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Sleep Concerns and Disorders in Children with an Autistic Spectrum Disorder (ASD)

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1. Introduction

The autistic spectrum disorder or ASD is frequently described or defined from several common characteristics during the periods of time concerning the wake time. More than many other situations, the investigations in ASD are difficult due to the particular personality encountered in this entity. This paper aims to present the interest of sleeping time study, owing to our experience and studies concerning sleep concerns in infants born prematurely, and in children suffering an ASD.

2. Definition of the autistic spectrum disorder or ASD and historical note

The ASD is included in the pervasive developmental disorders in the fourth edition text revision or DSM-IV-TR. That means that the original clinical description (Kanner's classic autism) has hardly changed with time, owing to the great variability of form and intensity in presentation. This clinical and biological entity contains a group of disorders (see Table I) with impairments in three major aspects: socialization, communication and behavior. It represents different clinical forms having however common social difficulties: a delay in language skills, an impaired social interaction, an impaired verbal or non-verbal communication, and repetitive, stereotyped or severely restricted activities and interests.

- | |
|--|
| <ul style="list-style-type: none"> - Classic autism or early infantile autism - Childhood autism (Kanner's autism) - Asperger syndrome or disorder - Atypical autism - Pervasive developmental disorder not otherwise specified - Childhood disintegrative disorder - Rett disorder |
|--|

Table 1. The different forms of ASD

3. Diagnosis

It might happen, in most typical cases and with a short video recording, that the diagnosis is rapidly done. In most cases however, it will need time, after several observations and records of the CHAT or ADOS scales. One needs also to exclude the intervention of a mental

retardation, an epilepsy, the effects of psychotropic drugs. The first signs may become prominent during infancy, and the diagnosis is merely done at three years, eventually sooner or later in life. In case of suspicion, it is highly recommended to address the infant to a specialized multidisciplinary team, after also an establishment of the IQ, a neuropsychological assessment, the assessment of hearing and vision .

4. Epidemiology, etiology, clinical description of ASD

The prevalence of ASD at 8 years of age has increased from 0.4 to about 2/1000 (range: 2-9 /1000. This observations is due to a combination of changes in case definition and an increased awareness together with more specialized developmental services. There is a male predominance with a male:female ratio of 4:1. One can also mention that ASD is present in siblings of an established ASD, in 2-8 percent. ASD is more frequently encountered in cases of monozygot twins and in case of prematurity. Associated following conditions are possibly found:

- Mental retardation;
- Seizures;
- Brain and cerebellum abnormalities (importance of MRI studies);
- Fetal alcohol syndrome;
- Phenylketonuria;
- Tuberous sclerosis;
- Chromosomal abnormalities: Fragile X, Rett syndrome, Angelman syndrome, 15 q long arm duplication/triplication.

The causes or explanations of this entity are no yet elucidated, even if both genetics and environment seem to play a role in 10 to 25 % cases. It is likely that interactions between multiple genes (locus on chromosomes 15 and 16) are responsible, and that epigenetic factors and exposure to environmental modifiers contribute to the variable expression. Several biochemical abnormalities such as an impairment of intra cerebral folic acid, serotonin, catecholamines and the opioid systems have already been reported. Several studies concerning the outside and inside receptors to different neurotransmitters are in progress. Until now, the association with immunizations (mainly thimerosal as conservative) is not confirmed.

5. The building of a normal sleep architecture in infants

Before 6 months of age, in normal circumstances, the infant falls in sleep and goes directly in a REM or rapid eye movement phase and remains in it during about 55 minutes. REM phase is followed by a non REM phase which remains about 65 minutes. After 6 months of age, the infant falls in sleep and goes directly in a non REM phase, remains in it for about minutes 90-120 minutes, and it is followed by a REM phase for a period of about 45 minutes. A sleep cycle contains a REM and non REM phase. Sleeping night time contains 8 cycles until 12 months, 6 cycles from 12 to 24 months, and 5 cycles after this age. The repartition of all these cycle has an homogenous distribution through night before the 24 months of age, and more --distributed after midnight after this age. These facts are illustrated in the Figure 1.

It is known that this process is in correlation with the melatonin synthesis from tryptophan in the infant. We can summarize that physiology by the following points:

- Circadian rhythm is usually present between 3 to 6 months of age;

- The sun and the melatonin synthesis have an important role;
- The secretion (by the pineal gland) of melatonin becomes evident at 3 months of age, and it increases until 1 year of age, and thereafter remains stable until puberty;
- Its secretion and release shows an increasing level at around 7-8 pm, with a pic level at 2-3 am, and remains stable from 7 am until 7-8 pm;
- One can observe a significantly low level in case of epilepsy, ASD, diabetes, babies born before 32 weeks or with a birth weight below 1500 g and in babies born from addicted mothers.

