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DAMP-concept grew out of “MBD” (Clements 1966)

- In the 1970s first population-based study of “MBD” started in Sweden under the leadership of Bengt Hagberg and sponsored by the National Educational and Health and Welfare Departments
- MBD operationally defined as “ADD” + “MPD”
- ADD = Attention Deficit Disorder (cross-situational)
- MPD = Motor-Perception Dysfunction
DAMP-concept

Moderate MBD = All non-severe MBD

Severe MBD =

• ADD +
• Gross motor +
• Fine motor +
• Perceptual +
• Speech/language dysfunctions
DAMP-concept

- First paper from MBD/DAMP-study was published in 1982
- ADD in DSM-III had arrived
- MBD as label increasingly criticized including by ourselves (Gillberg & Rasmussen 1981, Rutter 1981, 1982)
- We therefore introduced the PMAD (Perceptual, Motor, and Attentional Deficits) concept (Gillberg et al 1982)
DAMP-concept

- We found this ("PMAD") to be too difficult to "say" and - in accordance with widespread ideas at the time - believed the attentional problems to be primary.

- Hence, we changed the order of the letters to DAMP (Deficits in Attention, Motor control, and Perception).
DAMP-concept

- Since then, there have been at least 57 publications on the DAMP-syndrome, a handful of which derive from countries outside Scandinavia.
- DAMP most commonly used in Sweden and Denmark.
DAMP-concept

With the event of the DSM-III-R (and the DSM-IV) we looked back at our original cohorts and found that 85% of cases with DAMP met criteria for ADHD (mainly inattentive and combined subtypes).

We also found that the MPD-label corresponded very well with DCD (Developmental Coordination Disorder).
DAMP-definition and diagnosis

- DAMP is now diagnosed on the basis of
- ADHD according to the DSM-IV plus
- DCD according to the DSM-IV
- In individuals who do not meet criteria for cerebral palsy
ADHD/DAMP epidemiology

ADHD is a common condition affecting (in clinically severe form) 3-5 (7)% of all school age children; many more boys than girls (but many girls missed/misdiagnosed)

- about half of all with ADHD meet criteria for DAMP (Kadesjö & Gillberg 1999)

AD/HD is possibly an artificial (?) concoct of AD and HD

- Two separate syndromes/ends on dimensional scales with considerable overlap
- AD, HD and AD+HD
ADHD/DAMP diagnosis

A-D according to DSM-IV (at least 6 of 9):

- Careless mistakes
- Failure to sustain attention
- Appears not to hear/listen
- Does not complete tasks
- Difficulty organising work
- Reluctant to engage in tasks requiring mental effort
- Loses things
- Easily distracted
- Forgetful
ADHD/DAMP diagnosis

HD according to DSM-IV (at least 6 of 9):

- Fidgets - overactive
- Difficulty sitting still
- Restlessness
- Difficulty remaining silent
- Always on the go, acts as if driven by motor
- Talks too much
- Impulsive responding
- Difficulty awaiting turn
- Interrupts and intrudes on others
ADHD/DAMP diagnosis

- All three AD/HD variants require handicapping symptoms before age 7 years
- Impairing symptoms in at least two different settings
- Clinically significant impairment in at least two of social, school and home setting
- Exclusionary criteria (counterproductive?) (“not better accounted for…”)
ADHD/DAMP diagnosis

**DCD:**

- gross and/or fine motor function and coordination consistently below level expected for age and overall level of functioning
- Functionally disabling symptoms in everyday life
ADHD/DAMP overlap

1. ADHD almost always associated with comorbid (or rather “co-existing”) problems (Kadesjö & Gillberg 2001):
   - **DCD** 50% in both clinical and subclinical cases (ADHD + DCD = DAMP; in particular AD + DCD) and other learning disorders
   - **ODD** in 60% of clinical cases, only 10% in subclinical cases; 60% at 3 years, 60% at 5 years, 60% at 7 years (more often HD + ODD); doubtful whether strong predictor of **CD**
   - **Affective and anxiety** disorders (more often AD and DAMP)
   - **Tics** (more often HD)
   - **Drug abuse** (from adolescence)
ADHD/DAMP overlap

- ADHD + DCD (=DAMP) very often associated with speech-language, reading-writing, and mathematics disorder (Gillberg et al 1985, Landgren et al 1998, Kadesjö & Gillberg 1998)
- ADHD+DCD (=DAMP, particularly severe variant) very often associated with autism spectrum disorder/problems
- ADHD+DCD (=DAMP) interactive effect on learning problems and autistic features (Kadesjö & Gillberg 1999)
ADHD/DAMP overlap

