

Lost in the Present: Anterograde Amnesia and Medical Decision Making Capacity

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ABSTRACT

Although there have been a limited number of case reports of human bilateral hippocampal injury, none of these have addressed the impact of such injuries on medical decision making capacity. The authors present a case of an elderly man with discrete bilateral hippocampal injury. As a result of his injury, the patient was hopelessly “lost in the present” and only retained the basic cognitive functions necessary to have decision making capacity for a limited period of time. He was unable to appreciate the nature of his injury, the potential risks involved in his decisions, and the recommended course of treatment longer than a few minutes. The patient’s resultant neurocognitive deficits left him lacking medical decision making capacity, a likely outcome for patients with persistent anterograde amnesia.

KEYWORDS

Bilateral Hippocampal Injury; Anterograde Amnesia; Capacity; Medical Decision Making Capacity; Episodic Memory; Prospective Brain

1. Introduction

Numerous studies and cases have explicated the role of the hippocampus and structures of the medial temporal lobe in memory, learning, and behavior. Scoville and Milner [1] first reported on HM and persistent memory impairment absent deterioration in general intelligence following bilateral medial temporal lobe resection involving the anterior hippocampus and hippocampal gyrus. They concluded “the anterior hippocampus and hippocampal gyrus, either separately or together, are critically concerned in the retention of current experience” [1]. Indeed, a review of 147 cases confirms the common finding of anterograde episodic amnesia with less involvement of procedural and working memory [2].

As with other structural insults, bilateral hippocampal damage may present with a range of deficits, not solely

dense amnesia. Often, autobiographic memory and semantic memory are preserved [3]. It is generally agreed that the hippocampus is responsible for the consolidation of episodic information [4]. However, patients with selective hippocampal damage may show differing abilities to learn new semantic information [4-7] which may be rigidly organized, cortically mediated, and of a non-declarative nature [7]. Though patients with circumscribed hippocampal damage demonstrate impaired recognition and recall, these deficits may not be proportionate [8]. The hippocampus is also critical to construction of new imagined experiences [9].

Consult-liaison “CL” behavioral health teams are often asked to determine a patient’s capacity to make medical decisions. One study placed these assessments at 25% of all referrals to such teams [10]. Patients’ unwillingness to follow physicians’ treatment recommendations often motivate these referrals [11]. Regardless of level of con-

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gruence between physician and patient treatment preferences, it is important to assess a patient's capacity to make treatment-related decisions when cognitive or emotional factors are present that may interfere with sound deliberation. Particularly when the extent of a patient's deficits is uncertain, CL teams can provide the primary treatment team with accurate impressions of capacity [12]. Patients with intact decision making capacity (DMC) are able to 1) communicate a choice, 2) understand relevant information, 3) appreciate the medical consequences of his situation, and 4) rationally manipulate information concerning treatment alternatives [13-16]. Capacity evaluation must also balance patient autonomy with clinicians' ethical responsibility to beneficence. The consequences to the patient of a given choice should inform the latitude given the patient to make that choice [16,17]. In the case of amnesic patients, clinicians must carefully consider the effect of neurocognitive deficits on DMC.

There have been limited case reports of human bilateral hippocampal injury and no reports regarding the impact of such injuries on medical decision making capacity (DMC). Bolouri and Small [18] described a patient who suffered a bilateral hippocampal stroke secondary to cardiac arrest and cocaine exposure. Another well studied subject, KC, also experienced bilateral hippocampal lesions, among other insults, after a motor vehicle collision involving a motorcycle [19]. Several other authors have reported cases of amnesia in patients with circumscribed hippocampal damage [20-22]. In this paper, we present the case of a man with discrete bilateral hippocampal injury secondary to cocaine use. The interdisciplinary consult liaison team's evaluation of capacity is discussed in light of current functional criteria and in consideration of the patient's neuropsychological deficits. Finally, neurocognitive findings on hippocampal injury and amnesia are discussed as they relate to capacity assessment. Patients with dense anterograde amnesia are unlikely to retain DMC given unique neurocognitive deficits.

2. Clinical Case

"LN", a 70-year-old unmarried male, was brought to the emergency room after a two-day absence from work. LN was confused, oriented only to person and place. He had facial abrasions and contusions but could not recall a fall or other recent trauma. In fact, he lacked any recollection of the preceding week. LN's initial medical workup was unremarkable. He denied significant medical history and related that he had not seen a doctor in over 20 years. Though he acknowledged moderate alcohol use, LN repudiated clinicians' suspicion of recent illicit substance use. However, a subsequent urine toxicology screen was found positive for cocaine. Because of his continued al-

tered mental status and obvious memory disturbance, LN was admitted to the inpatient medical service. There, consulting neurologists confirmed his persistent anterograde amnesia and recent retrograde amnesia, but found neurological functioning otherwise grossly intact. Though serial CT studies revealed no acute intracranial abnormalities, a subsequent MRI revealed restricted diffusion in the bilateral hippocampi consistent with ischemic infarctions. It is believed that LN's cocaine use caused this markedly discrete neurological damage, possibly secondary to seizure activity and associated hypoxia. In adults, the hippocampus is particularly vulnerable to cerebral ischemia [23].

