Post Stroke Apraxia

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Contents

- What is praxis?
- What is Apraxia?
- The Praxis Network
- Types of Apraxia
- Assessment
- Treatment
- Summary & Questions
What is Praxis?
What is praxis?

• From Greek for ‘doing’…..

• Doing of volitional, goal directed movements

• Praxis is a complex interplay between motor/ sensory/ perceptual & cognitive processes

• A performance skill

• Forms the foundation for development of performance patterns and occupation
The Cognitive Hierarchy

- Executive Functions
- Praxis
- Memory
- Object Recognition
- Visual and Spatial Perception
- Attention
- Sensory Registration
Programmes for action

- Motor programme: a stored action memory for a particular movement
- Not only which muscles to use to activate but the force, direction and timing of the movement
- Open loop versus closed loop movement
- Can involve the use of multiple objects
- Motor schema - actions are combined in a certain order to achieve goal
- Correct sequence is essential to success
- Errors are possible usually at transition points
What is Apraxia?
Apraxia and Dyspraxia – Is there a difference?

**Dyspraxia**
Impairment in *new* learning of motor patterns and sequences i.e. developmental / related to paediatrics (Cermak, 1985)

- Sensory / perceptual disorder
- Paediatrics
- Sensory Integration Treatment

**Apraxia**
A disorder of *learned* movement i.e. previously able and now this ability is absent / related to acquired brain injury (Grieve and Gnanasekaran, 2008)

- Cognitive/Motor disorder
- Adults
- Restoring existing motor pathways (repetition, mental imagery treatments)
Apraxia

- A complex higher order cognitive-motor deficit (Leiguarda & Marsden, 2000; McClain & Foundas, 2004)

- An “inability to perform skilled sequential purposeful movement” (Banich, 2004: 178)

- “A cognitive motor disorder that involves the loss or impaired ability to programme motor systems to perform purposeful, skilled movements” (Zoltan, 2007:109)
Apraxia: Error Types in Function

- Omissions
- Difficulty terminating movements
- Repetitions
- Disturbances to order of movements in sequence
- Difficulties co-ordinating limbs in time and space
- Perseveration
- Performance in wrong plane
- Using body part as object
- Verbalise performance without completing

(Grieve and Gnanasekaran, 2008)
The Praxis Network
The Praxis Network

**Neuroanatomy**
- Seeking to locate the parts of the brain responsible for praxis
- Historically thought to be the left hemisphere and the left parietal lobe due to impact of language

(Liepmann, 1908; Geschwind, 1975; Heilman, 1979)

**Praxis Processes**
- Seeking to identify the levels of processing involved in creating skilled movements.

(Roy and Square, 1994; Rothi & Heilman, 1997)
Neuroanatomy: Not just the Left Parietal Lobe

Bilateral distribution
Hanna-Pladdy et al 2001

Left frontal lobe
Haaland et al 2000

Basal Ganglia
Pramstaller et al 1996

Occipital and temporal lobe
Makuuchi et al 2005
Apraxia: Not just the Left Parietal Lobe

Frontal lobe:
- Pre-motor cortex
- Primary motor area for execution of movement

Right and left parietal lobe:
- Perceptual analysis

Left occipital parietal lobe:
- Action memory store

Dominant occipital lobe:
- Visual information
Apraxia and Aphasia

- 80% of patients with apraxia are also aphasic
- Close relationship between apraxia and aphasia well researched
- Exact impact of each on other remains poorly understood
- Clear evidence one can exist without the other.

(Alexander, 1992; Papagno et al, 1993)
Praxis Processes

Based on three level system:

- Sensory/Perceptual Level
- Conceptual Level
- Production Level

Disruption at Conceptual or Production level would result in Apraxia
Key Process Concepts

Movement is processed in similar way to language

Meaning associated with gesture that is important

Meaning of gesture determines route:

• One route for processing meaningful gestures (transitive & intransitive)

• One route for processing meaningless gestures
Types of Apraxia
Apraxia: Are there different types?

- Ideomotor
- Ideational
- Limb/Manual
- Bucco-Facial
- Constructional
- Speech
- Dressing
Apraxia: Are there different types?

- Manual/Limb Apraxia
  - Ideational Apraxia
  - Ideomotor Apraxia
Ideational Apraxia

Network
- Disturbance in the conceptual system
- Agnosia of object utilisation
- Able to recognize objects, but unable to explain use
- Most evident in complex tasks when using multiple objects
- Least evident in routine/simple tasks
- Disturbance of serial ordering of actions
- Often accompanied by language problems

Signs
- Inappropriate object use
- Incorrect order of elements of activity
- Sections of the sequence omitted
- Two or more elements blended
- Overshooting of action
- Action remains incomplete
- After interruption unable to continue
- Perseveration
Ideomotor Apraxia

**Network**
- Disturbance in the *production* system
- Intact conceptual system
- Ability to verbalize task
- Automatic vs. non-natural context
- Actions to command/imitating actions
- Timing, direction and force of movements

**Signs**
- Spatial orientation errors
- Initiation and timing
- Poor distal differentiation
- Body part as object
- Verbalisation
- Gestural enhancement
- Perseveration
- Fragmentary responses
Assessment
Diagnosis: Apraxia

Based on a differential diagnosis of what it is not:

- Comprehension deficit
- Muscle weakness
- Sensory Impairment
- Tone abnormality
- Other movement disorder

(Butler, 2002)
Apraxia-How should we assess?

