Session Objectives

- Define CAS and characteristics
- Describe diagnostic criteria of CAS
- Review current research
- Describe and discuss treatment principles

Speech Delay of Unknown Origin-Suspected Causes

“Approximately 15% of 3-year-old children have speech intelligibility challenges that are not associated with known etiologies. By first grade, approximately 25% of these children (about 3.5% of all children) retain a significant speech disorder of currently unknown origin.”

ASHA 2007 Position Statement on CAS

- Neurological pediatric speech sound disorder
- Precision and consistency of movements underlying speech are impaired
- Absence of neuromuscular deficits (e.g., abnormal reflexes, abnormal tone)
ASHA 2007 Position Statement on CAS

- May occur as a result of known neurological impairment, along 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.

Prevalence (Davis, 2009)

- No sound estimates of prevalence are available
- In a large metropolitan hospital, 516 cases of CAS (3.4%-4.3%) of 12,000 -15,000 referrals for speech delay of unknown origin reported from 1998-2004 involving 15 SLP’s (Delaney & Kent, 2004)
- Population estimate (% of all children) = .1 - .2% (Shriberg, Aram, & Kwiatkowski, 1997)
- 1-10 in 1000 children affected or 3-5 % of speech-impaired preschoolers (CASANA website)

Causes

- Studies have not found evidence of specific brain lesions or differences in brain structure in children with CAS
- Children with CAS often have family members who have a history of communication disorders or learning disabilities.

Genetic Factors

- London-Oxford group studied the KE family over 15 yrs
- Half of members have orofacial apraxia and reported apraxia of speech
- Found mutation on the FOXP2 gene
- Neural phenotypes (characteristics) consistent with behavioral phenotypes associated with CAS
FOXP2

- London-Oxford group: N=43 children with CAS. One child (and his affected sibling and their mother) had the same FOXP2 mutation observed in affected members of the KE family (MacDermot et al., 2004)

- Canadian group: Identified a FOXP2 deficit in a child who reportedly has CAS, as well as craniofacial dysmorphology (Zeesman et al., 2006)

- United States group: Reported CAS, as well as dysarthria, in a mother and daughter with a chromosome translocation in a region affecting FOXP2 (Shriberg et al., 2005)

Ongoing collaborative genetic projects in apraxia of speech are developing the phenotype for this disorder, using perceptual and acoustic techniques to quantify affected children's and family members' speech and prosody. (Shriberg, website)
What is the difference between Developmental Articulation Disorder and CAS?

Diagnostic Features

• No validated list of dx features of CAS that differentiate it from other types of speech sound disorders including phonological delay or dysarthria

Consensus of Features

(Davis, February 2009)

• Inconsistent errors on consonants and vowels in repeated productions of syllables or words (rather than stable error patterns)
• Lengthened and disrupted coarticulatory transitions between sounds and syllables
• Inappropriate prosody, especially in lexical or phrasal stress; may include duration, intensity, and rate

Symptoms of CAS

(Taken from website of Shelley Velleman, Ph.D., University of Massachusetts at Amherst)

• Little or no babbling in infancy; few consonants
• Understanding of language much better than production of language
• Slow, effortful, or halting speech
• Very hard to understand
• May make slow progress in therapy
Very New Research!

- March 2010, Aziz et. al. (Cairo, Egypt)
- Looked at differences between speech and non-speech tasks in 3 groups ages 4-6 years (N=30):
  - Multiple phonological disorder
  - Suspected CAS
  - Control group

Results

- CAS group had significantly lower exp. abilities
- No significant differences in NSOM tasks, except for those that had 2-sequence motor perf.
- Speech tasks in CAS that were significantly different from other groups:
  - C and V accuracy lower and inconsistent
  - Syllable #, shape, and sequence accuracy
  - Difficulty processing prosodic features

Diagnostic Limitations

- Difficult as formal definition is unclear
- Co-morbid conditions make dx difficult
- Challenging to diagnose children <3yrs
- Provisional dx may be helpful
  - “CAS cannot be ruled out”
  - “Signs are consistent with CAS”
  - “Suspected to have CAS”

Diagnosis of CAS <3yrs

- Cautious application
- May be more appropriate after a period of intervention
Early Speech Markers

- "Incomplete syllables" as basis for early words: C alone or V alone
- Limited variety of syllables (Same CV used across contexts)
- Idiosyncratic, word shapes with apparently consistent meaning
- Homesign development
- One stereotyped intonation pattern
- Cannot combine different syllables (reduplicated only) or
- Limited movement patterns
- Oral motor incoordination, especially for non-automatic sequences
- Groping
- Words seem to be learned, then disappear (more than normally expected at this age).

