometimes advanced age of these patients and the compensatory strategies introduced since childhood, clinical expression may be different and lead to a cognitive complaint. ADHD can thus be suspected outside the psychiatric setting and may be a source of difficulties for a clinician unfamiliar with these conditions. Our objective in this study was to identify, through the descriptive analysis of 13 patients, the clinical features that could facilitate screening for adult ADHD in memory consultation.

### 4.1. *Significant clinical features of ADHD in memory consultation*

In our population, the average age of patients was 50 years. This observation confirms the existence of adult ADHD symptoms whose presence beyond age 60 is estimated at 4.2% [4]. By definition, there is no ADHD adult onset. Despite a long-standing cognitive discomfort, psychiatric comorbidities or a major lifestyle modification seem to be an opportunity to uncover cognitive difficulties that were previously well compensated. The falsely delayed character of the cognitive complaint leading to consultation may lead to the suspicion of

a neurodegenerative disease. In this context, certain clinical features noted in the patient's past and present history may guide the clinician towards the diagnosis of ADHD.

The sex ratio for children is four to nine boys for one girl [1]. In our population, this sex ratio was reversed (10 women for three men). This change could be partly explained by the underestimation of the number of girls with childhood onset. Indeed, the latter mostly present predominantly the inattentive type, which is the most difficult type to diagnose [17]. In adulthood, these attention disorders can become more disabling and constitute a reason for consultation in memory centers. No patient was aware of symptoms that had begun in childhood. Interrogation should, however, focus on specific symptoms of inattention or restlessness during childhood, often referred to schools. Contrary to usual practices in memory consultation, the search for a family history will focus more on the descendants than on the ascendants. In our population, 46% had at least one child or grandchild with ADHD. ADHD has, in fact, a major genetic component with an estimated heritability of 0.8 [5]. The genes involved seem to be coding for proteins, a significant element in the regulation of dopaminergic and serotonergic pathways.

This early and non-progressive complaint was always cognitive and concerned mainly memory, attention and concentration abilities. Some subjects had difficulty finding words in conversation. Each of these cognitive complaints may be the expression, in adulthood, of the syndromic triad hyperactivity/impulsivity/inattention.

Restlessness or hyperactivity seems to decrease by 50% between childhood and adulthood [18]. Although characteristic, motor restlessness (''incessant fidget'') was noted only in three of our patients. In adulthood, restlessness seems to be more internalized [19]: in verbal form (over-talkativeness to logorrhea) as in three of our patients or in the form of more subjective elements (feeling of motor impatience, nervousness, voltage…). Another form this time of psychic nature concerned 31% of our patients: excessive mind-wandering. This form of mental hyperactivity, classically described in adults with ADHD, is defined by ''a mind that drifts away from a task and focuses on internal thoughts and images that are unrelated to the task or situation at hand'' [3]. Restlessness can also be expressed in everyday life by a rapid loss of interest in various activities leading to the multiplication of activities (leisure or work), procrastination, the avoidance of sedentary trades and a craze for social relations [2].

Impulsivity appears to decrease by 40% in adulthood. Like restlessness, it takes over time a form which tends to be more verbal than motor (20). In our population the three patients who complained of verbal impulsivity also complained of verbal restlessness; these signs are easily spotted at interrogation. Language is presented as disconnected, with many digressions with patients who speak without thinking, answer before the question is fully posed, interrupt their interlocutor, lose the thread of discourse… Motor impulsivity can be integrated for a long time in the personality of the patient who is described as passionate and unreflective. In our population, restlessness had not resulted in any of the dangerous consequences conventionally reported in this syndrome: offenses, reckless expenditures, dangerous driving… [19]. The patients are aware of all these facts and suffer from them, which is not the case in megalomania experienced in manic episodes.

Inattention is the central symptom in adult ADHD [5,7]. This disorder brings together a very rich set of manifestations which constitute the main part of the complaint. In our population, attention disorders were at the center of the complaint in 69% of the cases, dealing with commonplace things like loss of objects, forgetting appointments or difficulties in reading. More specifically, attention disorders were manifested by difficulties in concentration in 77% of patients and organization in 54% of patients. These difficulties are frequently reported in adults with ADHD when faced with new demands and responsibilities [20]. One of the particularities of ADHD attention disorders is its fluctuating nature. Conners et al. report that, usually, symptoms worsen in situations lacking intrinsic attractiveness or novelty, in monotonous and repetitive tasks. On the contrary, the symptomatology diminishes or even disappears if the subject is in a new or particularly interesting environment [20]. It is thus rarer to observe these attention disorders during consultation.

Retrieving the patient's life history may reveal additional elements resulting from the association of several of these symptoms. In the school setting, 79% of patients were affected, mostly with delays in acquisitions, repetition and children judged as ''stunned'' in class. The number of years of study is often lower than in the general population [18]. On the social level, we noted interpersonal difficulties in 50% of our patients, associating conflicts with the environment, problems of insertion and relational or couple stability [19]. The family network is often reduced, especially among people over the age of 60 [21]. Initial sleep insomnia was found in four of our patients. If it does not represent a diagnostic criterion, it is present in more than 70% of adults with ADHD [3]. Although only one of our patients had an emotional complaint, emotional dysregulation is a common associated feature of ADHD with frustration intolerance (aggravated by agitation), irritability and high mood lability [1,3,22]. For all these reasons, adult ADHD can have a major socio-economic impact [23].

