

Procedural Learning of Functional Mobility Tasks in the Presence of Severe Memory Deficits from Intraventricular Hemorrhage

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Introduction

- ♥ Memory deficits frequently occur in patients with both acquired and traumatic brain injuries³⁻⁵.
- ♥ Declarative memory and learning of facts and events are often impaired in these patients³⁻⁵.
- ♥ Procedural memory and learning of motor skills are often preserved^{1,3-5}.
- ♥ This case report describes how a severely amnesic patient was able to learn functional mobility tasks in physical therapy.

Subject

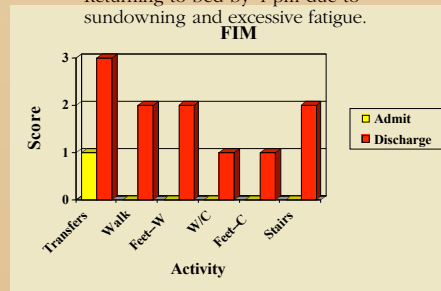
- ♥ 52-year old woman suffered an intraventricular hemorrhage in all 4 ventricles.
- ♥ Presented with significant anterograde and retrograde amnesia, severely impaired declarative and working memories, and frequent confusion.
- ♥ Initially dependent in all areas of functional mobility.
- ♥ Patient likely with some brainstem damage.
 - She did not demonstrate any righting reactions when she fell posteriorly.
 - She also exhibited a disconjugate gaze with some nystagmus.
 - She frequently closed one eye when looking at something, but did not consistently or reliably report double vision.

Intervention

- ♥ Physical therapy intervention focused on standard functional training.
 - Bed mobility
 - Transfers
 - Sitting/standing balance
 - Gait training/stairs
 - Wheelchair propulsion
- ♥ More specifically, functional mobility training consisted of repetitive procedural learning due to severe memory impairments.
- ♥ Novel tasks included wheelchair propulsion and use of a rolling walker for ambulation.
- ♥ These tasks were initially taught hand-over-hand. Therapy sessions included very regimented routines with consistent, brief, automatic cues.
 - "Stand up"
 - "Push the wheelchair"
 - "Let's walk"
- ♥ Overall, there was no use of declarative learning in training these skills with this patient.

Outcomes

- ♥ By discharge, her FIM scores improved by 1-2 levels overall.
- ♥ The patient progressed her wheelchair propulsion from a dependent to a supervision level for multiple intervals of less than 50 feet.
- ♥ She also improved her ambulation from a dependent to a minimal assist level up to 120 feet using a rolling walker.
- ♥ Transfers changed as well from a dependent to a minimal-moderate assist level, and bed mobility improved as well from dependent to minimal assist.
- ♥ She was able to stand statically using bilateral arm support x 8 minutes with close supervision up to minimal assist, as she tended to lean/fall posteriorly on a frequent basis.
- ♥ Despite increased fatigue and confusion in the PM, she retained the technique for these mobility tasks.
- ♥ However, her memory remained severely impaired, and she remained unaware that she was performing these functional tasks on a daily basis.
- ♥ She was able to be discharged to her home with the assistance of a home health aide and her mother.
 - First floor set-up
 - 24 hour supervision
 - Home physical therapy
 - Use of a lap belt for safety
 - Returning to bed by 4 pm due to sundowning and excessive fatigue.



Discussion

- ♥ Typically healthy individuals with intact cognition use both procedural and declarative learning together⁴.
- ♥ The patient was able to learn mobility tasks despite her memory deficits because procedural learning does not require the use of working memory, whereas declarative learning does².
 - Her declarative and working memory systems were not functional after her hemorrhage.
- ♥ With procedural learning, there is no need to deliberately remember anything; only cues are needed^{4,5}.
- ♥ Procedural learning can take place without declarative learning due to encapsulation of the two memory systems separately^{1,4-5}.
 - Procedural learning--sensorimotor cortex, basal ganglia, and cerebellum
 - Declarative learning-- hippocampus, amygdala, thalamic nuclei, basal forebrain, and septum.
- ♥ While she likely acquired some damage to both memory systems due to the large bleed, procedural learning could still occur to some degree because there was no competition for resources from her declarative and working memory systems².
- ♥ While the patient was indeed able to learn skills, her lack of awareness of her performance was a negative impact of only being able to use procedural learning.

Conclusions/Clinical Relevance

- ♥ The literature supports the use of procedural learning for those lacking declarative and working memories.
- ♥ However, the majority of this research does not involve the use of real-world tasks or functional mobility skills.
- ♥ The successful treatment of this patient indicates that procedural learning of functional mobility skills is indeed possible despite severe memory deficits.

Acknowledgements/References

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