Assessment Principles

- Traditional articulation tests used alone WILL NOT assist with differential diagnosis
- Examine performance in differing conditions
  - Functional automatic vs. volitional actions
  - Single postures vs. sequences of postures in speech production
  - Simple vs. more complex or novel contexts
  - Repetitions of the same stimulus vs. repetitions of varying stimuli (i.e., sequential vs. alternating movements)
  - Various types of cuing (auditory, visual, tactile, or varying combinations of these cues)
- Examine children's performance in multiple contexts:
  - Elicited, initiated, spontaneous, syllable, single word, phrase, sentence, discourse
  - Caruso, Strand, Davis, Wilke, Hall, Hodge, Skinder-Meridith, Thoonen

<table>
<thead>
<tr>
<th>Test</th>
<th>Author/Year Published</th>
<th>Age Range</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaufman Speech Praxis Test for Children</td>
<td>N. Kaufman, 1995</td>
<td>2:0-5:11 yrs</td>
<td>Identify level of breakdown in speech</td>
</tr>
<tr>
<td>The Apraxia Profile</td>
<td>L. Hickman, 1997</td>
<td>3-13 yrs</td>
<td>Differential dx, OM sequences</td>
</tr>
<tr>
<td>Verbal Motor Production Assessment for Children (VMPAC)</td>
<td>Hayden, Square, 1999</td>
<td>3-12 yrs</td>
<td>Speech motor control</td>
</tr>
<tr>
<td>Early Motor Control Scales (EMCS)</td>
<td>Hayden, Weatherby, Prizant, Cheery, 2002</td>
<td>9 mos-2yrs</td>
<td>Experimental version released; Currently being updated</td>
</tr>
</tbody>
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Treatment Principles

- Motor programming
- Use of multi-sensory input
- Successive approximations
- Parent/teacher training
More linguistically or phonologically based approaches may also have a benefit for some children with CAS who ALSO have a linguistic or more traditional auditory perceptual or phonological deficit to their overall profile......

- but such methods do not replace the need for speech motor strategies in children with CAS!

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**Motor Programming**

- Practice, repetition
- Focus on sequences of phonemes, not isolated sounds
- Enhanced sensory input
  - Auditory, visual, tactile cues
- Immediate reinforcement
- Build in success (80% mastered : 20% new)

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**Multi-Sensory Input**

- PROMPT (Chumpelik(Hayden)), 1984)
  - PROMPTS for Restructuring Oral Motor Phonetic Targets
  - Philosophy: To (re)connect and integrate the motor, cognitive-linguistic and social-emotional aspects of communication
  - System: Helps gain voluntary control of motor-speech systems and links the necessary motor movements to linguistic (word, phrase) equivalents for use in functional communication
  - Technique: Restructuring the speech production output of children and adults with a variety of speech disorders (e.g. phonological, dysarthria, dyspraxia, and hearing impaired)

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**PROMPT Research**

- PROMPT's effectiveness in treating children with speech-motor deficits (Square, Goshulak, Bose, & Hayden, 2000)
  - 6 males (ages 4; 2 to 4; 6 years): Unintelligible speech and minimal progress in traditional therapy
  - 90 minute group session twice weekly for 15 weeks
  - Standardized tests of phonological, motor, language and social skills were administered before and after treatment
  - Results
    - PROMPT treatment resulted in perceptually improved speech even on untrained words
    - Participants' overall behavior, social interactions, and language skills improved significantly as measured by the Speech and Language Assessment Scale (Hadley & Rice, 1993), the Systematic Analysis of Language Transcripts, SALT (Miller & Chapman, 1998), and the Social Skill Rating System (Grasham & Elliott).
Dynamic Temporal and Tactile Cueing for speech motor learning (DTTC) (Strand, E., 2006)

- Adapted from Integral Stimulation Method (“Listen to me, Watch me, Do what I do.”) for nonverbal children
- Tactile and gestural cues
- Prosodic cues (MIT and contrastive stress)
- Single-subject, multiple baseline design with 4 children
- Results: 3 out of 4 children exhibited rapid change

Successive Approximations

- Uses our knowledge of phonological process development to break words down to their simplest expressive form (word shells)
- Encompasses aspects of behavior modification (shaping, cueing, fading) of consonants and vowels already in the child’s repertoire and moves to whole words, phrases and sentences.
- Successful attempts at words are achieved, reinforced, and rewarded
- Practice of this hierarchy of consonant and vowel patterns help the child gain verbal praxis skills for the ultimate goal of successful verbal communication

Parent/Teacher Training

- Education and observation
- Incorporate strategies into daily activities
- Provide videotaped samples of cues and strategies—Worksheets aren’t enough
- Apraxia kids website: great resource www.apraxiakids.org
Issues in Service Delivery

Recommends 3-5 individual sessions/week for CAS as compared to 1-2 x for traditional tx

(ASHA technical report by the Ad Hoc Committee on Apraxia of Speech in Children, 2007)

Issues in Service Delivery

(Hammer, 2009)

- Those working with preschoolers with CAS need to prepare parents
- School-based tx: combo of group and ind.
- Education of teachers and school staff

ASHA Needs Our Help!

- ASHA statement calls for programmatic research and clinician training
- Research goals:
  - Develop reliable and efficient assessment protocols for age-app diff dx
  - Validate effective tx approaches

It’s Up To Us.....

- Enhance the resources and opportunities available to children with CAS
- Professional training programs must ensure SLP training
- Educate other allied health professionals
- Partner with clinicians across tx settings to document intervention programs that maximize resources and address complex deficits
- Collaborate with families, local and state boards of ed, consumer organization, and support networks
References


References


References


References

- http://people.umass.edu/velleman/ (Dr. Velleman’s website)
- www.apraxia-kids.org (Childhood Apraxia of Speech Association of North America CASANA)
- http://tinyurl.com/yr2noay (materials available)
- www.waisman.wisc.edu/FACULTY/SHRIBERG.HTML (Dr. Shriberg’s website)