### 4.2. *Neuropsychological evaluation*

ADHD is a clinical diagnosis. The DSM-V unambiguously states that the results obtained in neuropsychological tests do not have diagnostic value. Although the literature highlights some profiles, these results are not always reliable on an individual scale [9]; they can be a valuable aid in the diagnostic process.

In our population, all attention aspects were disrupted by neuropsychological tests. These results are similar to those found in the literature, where alterations in sustained attention, vigilance, working memory, speed of mental processes, mental flexibility… [9,24–26]. The working memory evaluated by the backward digit-span task and the Brown Peterson paradigm was altered in 46% of our patients. One of the most common findings in the literature [8,27] is that it is easy to seek in consultation. According to some authors, poor performances on digit-span task are associated with a lack of attention resources, which is responsible for impaired

encoding [28]. Information processing speed was the most impaired component in our sample. This process appears to often be deficient in ADHD patients and this deficit seems to increase with the complexity of the task [29]. Sustained attention and divided attention were impaired in 67% and 45% of patients, respectively. These attention deficits, which define ADHD, are correlated with the severity of the disorder and the presence of symptoms in childhood [30].

In our population during the Wisconsin test, 38% of patients had impaired performances in flexibility, inhibition or strategy maintenance. Although the majority of studies show at least one executive dysfunction in this population, it seems to concern mainly the tests requiring attention control [26,31]. Attention deficit can be a major contributor to executive difficulties such as planning, inhibition, flexibility, problem solving and decision-making on a regular basis in these children and adults [25,29]. At the individual level, it is less systematic to highlight a deficit in executive functioning. The implementation of compensatory mechanisms underpinned by executive control processes whose maturation differs from one person to another seems to be one of the explanations for the heterogeneity of the results and by extension of the late diagnosis [3]. Another explanation lies in the controversial hypothesis that hyperactive forms have less executive performance, whereas attention forms are more likely to be deficient in memory, attention spots and in the speed of information processing [26].

Intellectual functioning, perception, memory, language, praxis, and visuo-constructive abilities are generally well preserved. However, the impact of executive and attention difficulties on other cognitive functions can lead to disorganized speech or the presence of intrusions into memory tasks [24]. Despite the memory complaint, only three patients had difficulties in verbal episodic memory and one in visual modality. From a qualitative point of view, these abnormalities were not related to a genuine episodic memory deficit (hippocampal) but more related to a deficit in the recovery of an executive or attention alteration [26]. Concerning language, a ''word-finding'' problem can be linked to learning lags in childhood in these patients. In our study, language was evaluated by the verbal fluency test, which requires executive capabilities both for the recovery and for categorizing knowledge [32]. However, only two patients were deficient in this test, one of them suffering from developmental dyslexia.

The presence of comorbidities must be integrated in the consideration of these results. Indeed, most psychiatric comorbidities (mood disorders, addiction, schizophrenia) have neuropsychological deficits, mainly executive and attention, which interfere with the correct interpretation of the results [26,33]. Similarly, low level of education and possible learning disabilities must also be taken into account.

Finally, three patients had no deficit score. This apparent normality of the tests could be explained by the attention and motivational fluctuations usual in ADHD. Indeed, attention can vary on the order of seconds, fluctuating from one trial to the next of a cognitive task; minutes, declining over the course of a taxing or monotonous task; and hours, varying throughout the day with the circadian rhythm and drugs like caffeine. After qualitative analysis, non-significant errors were noted.

### 4.3. *Psychiatric expertise*

As recommended by the European consensus, all patients were given psychiatric expertise to diagnose ADHD, evaluate psychiatric comorbidities and develop appropriate therapeutic management [17]. Screening is based on self-assessment scales made up of items that put these difficulties in a situation; they are filled in by the patient and by means of directed interviews. The presence of a family member is strongly recommended. ASRS-V1.1 looks for already present signs. In our population, the mean score for the short version was 4.5/6 (above the threshold of 4) and the average score for the long version was high (12.3/18). The presence of diagnostic signs (before seven years according to the DSM-IV, before 12 years according to the DSM-V) was detected using the WURSS questionnaire completed by the patient. Because of its retrospective nature, the presence of a family member is strongly recommended by the DSM, as well as bringing school records books. These scales have a supplementary role, but the diagnosis is finally established with the DSM-IV (now V). The diagnosis of ADHD requires having five to seven symptoms in two areas of inattention/hyperactivity/impulsivity. It also requires significant clinical or psychosocial repercussions and must be present in at least two areas of daily life. In our study, five subjects had an attention type, five a combined type and only two had a predominantly hyperactive type. These results are consistent with the established notion of a decrease in hyperactive type over time.