On hospital day four, the CL service was consulted for an opinion on LN's capacity to make medical decisions. Unable to understand why he was being kept in the hospital, LN had become increasingly agitated and was demanding to leave against medical advice. An occupational therapy evaluation from the prior day expressed an opinion the patient was unsafe to return home alone noting his inability to find his room after a brief walk. LN was cooperative but guarded with the CL team during the initial assessment. Although oriented to person and place, LN could not identify the date or day of the week. He complained that his physicians had not explained the cause of his difficulties. LN appeared genuinely perplexed when the CL team reviewed chart notes detailing no less than six conversations with his primary team about his situation. The CL team noted LN's concrete and perseverative thought process. He lacked awareness of the cause or extent of his cognitive deficits. The team found LN lacking medical decision making capacity to leave against medical advice and agreed to follow him to monitor his mental status and behavior.

Two follow-up assessments were completed on hospital day six and seven. On the occasion of the first follow-up, LN refused to cooperate with the examination. He angrily demanded, "We need to get down to business on why I'm being kept here like a criminal!" Though conceding "memory difficulties," he minimized his dysfunction. Members of his primary team, whom LN could not recall between visits, noted his repeated demands to speak to "my doctor". On each successive explanation of his injuries and associated deficits, LN experienced dysphoria and agitation.

On the following day, two other CL team members met with LN to test for any improvement in his mental status. LN's affect brightened immediately on the team's introduction and he expressed his gratitude that "somebody has finally come to help me!" When again asked the reason for his admission, LN thought for a while then stated that he didn't know for sure but that it might have something to do with his "short term memory". He then offered that he had fallen and struck his head and de-

duced that “must have been” the precipitating event. On direct questioning, LN admitted he had used cocaine and alcohol in the recent past. The team wondered if this represented some temporal recovery in his retrograde memory loss.

LN was attentive to the CL team’s explanation of neuroanatomy and the locus of his injuries. He asked reasoned, appropriate questions during the discussion. However, as the interview progressed, LN demonstrated a stark inability to remember the content of conversation after an interval of only several minutes. On at least ten occasions over the course of an hour, LN inquired, “Doctor, can you tell me what’s wrong with me?” He responded well to, and was comforted by, therapeutic interventions targeted at his feelings of loss and terror caused by his memory disturbance. Reaffirming LN’s lack of decision making capacity for medical decisions, the CL team met with his physicians to suggest behavioral and orientation strategies.

3. Discussion

LN’s case illustrates the profound importance of hippocampal functioning and learning for retention of DMC. LN was able to voice his preference—sometimes quite forcefully—to leave the hospital. However, the simple ability to articulate a preference does not necessarily correlate with a patient’s ability to reason or act in his self-interest. In its Study of Ethical Problems in Medicine and Biomedical and Behavioral Research the President’s Commission rejected the solitary “expressed preference” standard [24] for DMC. A patient with capacity will additionally demonstrate reasonable consistency in his preferences [16]. Their decisions may change as new information emerges regarding the condition and prognosis. However, these decisions will be evaluated in relation to consistent personal standards regarding self and risk tolerance.

In service of self-determination, a patient needs a stable set of values against which to weigh treatment outcomes [24]. Inconsistent decisions may reflect instability in the patient’s value system or failure in his reasoning process. In LN’s case, presentation of salient information significantly influenced LN’s preferences. *During* conversations with clinicians, as he apprehended and considered the facts of his condition, LN readily reversed his prevailing desire to leave immediately and instead agreed to remain for evaluation and treatment. These periods of clarity guided clinicians as a proxy to LN’s premorbid preferences in lieu of an advance directive. It was clear to CL clinicians that he valued his personal well-being, compliance with recommended medical treatments, and avoidance of unnecessary medical risk.

In a recent study of 60 patients suffering amnesic mild cognitive impairment, Okonwo *et al.* [25] found short

term verbal memory capacity was a significant predictor of three decision making capacity criteria: appreciation, reasoning, and understanding. LN’s brain injury left him stranded in the present and increasingly remote past. Having intact working memory and grossly normal functioning in most neuropsychological domains meant that his immediate presentation often belied his profound disability. Like KC [19], LN performed well on a mini mental status screening administered by the medical student, demonstrating significant difficulty only with free call of three unrelated worlds. Despite being able to name target words above a chance level, LN had no confidence in his answers, suggesting lack of explicit availability of encoded information. The standardized mini mental status has been shown to be unsatisfactory as an instrument in evaluating DMC [12]. This is, in part, because of the screener’s failure to test long term memory under standard assessment procedures. After an interval of 10 minutes, LN was unable to recall any of the target words, even with category and forced choice assistance. Structured and semi-structured interview instruments, such as the Assessment of the Capacity to Consent to Treatment (ACCT) interview [26] and Aid to Capacity Evaluation (ACE) [27] can assist clinicians in evaluating DMC.