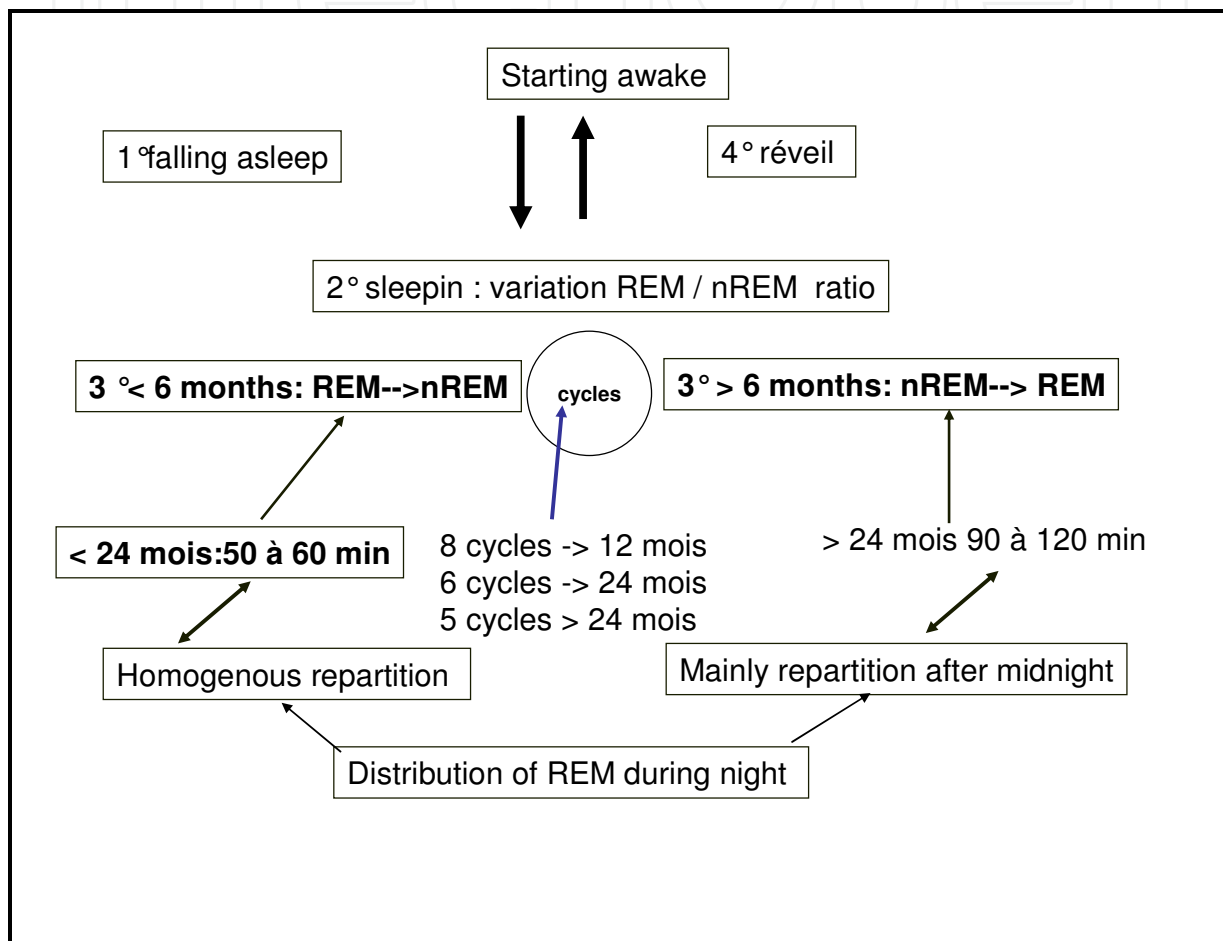


Fig. 1. The building of the normal sleep architecture in humans.

6. Sleep concerns in the autistic spectrum

In the ASD, the prevalence of sleep problems is between 44 and 83 % (in comparison of 30 % found in other population). It is not correlated to the IQ, although the degree of mental retardation tends to predict sleep impairment. Sleep disorders are hence more frequently encountered in children with an autistic spectrum.

The sleep disorders are not universal in autism, but they concerns about 55% of these beings. Good sleepers with ASD have fewer affective problems and satisfying social interactions.

Sleep disorders in ASD are listed in Table II.