During the consultation, the search for medical history or psychiatric comorbidities is essential. It is not reserved to psychiatric expertise only (although less specific), it is necessary for the diagnostic procedure, for the interpretation of neuropsychological tests and can lead to specific and adapted medical care. In our population, 85% of patients had at least one psychiatric comorbidity. The presence of psychiatric comorbidities is very high in patients with ADHD [5,34]. In the large cohorts, the three most frequent were found to be similar to those observed in our sample: addiction, generalized anxiety and mood disorders [5,6,34,35]. Depression in more than half of the cases in the elderly suffering from ADHD constitutes the main pejorative factor of this disorder [23,36]. One of the difficulties with the diagnosis of ADHD is the presence of common symptoms observed in this disorder and those observed in many other psychiatric diseases. Unlike the latter, the symptoms of ADHD are typically early and persistent over time. There is no sudden change in behavior [3].

The current recommendations indicate that the first treatment focuses on comorbidities and psycho-education, the aim of which is to obtain adaptive strategies. On the medicinal level, although the reference treatment is currently 80% efficient (as in children) [2,16,17], only three of our patients have been treated with psychostimulants (methylphenidate). Some people did not want to take this treatment, others were not able to take it because of a history of high blood pressure. The abuse of addictive substances which was

particularly high in our population (46%) is also an obstacle to psychostimulant treatment [37]. The main known adverse effects of psychostimulants are arterial hypertension, tachycardia and substance abuse; their prescription in elderly patients is therefore rather rare. On the other hand, 77% of the patients benefited from psychoeducation and 29% from a cognitive-behavioral therapy, the short-term benefit of which is proved and even more so if these measures are part of a multimodal approach [37]. Few data are available today on long-term effects [5].

### 4.4. *Other non ADHD patients*

Despite initial suspicion by the neurologist, the psychiatric expertise of four patients excluded the diagnosis of ADHD. These patients were younger (39.8 vs. 50.2). As they are non-specific, the complaint and its repercussions were similar and related to memory, attention and concentration. The neuropsychological assessment found no executive impairment in this population while the attention assessment was frankly deficient. As in ADHD, the presence of comorbidities was common. The mean values obtained by these patients on the screening scales were similar to those of patients with ADHD. Only the psychiatric expertise allowed the formal diagnosis of ADHD. It is essential on the one hand to meet the criteria of the DSM and on the other hand to eliminate differential diagnoses, which can sometimes be tricky (neurotic disorders for example), that could better explain attention disorders or hyperactivity.

### 4.5. *Limitations*

Due to the monocentric nature and small size of our sample, our results are probably not representative of the general population. However, they are consistent with those found in the literature. The collection of patient information and data as well as the completion of complementary examinations were carried out by three different neurologists working in the same center, following similar practices in a common care approach and with the same neuropsychology team. All files were also reviewed and discussed within the MRRC. The psychiatric expertise carried out by a single psychiatrist referring to the memory center, on the other hand, made it possible to standardize the diagnosis of ADHD. Given the period of this study, the diagnosis was based on the DSM-IV criteria. The DSM-V diagnostic criteria that are now referred to are practically unchanged but modifications have been made to facilitate the late diagnosis of these patients. ADHD is now included in a chapter called ''neurodevelopmental disorders'' and no longer in ''disorders usually diagnosed during childhood or adolescence''. Several symptoms must be present before 12 years and no longer before seven years, thus facilitating the retrospective investigation. Contrary to what has been observed in most studies, our patients were unaware of their diagnosis in adulthood and presented themselves in memory consultation for a purely cognitive complaint. In this sense, they are not representative of the majority of adults with ADHD. Similarly, we grouped all patients regardless of their age (18-75 years of age), although there are differences between ''young'' and ''old'' adults [38]. The heterogeneity of our results, as well as the low proportion of patients who were deficient in attention tasks, can be explained by the usual attention fluctuations in this disease. They may also reflect unhealthy psychometric tests that are not sensitive to screening for executive and attention difficulties in this population.

**Box 1. Clinical screening for ADHD during consultation → Psychiatric expertise**

- Family history of ADHD: descendants.
- Early and non-progressive complaint.
- Symptoms during childhood, stunned child, incessant fidget.
- Hyperactivity: mental or verbal restlessness.
- Attentional fluctuations.
- Multiplication of jobs and activities.
- Anxiety, mood disorders or addictive comorbidities.
- Loss of working memory, information processing speed, sustained and divided attention.

## 5. Conclusion

In adults, ADHD takes on a much more cognitive appearance which can be expressed in the form of an early and non-progressive complaint. By means of a targeted interrogation, the typical symptoms of hyperactivity/impulsivity/inattention can be easily found but in different forms in children (organization, concentration, mental restlessness...). Beyond these clinical symptoms, ADHD is characterized by a wide range of psychiatric symptoms such as sleep insomnia, emotional instability and is frequently associated with other psychiatric comorbidities. Fluctuating performances in working memory, information processing speed, sustained and divided attention as well as in execution are frequent in these patients. These symptoms and their impact on occupational and social life must be known to the clinician in memory consultation in order to trigger targeted investigations (Box 1). The lack of knowledge of this diagnosis is detrimental as it deprives the patient of suitable psychiatric care.

## Disclosure of interest

The authors declare that they have no competing interest.

## Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.neurol.2018.09.021.

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