- Mental retardation c. 15% (cf. 2% in general population)
- WISC Coding, Digit span, and Arithmetic often low and contribute to low IQ
- Overall low IQ over-represented?
- Low IQ “mistaken” for ADHD?
ADHD/DAMP pathogenesis
(Biederman 2002, Gillberg 2003)

- **ADHD** very often familial/hereditary (64-91% of variance explained by genes, lowest for dimensional ADHD, highest for categorical ADHD)
  - Dopamine (and NA) variant genes important in a proportion
  - Chromosome 16p? (cf autism, cf tuberous sclerosis)
- ADHD sometimes associated with **pre- or perinatal adversity** (prematurity, FAS, smoking)
- **Interaction gene-environment** in many (?) cases
- **DAMP** often familial (Gillberg & Rasmussen 1982)
- DAMP rather often associated with **pre- or perinatal adversity** (prematurity, smoking, reduced optimality) (Landgren et al 1998)
- Both ADHD and DAMP associated with **low social class**
  - Social class cannot explain ADHD/DAMP
  - Non-optimal rearing contributes to ODD/CD (Gillberg 1983)
**ADHD/DAMP brain**

- ADHD associated with slightly smaller brain (cf autism and bigger brain)
- Unclear whether this is due to ADHD or reduced IQ
- MRI longitudinally shows ADHD to be associated with smaller brain throughout childhood
- White matter reduction
- Cerebellar reduction
- Frontal and striatal areas implicated
- Right frontal rather than left frontal?
- Frontal = executive dysfunction? and Striatal = motor control and tics?
ADHD/DAMP work-up: what needs to be done in all cases?

- **Child examination**
  - Neuromotor performance, speech-language, psychiatric and physical status, hearing/vision
  - Neuropsychological: at least WISC-testing (dysexec syndrome; low on DSP, DSY, AR), CPT (long reaction time, omissions (AD), commissions (HD))

- **Parent interview**
  - ADHDRS, K-SADS?, Goodman (DAWBA)

- **Questionnaires**
  - CPRS, CTRS, FTF, SDQ, ADHD-IV-R, ASSQ
ADHD/DAMP work-up: what should be done in some cases?

Possibly

- EEG
  - Moderate increase low frequencies, epileptogenic, paroxysmal activity on activation, sleep abnormalities
- DNA- and/or karyotype
  - 22qdel, FMR-1, premutation Frax-A?, Frax-E, XXY, XYY, XO
- MRI
  - Migration defects, white matter lesions
- Other
ADHD/DAMP outcome

4 ADHD has poor outcome in 40-50% of cases; unmedicated individuals appear to have higher rates of later drug abuse
   • Barkley 2001, Biederman et al 1998

4 DAMP has poor outcome in 50-60% of cases; academic success almost unheard of in this group
   • Rasmussen & Gillberg 2000
ADHD/DAMP outcome

- **ADHD**
  - Antisocial personality disorder (30%), substance use disorder (10-40%), violent and criminal behaviours, psychiatric disorder including persistence of inattentive ADHD (mood and anxiety disorders)

- **DAMP**
  - Antisocial personality disorder (20%), substance use disorder (30%), violent and criminal behaviours (15%), psychiatric disorder including persistence of inattentive ADHD (50%), mood and anxiety disorders learning problems (60%) including severe dyslexia, dyscalculic problems and academic failure, DCD (30-40%), full pension
ADHD/DAMP associations

- Accidents
- Allergies?
- Fibromyalgia?
- Somatization?
ADHD/DAMP intervention

- ADHD/DAMP interventions (not treatment)
- PSYCHOEDUCATION FIRST AND FOREMOST
  - Information about the implications of the diagnosis
    - Child, parents, siblings, other relatives, teachers, others
  - Psychological support
  - Educational measures at school (dysexec syndrome)
  - Physical exercise
  - Training in “real-life” settings (incl motor)
  - Medication if other measures not sufficient
  - Sometimes financial support for family/respite care
ADHD/DAMP intervention

- Psychoeducation makes a positive difference
  - Psychologically and socially for family
  - Psychologically for child
  - Economically for family
ADHD/DAMP medication

- ADHD: always **consider medication if**
- Extreme problems
- In-patient, school removal, social authorities
- When other interventions have proved ineffective for 6 months or longer
- **Consider** medication treatment for all children with severe variants of the DAMP-syndrome
ADHD/DAMP CS