- Insomnia. Here the parents report a prolonged time to fall asleep, a later bedtime, a decreased sleep duration and continuity, an increased arousals, an early morning wake time;
- Sleep disordered breathing;
- Bruxism;
- Arousal from sleep with confusion or wandering;
- Rhythmic movement disorder;
- Leg movements;
- Daytime sleepiness

The most frequently encountered sleep disorder in ASD is insomnia;

One can understand that the expected building of normal sleep architecture (see above) is not easily encountered in ASD.

The sleep studies (polysomnography or better hypnology) in infants having sleep problems early in life are mainly indicated in situations concerned by the risk of cot death and the suspicion of epilepsy. Studies concerning behavioral difficulties in infants or children are not so few.

7. Observations in sleeping times of children having a ASD

In a group of 22 children with an ASD aged between 4 and 8 years, we find the following observations in a global polysomnography or hypnology (Table III): electrophysiology of brain, heart, muscles and retina, respiration, pulsed oxymetry, movements of whole body, sleep architecture, central and peripheral apneas.

- Obstructive sleep apnea due to enlarged tonsils;
- Obstructive sleep apnea due to tracheomalacia;
- Abnormal density of REM periods
- Abnormal distribution of REM periods;
- Monotony of source and trajectory of the electrophysiological wave.

In our experience of sleep analysis in children having a ASD diagnosis, the interesting observation is concerning the analysis of brain electrogenesis: in its emergence, its distribution and progression in the different cortical areas.

We found a combination of:

- A repetitive emergence of electrogenesis in the left hemisphere (and more precisely around junction of frontal and temporal lobes) and
- A monotony and the spreading of that electrogenesis in the other cortical areas. (see Figure 2).

One possible hypothesis is that the observed abnormalities in wake time can be earlier observed in sleeping time. The loss of a normal variability in the usual neurological and behavioural moments in daily life could reflect a sort of (brain) internal self defensive attitude, an over and repetitive use of the same (being considered as safe and comfortable) circuitries among neurological pathways. This could lead to a sort of physical and emotional dependency, to a real fatigue of finally to much devoted cognitive and associated motor areas.

Together to these overuse and also underuse of brain areas, the concerned neurotransmitters are also overused or underused.

This could explain the following items in a strategy of self defense:

- the overfocusing areas of interest
- some periods of fatigue with suddenly an aggressive person against himself or an other person
- without the eventually need of adequacy on the moment of life
- without the need of waiting for or concerning the other
- without the need of integrating the task in the activities of a group
- without the approbation or interrogation (by listening to or looking at the other) in a task, or the use of a material.

