Treatment for Pediatric Aphasia: A Critical Review

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ABSTRACT

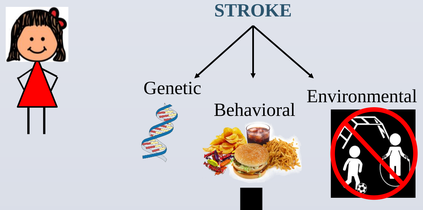
Objective: The primary aim of this study was to summarize the current state-of-science for principles and practices of intervention in acquired pediatric aphasia (APA). A secondary aim was to identify gaps in research regarding interventional frameworks, and to identify key areas of future inquiry to optimize language outcomes.

Conclusions: Although epidemiologic data indicate rising incidence in APA, limited research on recovery and intervention exists. Results suggest that language intervention supports aphasia recovery; however, available data lack adequate description of methodologies to make cross-comparisons and dosage recommendations possible. Evidence from observational studies suggests that a) pediatric recovery is not necessarily more rapid nor complete than adult recovery; b) principles of neuroplasticity may be applied to pediatric aphasia; however prognostication may be affected by developmental stage and presence of immature language networks; and, c) aphasia symptoms related to literacy may extend into adulthood, even after functional communication has been established. Clinical implications as well as recommendations for research are discussed in light of evidence.

BACKGROUND

- Increased incidence of stroke in childhood → cerebral arteriopathies, vasculopathies, and cardiovascular disease[1]
- Stroke = significant complication of cardiovascular disease in children → ~20-30% of childhood ischemic strokes[2]
- Stroke incidence has increased especially for underserved populations[3]
- 1 of many risk factors that may affect a child's chances of suffering a stroke → childhood obesity[4]

RISK FACTORS OF CHILDHOOD OBESITY LEADING TO STROKE



Pediatric Stroke Incidence: 2.3 to 13 per 100,000 older (28 days or older) children/y.[5]

Rationale

- Current aphasia care: adult-centric; practice standards lacking in APA
- Increased recognition of pediatric stroke/aphasia as increasingly prevalent
- Begin to assess for and establish future research priorities in APA

PURPOSE

To summarize the current state-of-science in treatment and management of pediatric aphasia in order to assess research priorities and identify clinical practice guidelines for speech pathologists and other related rehabilitation professionals.

METHODS

Design: Systematic review of literature

Data Sources: A search of extant literature was conducted using hand-search and database-driven searches including, but not limited to: CINAHL, Medline, PsycINFO, and PubMed.

Inclusion Criteria: (1) pediatric population of study (<18 years); (2) diagnoses of acquired aphasia/aphasic symptoms specified; (3) outcomes measured linguistic function. In addition to experimental studies, observational studies of neurophysiologic recovery processes were included.

Key Word Search Terms: pediatric stroke, acquired childhood aphasia, treatment, plasticity, recovery

Inter-Rater and Article Assessment: Authors independently reviewed articles for eligible publications based on criteria. Articles were evaluated using the Critical Appraisal of Treatment Evidence (CATE) tool[6]

CATE Tool:

CATE: Critical Appraisal of Treatment Evidence

Evaluator: _____ Date: _____
Evidence source:

Foreground question addressed by the evidence:

For _____ (Patient/problem)
Is _____ (Treatment/condition)
associated with _____ (Outcome)
as compared with _____ (Contrasting treatment/condition)

Appraisal points

1. Was there a plausible rationale for the study?
2. Was the evidence from an experimental study?
3. Was there a control group or condition?
4. Was randomization used to create contrasting conditions?
5. Were methods and participants specified prospectively?
6. Were patients representative and/or recognizable, at beginning and end?
7. Was treatment described clearly and implemented as intended?
8. Was the measure valid and reliable, in principle and as employed?
9. Was the outcome (at a minimum) evaluated with blinding?
10. What nuisance variable(s) could have seriously distorted the findings?
11. Was the finding statistically significant?
12. If the finding was not statistically significant, was statistical power adequate?
13. Was the finding important (ES, social validity, maintenance)?
14. Was the finding precise?
15. Was there a substantial cost-benefit advantage?

Validity: Compelling _____ Suggestive _____ Equivocal _____
Importance: Compelling _____ Suggestive _____ Equivocal _____

Clinical bottom line:

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CATE Assessment Grading Summary

Clinical Judgement	Validity	Importance	Clinical Bottom Line
Compelling (1)	Yes	Yes	*A change to current practice should be considered seriously.*
Suggestive (2)	Yes	Yes	*Different clinicians might responsibly make different decisions about whether to alter current practice.*
	Yes	No	
	No	Yes	
Equivocal (3)	Yes	Yes	*No change to current practice need be considered.*

