

## ASHA Invited Presentation Childhood Apraxia of Speech: Some Basics of Assessment and Treatment

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## Outline

- ▶ Part 1 – Definitions / Differential Diagnosis
  - Dr. Flipsen
- ▶ Part 2 – Goal Selection / Treatment Principles / Specific Treatment Suggestions
  - Dr. Gildersleeve-Neumann
- **Please hold questions until the end.**

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## Childhood Apraxia of Speech (CAS)

- ▶ ASHA's current preferred term.
- ▶ Known by many labels including:
  - Developmental Apraxia of Speech
  - Developmental Dyspraxia
  - Developmental Verbal Dyspraxia
  - Childhood Verbal Apraxia

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## Childhood Apraxia of Speech (CAS)

- ▶ Type of Speech Sound Disorder (SSD)
  - Broad category that includes any difficulty with output of speech sounds and includes:
    - articulation (phonetic) disorders, and
    - phonological (phonemic) disorders

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## Childhood Apraxia of Speech (CAS)

- ▶ Considerable controversy until recently.
- ▶ Does it even exist?
- ▶ What causes it?
- ▶ How do we define it?
- ▶ How do we distinguish it from other childhood speech disorders?
- ▶ Is intervention different from what we do with other SSDs?

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## Childhood Apraxia of Speech (CAS)

- ▶ ASHA (2007) expert panel did an extensive literature review and evaluation of that literature and concluded (among other things) that:

**YES, IT EXISTS!**

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## Childhood Apraxia of Speech (CAS)

- ▶ Prevalence (how common?):
  - No large population studies yet available.
- ▶ Current best estimate = 0.1–0.2% of the general population (Shriberg, Aram, & Kwiatkowski, 1997).
  - Probably translates to no more than 1–2% of the average SLP caseload.
- ▶ One large study showed 3–4% of the caseload at a large urban hospital (Delaney & Kent, 2004).
  - 516 cases out of 12–15,000 children with SSD

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## Childhood Apraxia of Speech (CAS)

- ▶ Recent increases in diagnoses, especially in the last decade.
- ▶ Actual increase in cases?
  - Greater survival rates of high-risk infants?
- ▶ May also be due to:
  - Legislative changes
  - Funding issues
  - Inconsistency of definitions

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## CAS definition

- ▶ “ Childhood apraxia of speech (CAS) is a neurological childhood (pediatric) speech sound disorder in which the precision and consistency of movements underlying speech are impaired in the absence of neuromuscular deficits (e.g., abnormal reflexes, abnormal tone). CAS occurs as a result of known neurological impairment, in association with complex neurobehavioral disorders of known or unknown origin, or as an idiopathic neurogenic speech sound disorder. The core impairment in planning and/or programming spatiotemporal parameters of movement sequences results in errors in speech sound production and prosody.”
- ▶ – ASHA 2007 position statement.

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## Causes of CAS

- ▶ Neurological impairment.
- ▶ No single source. ASHA (2007) expert panel suggested three broad routes:
  - 1. May be idiopathic.
  - 2. Result of known neurological impairment
    - Specific nervous system damage?
    - Specific events or disease processes known to cause neurological insult?
  - 3. Co-occurring with some complex neurobehavioral disorders

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## Some Complex Neurobehavioral Disorders associated with CAS

- Autism – 1% of cases??
- Chromosome Translocations
- Coffin-Siris syndrome (7q32–34 deletion)
- Down syndrome (Trisomy 21)
- Rolandic Epilepsy
- Fragile X syndrome (FMR1) – up to 40% of cases?
- Joubert syndrome (CEP290; AHI1)
- Galactosemia – 40–60% of cases?
- Rett syndrome (MeCP2)
- Russell-Silver syndrome (FOXP2)
- Velocardiofacial syndrome (22q11.2 deletion)
- Williams-Beuren locus duplication (7q11.23)

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## CAS and Genetics

- ▶ 80% of cases are male.
- ▶ Nuclear family aggregation
  - CAS and other SSDs often “run” in families
- ▶ Has been associated with mutations of the FOXP2 gene
  - Based on findings from different studies using different labs.
  - Not all individuals with CAS have this mutation however.
- ▶ May accompany some genetic syndromes

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## Core Impairment in CAS

- ▶ Problem in planning or programming the movement sequences for speech.
- ▶ In the absence of neuromuscular deficits (i.e., tone and reflexes not necessarily impaired)
  - But may have co-existing dysarthria
- ▶ In the absence of problems with planning for “non-speech” activities such as chewing and swallowing.
  - But may have co-existing oral apraxia