- ADHD central stimulant treatment
- Meticulous physical and mental examination
- Child aged 5 or older
- Have other measures been systematically evaluated?
- How severe are the child’s problems?
  - Will family be able to comply with treatment plan?
  - Parent and child attitudes to treatment essential
  - Drug abuse in family?
- Will prescriber/nurse have sufficient services available?
- Child’s attitude should be constantly re-assessed
ADHD/DAMP CS

- ADHD medication
- Methylphenidate usually drug of choice
- If no effect: try D-amphetaamine
- If no effect: consider the possibility that comorbidity (anxiety, aggression, explosive behaviours (mania?), tics, autistic symptoms) might be the explanation
- Reduce use of other drugs to a minimum, particularly old neuroleptics
ADHD/DAMP CS

ADHD: central stimulants (CS)
- Methylphenidate and D-amphetamine have comparable effects (about double the dose of amphetamine for methylphenidate)
- Few if any absolute contraindications
- Other medications should only rarely be tried if CS have not been carefully evaluated in the individual case (atomoxetine may change this)
- Can be usefully combined with other medications
ADHD/DAMP CS adverse effects

- Adverse effects of CS
  - decreased appetite (13-50%), insomnia (18-70%), belly aches (6-35%), headaches (4-20%)
  - rebound-phenomena (1-30%)
  - hallucinations, psychosis, high blood pressure
  - depressive symptoms no more common than in placebo groups, but may be clinically significant in some cases
  - 0.1-1 cm reduction of final height
  - 1-5 kg weight loss --- gradual normalisation
ADHD/DAMP dosing CS

Dosing central stimulants

- Methylphenidate (5-12 years): 5 mg x 1-4 or max 1 mg/kg will give positive response in 75% of all cases with severe ADHD/DAMP
- D-amphetamine (5-12 years) 2.5-5 mg x 1-4 will give positive effect in 1/3 of cases not responding to methylphenidate
- Older (and younger?) patients appear to respond only in 50%, but recent studies suggest equal response rate
- Slow release much more convenient but poorer effect?? (Pelham et al 1987); Concerta vs other preparations?
ADHD/DAMP when not to use CS

- Contraindication/caution in CS-medication
- When you do not expect good compliance
- No other absolute contraindications
- Caution in heart disease/high blood pressure (consult with cardiologist)
- Caution when combined with TCA
- Caution in epilepsy (but CS may have specific anti-epileptic effects)
- Careful monitoring when ADHD co-morbid with tics
- Lithium and CS counteract each other
ADHD/DAMP CS caution

1. Before starting treatment with CS
   - Try psychoeducation
   - Careful neuropsychiatric examination of child including assessment of co-morbid features
   - Height, weight and head circumference
   - Blood pressure
   - Adverse effects monitoring

2. During treatment with CS
   - Follow-up as above
ADHD/DAMP other meds

- Other medication treatments
  - Atomoxetine - better for ADHD with tics, depression, anxiety, sleep problems? Liver damage extremely rare (2 in 2 million treated)
  - Atypical neuroleptics for comorbid violent and chaotic behaviours
  - SRIs for anxiety, panic, OCD, depressed mood?
    - Note risk of provoking explosive behaviours
  - Venlafaxine
  - Melatonin for sleep problems
  - Buspirone for anxiety, aggression?
  - Bupropione?
  - Tricyclics??
  - Clonidine??
ADHD/DAMP intervention

- How long should interventions continue?
- Most will need education support throughout childhood into adulthood
- Some children and adults need medication only occasionally and for specific events
- All medication treatment should be individualised
  - Common treatment time span 2-5 years, but some continue for many years
Once stimulant medication has been started, other interventions need to be re-evaluated.

“Comorbidity” should inform treatment options:
- Anxiety, autistic features, tics, OCD, ODD

CBT, but long-term effects are doubtful:
- Robo-Memo (Klingberg et al 2005)

Special education measures:
- Learning, language and motor problems of various kinds
ADHD/DAMP consensus documents

- **AMA**: American Medical Association (Council of Scientific Affairs) (1997)
- **NIH**: Consensus Development Program: Diagnosis and Treatment of ADHD (1998) (odp.od.nih.gov/consensus/)
- **European**: Clinical guidelines for HKD (Taylor et al 1998)
- **AACAP**: Practice parameters (2002)
- **Socialstyrelsen**: ADHD (strd.se/webshop/socialstyrelsen) (2002)