FINDINGS

Author, Year	Population Studied (N)	Treatment Methods Adequately Specified and Described to Allow Study Duplication	Control Group	Outcome(s) Measured	Effect Size Reported	Validity: Compelling (1) Suggestive (2) Equivocal (3)	Importance: Compelling (1) Suggestive (2) Equivocal (3)	Conclusions/Clinical Recommendations
Basso, (1990)[7]	1st study: Children (N=32) Adults (N=31) 2nd study: Children (N=12) Adults (N=15) Aphasia and TBI	No	1st study: Y 2nd study: Y	Standardized tests: • Token Test TT) • Raven's Colored Progressive Matrices (RCPM) • Wechsler Intelligence (WISC) • Weigl Sorting Test Clinical Assessments of Language – Non-Standard: • Standard Language Examination for aphasia • oral apraxia • ideomotor apraxia • acalculia • word fluency & story recall • memory tests	No – descriptive study *p*-values reported for Chi-square analysis	2	2	"Aphasia in children is more frequently non-fluent & only rarely shows jargon and verbal paraphasias."
Chilosi, (2007)[8]	N=1 3;4yrs Global aphasia post brain infarction	No; speech therapy carried out until elementary school age (fifth grade) but not systematically	Y	Clinical Assessments of Language – Non-Standard: • Language: Relative % of complex vs. simple utterances; % omission of grammatical morphemes • working memory • phonological processing • written language • non-verbal intelligence fMRI	No – means, Standard Deviation, and qualitative assessments of fMRI findings	2	2	• Compensatory processes are at work from an early age • Children must recover the components of language acquired before aphasia onset as well as face the problem of learning new language skills/processes over a long-term span
Favoretto, (2017)[9]	N= 1 11yrs Aphasia post CVA	No; 91 50-minute sessions of speech-lang. therapy	N	Clinical Assessments of Language – Non-Standard: • naming • repetition • recalling • reading • writing	No – Case Study data pre- and post- intervention	2	2	Early rehabilitation may warrant recovery 2x greater than spontaneous recovery
Gout, (2005)[10]	N=9 Aphasia post CVA	No	N	Standardized tests: • Test de vocabulaire actif et passif (TVAP) • Token Test for Children • Clinical Evaluation of Language Fundamentals (CELF) • Echelle d'evaluation de l'aphasie (BDAE) Clinical Assessments of Language – Non-Standard: • Epreuve pour l'evaluation du language (ELO) • Borel Maisonny written language test • 15 mots de Rey verbal memory tests CT and/or MRI	No – descriptive case data pre- and post- intervention Standardized test result statistics not reported	2	2	Basal gray nuclei and the adjacent white-matter pathways are crucial in the development and use of oral and written language.
Kojima, (2010)[11]	N=1 9yrs Aphasia post CVA	No; received speech therapy 3x/week After re-enrollment to school (8 months post CVA), received speech therapy 1x/week	N	Standardized tests: • Standard Language Test of Aphasia (SLTA) Clinical Assessments of Language – Non-Standard: • Dichotic Listening tasks Regional cerebral blood flow (rCBF)	No – Case Study data from 3 mos. – 10:5 post-CVA; % correct for linguistic measures	2	2	"…plasticity of both hemispheres is involved in recovery from aphasia over the long-term."
Lauterbach, (2010)[12]	N=3 Aphasia post CVA	No	Y	Neurolinguistic testing procedures – not specified MRI	No – Descriptive MRI comparisons for cortical activation patterns by task; Norm-referenced normal vs. abnormal findings; statistical measures of linguistic testing not reported	2	2	"…early commitment of the left hemisphere to language initiates an almost irreversible specialization."
Peru, (2006)[13]	N=1 9yrs Aphasia due to brain lesion	No	N	Standardized tests: • Token Test – short • Grammatical Completion Subtest (ITPA) • Test di Comprensione Grammaticale per Bambini (Grammatical Comprehension Test for Children) Clinical Assessments of Language – Non-Standard: • spontaneous speech • written production • oral comprehension • written comprehension • repetition	No – descriptive case study *p*-values reported for Chi-square analysis	2	2	"Etiology – with related early or late shift of language to the right hemisphere and the possible presence of epilepsy – plays a critical role in the reorganization of language after brain lesions"
Van Dongen, (2000)[14]	N=24 Acquired childhood aphasia (unselected for age, gender, etiology, and aphasia severity ratings)	No	N	Clinical Assessments of Language – Non-Standard: • Standard open-ended interview questions • 10 variables assessed within spontaneous speech samples	No – descriptive study Exact *p*-values reported with Mann-Whitney U statistic	2	2	"There is an innate predisposition for most aspects of language to develop preferentially in the left hemisphere."

CONCLUSIONS

1. Despite that epidemiologic data reflect a rising incidence of pediatric stroke, high-quality intervention studies that inform language recovery programs and processes remain scant, with resulting limited guidance on specific treatment procedures and their related effectiveness in restoring linguistic function in APA.

2. Current evidence is suggestive that intervention overall may be effective in facilitating linguistic recovery in APA, yet non-discriminant for methodologies, dosages and timing of intervention.

- Variables/factors predictive of APA recovery:
  - Age of onset
  - Etiology
  - Site and extension of lesion
  - Severity of initial damage
  - Language performance prior to onset
  - Duration of follow-up

3. Evidence from observational studies provides several broad patterns and principles of recovery in pediatric aphasia, and may serve to provide preliminary guidance for clinicians:

- •Predominance of non-fluent aphasias
- •Less-stable and still-developing language network
- •Children do not necessarily recover more efficiently/thoroughly than adults
- •Trajectory of recovery → less predictable
- •Initial severity not predictive
- •Recovery pattern more variable
- •Long-term residual deficits into adulthood: literacy
- •Outcomes: functional oral language & literacy are key

LIMITATIONS

- Available data lack adequate description of methodologies to make cross-comparisons possible
- Varied approach to reporting of aphasia sub-types
- Varied outcome measurements limit study comparison
- Statistical/measurable outcome analyses: lacking or weak

RECOMMENDATIONS

- **Future Research**: 1) assess effectiveness of adult intervention models in pediatric populations; 2) investigate factors including spontaneous recovery vs. early rehabilitation; 3) explore role of hemispheric cross-transference in linguistic recovery of APA
- **Clinical Practice**: 1) clinicians should refer to pediatric intervention specialists, develop collaborations between adult aphasiologists and pediatric specialties; 2) incorporate literacy skills; 3) recognize long-term impacts

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