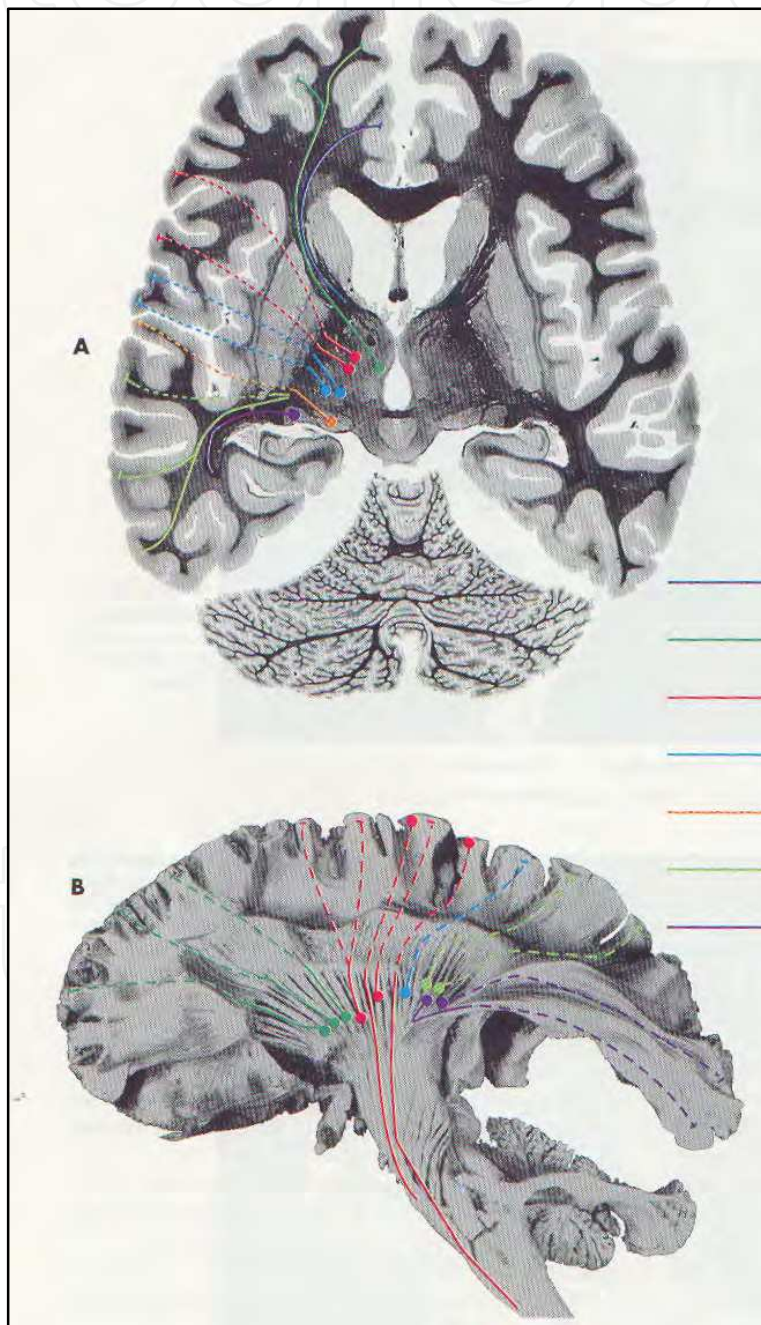


Fig. 2. Hypothetic fiber tracts repetitive activity in the autistic spectrum.

8. Integration of observation during sleeping and wake time for interventions and medications

As others, we find an association between sleep analysis and daytime functioning in ASD. Although it is difficult in this type of pathology, to determine whether poor sleep is the cause or result of a more problematic daytime functioning, or whether the severity is contributing to both poor sleep and more impaired daytime functioning, it seems plausible to imagine, as what can be seen in patients not having an ASD, that a better sleep time will contribute to a better daytime functioning and vice versa, and the more that is maintained over time, the more the resistance to possible perturbing factors will be high or low.

Autism therapies are designed to treat symptoms (mood instability, sleep disorder, aggressivity) or interrupt the abnormal equilibrium when this is found (disturbed balance of neurotransmitters, disturbed brain input of tryptophan or folic acid, disturbed pineal secretion of melatonin, disturbed endorphin secretion against neuropathic pain).

9. Behavioral and educational interventions

The therapies have the following nominations: the antecedent package, the behavioral package, the comprehensive behavioral treatment, the joint attention intervention, the modeling, the naturalistic teaching strategies, the peer training package, the pivotal response treatment schedules, the schedules, the self-management, the story-based intervention package. Their goals are to improve the social functioning (decrease non functional or negative behaviors), to move the child toward independence (better communication, more adaptive skills, promote academic functioning and cognition).

These combined and adapted therapies to the given precise case should begin as soon as possible, with a minimum 25 hours/week schedule, 12 months per year

10. Medications

They should be associated to the behavioral, educational and environmental interventions.

Usually, the medications are given either to treat symptoms or to reestablish a normal brain input of mediators.

These are:

- psychotropic therapies targeting (as antagonists) dopaminergic and or serotonergic receptors: haloperidol, risperidone, clomipramide.
- Anxiolytic when the patient is particularly anxious
- Mood stabilizers
- Vitamins (folic acid, B6, B12)
- tryptophan
- Opioids antagonists (naltrexone)
- Sleep concerns medications.

It is interesting to remind here the neurobiology or chemistry of sleep.

Sleep and ASD have similar neurotransmitters intervening in the sleep-wake cycle: GABA, serotonin, histamine, melatonin. For all these 4 molecules, abnormalities are found in ASD

Any case is particular and request a fine analysis of daytime, sequence at bedtime, sleep time, but insomnia in ASD is particularly frequent.

After having discarded other causes (gastro-oesophageal reflux, severe atopic dermatitis, cow's proteins or other allergy, tracheomalacia, enlarged tonsils or adenoids), we can choose the best or most appropriate medication. In this point of view, melatonin, then a benzodiazepine, then an antihistamine drug given 1 hour before bedtime beside other therapies in daytime, could counteract the disturbed balance of neurotransmitter.

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The aim of the book is to serve for clinical, practical, basic and scholarly practices. In twentyfive chapters it covers the most important topics related to Autism Spectrum Disorders in the efficient way and aims to be useful for health professionals in training or clinicians seeking an update. Different people with autism can have very different symptoms. Autism is considered to be a "spectrum" disorder, a group of disorders with similar features. Some people may experience merely mild disturbances, while the others have very serious symptoms. This book is aimed to be used as a textbook for child and adolescent psychiatry fellowship training and will serve as a reference for practicing psychologists, child and adolescent psychiatrists, general psychiatrists, pediatricians, child neurologists, nurses, social workers and family physicians. A free access to the full-text electronic version of the book via Intech reading platform at <http://www.intechweb.org> is a great bonus.

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