Assessment should include:

1. Pantomime (transitive & intransitive)
2. Delayed Imitation (transitive & intransitive)
3. Concurrent Imitation (transitive & intransitive)
4. Assessment with the object
5. Functional Assessment (familiar sequential task, different tasks & environments)

(Jackson, 1999; Butler, 2002; Zwinkels et al, 2004; Bartolo et al, 2008)
Apraxia-How should we assess?

- How the instruction is given is important (Bartolo et al, 2003)

- Presentation of blocked meaningful actions then blocked meaningless actions (Tessari et al, 2007; Press & Hayes, 2008; Murray, 2009; Carmo & Rumiati, 2009)
Treatment
A Cure for Apraxia?

- Recovery of apraxia should not be goal for rehabilitation
- Treatment involves teaching compensatory techniques for impairments but does not cure apraxia
- Will not improve underlying impairments
- Aims to enable more independent function despite presence of apraxia
- Minimise extent to which impairment influences performance of daily life

Buxbaum et al, 2008
Apraxia Intervention - Evidence Base

Cochrane Review (Level 1 Evidence)

• Strategy training
• Sensory stimulation
• Proprioceptive stimulation
• Cueing, verbal or physical prompts
• Chaining (forward or backward)
• Normal movement approaches

West et al, 2008
Evidence Base

Evidence Based Review of Stroke Rehab (EBRSR)

“There is strong (level 1) evidence that strategy training is effective in the treatment of apraxias post stroke. Training effects may include improvement in performance of ADL’s that appear to be sustained over time”

“There is strong (level 1) evidence that gesture training is associated with improvement in ideomotor apraxia. Improvements may extend to ADL’s and these effects may be sustained for at least 2 months following the end of treatment”

Cicerone et al, 2005; Salter et al, 2008
What is Strategy Training?

• Focus on teaching ways to compensate for impairment
• Compensation can be internal or external
• Incorporates errorless learning through practice & repetition
• The individual is guided through the tasks but is not allowed to make errors.
• When repeating and practising the task only the ‘correct’ sequence of actions will be learnt to successfully completed the task.

van Heugten et al, 1998
Buxbaum et al, 2008
Evidence for Strategy Training

- Significant improvement in ADL function through successful teaching of compensatory strategies (van Heugten et al, 1998)
- Strategy training used in conjunction with usual OT intervention is more effective than usual OT alone (Donkervoort et al, 2001)
- Strategy training of specific activities reduces errors and need for assistance (Goldenberg et al, 2001)
- Errors in learning compensatory strategies are disruptive - errorless learning beneficial (Buxbaum et al, 2008)
Important Considerations

- Therapeutic results are restricted to the trained activity does not generalise to non-trained tasks
- Training needs to be task specific
- Tasks must be meaningful to patient and part of daily routine
- Environment for training is very important
- Limited evidence on transfer of skill/ environment

Goldenberg et al, 1998
Geusgens et al, 2007
What is GestureTraining?

• Focuses on training both transitive and intransitive gestures
• Transitive training consists of 3 phases:
  - shown use of tool
  - shown static picture of a portion of action using tool – produce pantomime
  - shown picture of tool – produce associated gesture
• Intransitive training:
  - shown a picture of context and one of related gesture
  - shown context picture – asked to produce gesture
  - shown picture of different but related cotextual situation & asked to reproduce gesture

Buxbaum et al, 2008
Evidence for Gesture Training

- Significant improvement on measures of ideational and ideomotor apraxia (Smania et al, 2000)
- Significant reduction in praxis errors (Smania et al, 2000)
- Significant increase in gesture comprehension (Smania et al, 2000)
- Patients and carers reported more independence in ADL’s after treatment (Smania et al, 2006)
- Maintenance of gains shown at 2 months after treatment (Smania et al, 2006)
Clinical Guidelines

• Grade A evidence for effectiveness compensatory strategies
• Treatment should focus on functional activities
• Activities should be structured
• Activities should be practised using errorless learning approaches
• Transfer of training is difficult to achieve
• Training should focus on specific activities in a specific context, close to normal routines of patient
• Recovery of apraxia should not be goal for rehabilitation
• Repetition & practice most utilised approach

European Federation of Neurological Societies: Task Force for Cognitive Rehabilitation
(Cappa et al, 2005)
(Tempest & Roden, 2008)
Summary

• Apraxia & dyspraxia are different—utilisation of correct terminology
• The underlying knowledge and framework of the praxis system remains poorly understood
• Assess all other modalities first (motor/ sensory/ communication & baseline cognition)
• Assessment should include pantomime, imitation of transitive/ intransitive gesture presented in blocks of meaningful & meaningless gesture
• Functional assessment & activity analysis is key
• Utilise model to determine ideational / ideomotor
• Limited transferability of current evidence into practice
• Utilisation of strategy training & gesture training
• More research is needed into effective treatment for apraxia
Thank You for Listening

Any Questions?

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References

References

- Hanna-Pladdy B, Heilman KM, Foundas AL (2001b) Cortical and Subcortical contributions to ideamotor apraxia – analysis of task demands and error typesBrain 124 (12) pp 2513-2527
References