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## Other key issues

- ▶ Speech often (though not always) normalized by adulthood.
  - Because of Tx? In spite of Tx?
- ▶ Often slow to respond to therapy
  - Not a clear diagnostic sign however
  - Could simply mean we've erred on the diagnosis and have been applying the wrong treatment

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## CAS vs. Adult form (AOS)

- ▶ Both assumed to represent problems with programming and/or planning for speech.
- ▶ AOS involves damage to an intact speech and language system.
- ▶ CAS occurs before speech and language system has been fully developed.
  - May affect the DEVELOPMENT of the higher levels of speech and language (Maasen, 2002).
  - No “automatic” speech yet – often spared in AOS

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## Key Differential Signs?

- ▶ Emerging literature suggests the following MAY be unique to CAS:
  - 1. Inconsistent output on repeated attempts at the same words
    - May include vowel errors, especially atypical errors
  - 2. Disrupted and lengthened transitions
    - Difficulty with articulatory sequencing
    - Problems more apparent as words get longer
    - Breaks between consonants and vowels
  - 3. Disordered prosody
    - Excessive equal stress?
    - Monotone?
    - Possible problems controlling rate, nasality, pitch, loudness?

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## A note on “inconsistency”

- ▶ 1. sound used correctly in some word positions but not others?
  - Not unique to CAS; could just be incomplete learning.
- ▶ 2. sound used correctly in some words but not in others?
  - Not unique to CAS; could be “fossilized” forms.
- ▶ 3. multiple attempts at the same word yield different outputs?
  - Consistent with planning difficulties of CAS

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## Features shared with other SSDs (not unique to CAS)

- ▶ Delayed speech onset
- ▶ Limited vocal output
- ▶ Reduced intelligibility
- ▶ Limited phonetic inventory
  - Likely reliance on early sounds
- ▶ Limited syllable shape inventory (V, CV, VC, CVC, etc.)
- ▶ Tendency to rely on gestures over vocal communication

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## Long-term risks and CAS

- ▶ Persistence of speech problem well into the school years?
- ▶ Difficulties with expressive language?
  - Look like they may have co-existing language impairments (Lewis et al., 2004).
  - Suggests planning problem extends beyond speech (Ball et al., 2002)
- ▶ Difficulties with the phonological foundations of written language?
  - ASHA, 2007

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## Who makes the diagnosis?

- ▶ According to the ASHA expert panel (ASHA, 2007):
  - "It is the certified speech-language pathologist who is responsible for making the primary diagnosis of CAS, for designing and implementing the individualized and intensive speech-language treatment programs needed to make optimum improvement, and for closely monitoring progress."

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## Diagnostic challenges

- ▶ 1. Separating CAS from other SSDs
- ▶ 2. Separating CAS from possibly co-existing dysarthria and/or oral apraxia
- ▶ 3. CAS signs likely vary with:
  - Age
  - Severity
  - Particular task being used

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## Formal Assessment Approaches

- ▶ Several published procedures available:

Test / Procedure	Age Range
Apraxia Profile (Hickman, 2000)	3;0 – 13;11
Kaufman Speech Praxis Test (Kaufman, 1995)	2;0 – 6;0
Screening Test for Developmental Apraxia of Speech-2 (Blakely, 2001)	4;0 – 7;11
Verbal Dyspraxia Profile (Jelm, 2001)	None listed
Verbal Motor Production Assessment for Children (Hayden & Square, 1999)	3;0 – 12;11

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## Basic Dx Protocol

- ▶ Need to gather fairly typical data:
- ▶ Case history
  - Family background, oral motor history, speech and language milestones
- ▶ Single word artic test
- ▶ Oral facial exam – include DDK tasks
- ▶ Conversational speech sample – transcribe
- ▶ Language comprehension testing
- ▶ Phonological awareness testing

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## Assessment in infants / toddlers

- ▶ Often see limited vocal output
- ▶ Limited variety of consonants and vowels
- ▶ May see single sounds used as words
- ▶ **Need speech output or at least attempts at speech to make a diagnosis!**
  - means diagnosis before age 3 years is very difficult.
- ▶ Non-speech problems (drooling, dysphagia) may only indicate co-existing oral apraxia.

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## Assessing the “key signs”

- ▶ 1. Inconsistency – a few options
  - A. Conversational speech
    - Look for consistency in attempts at words produced multiple times.
      - Can quantify using Ingram & Ingram (2001) measure PWV (percentage of whole word variability)
  - B. Consistency subtest of DEAP (Dodd et al, 2006)
    - Norm-referenced procedure
      - Was not developed for CAS however (says it is for “inconsistent phonological disorder”).

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## Assessing “key features”

- ▶ 2. Problems with transitions
  - DDK procedures
    - Focus on consistency and accuracy (not speed)
    - May not have difficulty with AMR tasks (same place of artic)
    - More likely to see problems with SMR tasks (place of artic changes)
  - Problems with both may signal co-existing dysarthria

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## Assessing “key features”

- ▶ 2. Transitions?
- ▶ Problems with multisyllabic words and/or as words get progressively longer?
  - Probably only useful for children over 6 years
    - ham – hammer – hammering
    - hope – hopeful – hopefully
    - hand – handle – handily
    - wide – widen – widening

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## Assessing “key features”

- ▶ 3. Prosody
  - ▶ Evaluate conversational speech
    - Watch for inappropriate use of stress on multisyllabic words
    - Watch for inappropriate use of pitch and intonation
    - Watch for inconsistent rate or loudness
      - Overall slower rate may indicate co-existing dysarthria
    - Inconsistent nasality?
  - Need to evaluate at least 25–30 utterances to get a valid sample.

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## Additional Analyses

- ▶ Case history
  - Look for “neurological events” that might suggest neurological damage – not always there.
  - Look for family history of any speech or language impairments – not always there.
  - Look for (past and current) problems with feeding, chewing, swallowing, and/or drooling.
    - Would suggest possible co-existing oral apraxia

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## Additional Analyses

- ▶ Use conversational speech to establish:
  - 1. Overall intelligibility (% words understood)
  - 2. Syllable shape inventory
    - Ignore accuracy here; any consonant counts as C, any vowel counts as V
  - 3. Phonetic inventory
    - Any sound that shows up counts regardless of whether it matches the target

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## References

- American Speech-Language-Hearing Association. (2007). *Childhood Apraxia of Speech* [Position Statement].
- American Speech-Language-Hearing Association. (2007). *Childhood Apraxia of Speech* [Technical Report].
- Ball, L. J., Bernthal, J. E., & Beukelman, D. R. (2002). Profiling communication characteristics of children with developmental apraxia of speech. *Journal of Medical Speech-Language Pathology, 10*, 221-229.
- Blakeley, R. W. (2001). *Screening Test for Developmental Apraxia of Speech - Second Edition*. Austin, TX: Pro-Ed.
- Delaney, A. L., & Kent, R. D. (2004, November). *Developmental profiles of children diagnosed with apraxia of speech. Poster session presented at the annual convention of the American-Speech-Language-Hearing Association, Philadelphia.*
- Dodd, B., Huis, Z., Crosbie, S., Holm, A., & Ozanne, A. (2006). *Diagnostic Evaluation of Articulation and Phonology*. San Antonio, TX: The Psychological Corporation.
- Hayden, D., & Square, P. (1999). *Verbal Motor Production Assessment for Children*. San Antonio, TX: The Psychological Corporation.
- Hickman, L. (1997). *Apraxia Profile*. San Antonio, TX: The Psychological Corporation.
- Ingram, D., & Ingram, K. D. (2001). A whole-word approach to phonological analysis and intervention. *Language, Speech, and Hearing Services in Schools, 32*, 271-283.
- Jelm, J. M. (2001). *Verbal Dyspraxia Profile*. DeKalb, IL: Janelle Publications.
- Kaufman, N. R. (1995). *Kaufman Speech Praxis Test for Children*. Detroit, MI: Wayne State University Press.
- Lewis, B. A., Freebairn, L. A., Hansen, A. J., Iyengar, S. K., & Taylor, H. G. (2004). Schoolage follow-up of children with childhood apraxia of speech. *Language, Speech, and Hearing Services in Schools, 35*, 122-146.
- Maassen, B. (2002). Issues contrasting adult acquired versus developmental apraxia of speech. *Seminars in Speech and Language, 23*, 257-266.
- Shriberg, L. D., Aram, D. M., & Kwiatkowski, J. (1997). Developmental apraxia of speech: I. Descriptive and theoretical perspectives. *Journal of Speech, Language, and Hearing Research, 40*, 273-285.

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