As described above, LN was attentive to explanations of the specific brain insults apparent on imaging. He apprehended the expected consequences of hippocampal damage on memory consolidation. Moreover, LN asked insightful and reasoned questions about the persistence and specificity of his memory deficits. However, his ability to understand information in the moment did not translate into knowledge. Unable to consolidate information into declarative memory, LN could not learn. When asked gently what was just explained to him, LN replied, “I don’t know; am I missing something?” More specific questions, such as “do you remember me explaining the hippocampus?” evoked apparent frustration, confusion, embarrassment and disbelief.

LN developed little appreciation for his persisting injury. His only complaint, which he reported matter-of-factly, was the sense that his “short term memory” was troubled. Unable to recall explanations of his illness, LN was caught in an unrelenting state of not knowing what he didn’t know. Because of preserved processing capacities, LN’s anosognosia was qualitatively different from that often seen in patients with Alzheimer’s dementia. When made evident to him, LN was both appreciative of and frightened by his deficits.

So important is memory to DMC, the U.K. legislature [28] included the inability to retain information as one of four sufficient criteria for declaring a person incapable of making medical decisions. Deficits in attention and memory may profoundly impair a patient’s ability to reason

and deliberate on his situation and options [29]. The process of medical decision making requires the patient to evaluate probable outcomes and is contingent on his ability to understand and retain information regarding his condition and treatment [14]. LN's initial consult succinctly concluded, "...he cannot fully appreciate or manipulate the risks/benefits of a decision to discharge" because of his memory impairment. LN was unable to recall relevant information long enough to incorporate them into his decisional process.

Future orientation is another important capability supporting DMC. Memory impairments may dramatically compromise future orientation. A patient who retains capacity is able to provide a rationale for his or her expressed, consistent medical decision that considers the facts of the condition/impairment, the alternatives available, and explain how that choice reflects goals and values [14]. At the most fundamental level, the densely amnesic patient may lack the autobiographical memory to maintain their historical self and associated values.

Amnesic patients may be unable to imagine new experiences troubling future orientation. In a small sample study, Hassabis, Kumaran, Vann and Maguire [9] found that subjects with primary bilateral hippocampal damage were markedly impaired imagining future events as compared to matched healthy controls. Recently, researchers have advanced the concept of a "prospective brain" that uses previously encoded information, particularly episodic memories, to imagine, simulate and predict possible future events [30]. A growing body of evidence suggests that remembering the personal past, imagining the future, and taking the viewpoint of others rely on common neural networks [31]. Using fMRI, Addis, Wong and Schacter [32] have described common and unique neural networks supporting episodic memory and future event construction that differentially engage hippocampal regions, frontopolar and prefrontal cortices. Scene construction, the generation, maintenance and visualization of complex spatial contexts, may be a key common process in episodic memory and imagination of future experiences [33].

LN's deficits in future orientation were evident on examination. A custodian, LN's job required him to travel to multiple sites. Asked how he would be able to compensate for his ongoing memory deficits to perform his job, LN protested, "I don't know; I guess I'll just remember." Consistent with the constructive episodic simulation hypothesis [34], LN attempted, and failed, to recall details from past events to construct potential personal future events. Prompted to imagine using a map and checklist to keep track of where he had cleaned, LN became bewildered and asked, "I haven't been using a map, have I?"

In evaluating DMC, clinicians must balance patient

autonomy and self-determination with patient well-being. The consequence to the patient for a given decision informs the level of impairment necessary to obviate his capacity [16]. This balance is often referred to as the "sliding scale" approach [35]. The authors often struggle with capacity questions when a patient's choice is not in his best long-term interests. Examples include the cachectic alcoholic who wants to go back to the streets rather than to substance treatment and the morbidly obese young woman who prefers placement in a skilled nursing facility rather than rehabilitation therapy. Despite making a decision that is in conflict with the recommended treatment, this is not evidence of impaired decision making capacity. This autonomy/consequence balance is salient in DMC situations where an impaired patient consents to physician recommended treatment when he or she does not, in fact, have capacity to do so. The sliding scale also insinuates itself into situations when a difficult patient previously deemed lacking capacity subsequently agrees to recommended treatment absent a change in mental status.

Gutbrod *et al.* [36] have described amnesic patients' difficulty making advantageous choices stemming from impaired memory for prior reinforcements. Other researchers have demonstrated impairment in complex, contextual fear conditioning following hippocampal lesions [37]. Clinicians and the consult team were concerned with LN's capricious decisions and evident vulnerability. Early in his hospital stay, a friend visited LN. At LN's request, the friend escorted him out of the hospital and drove him home. On discovering his absence, the primary team phoned LN at home, informed him he was absent without leave, and told him to return to the hospital. Unable to recall his motivations for leaving in the first place, LN readily complied with the physician's directive. The CL team gave serious consideration to this series of events in weighing respect for LN's autonomy against the potential consequences for his decisions. The team concluded that LN could not be safe unsupervised or act in his own best interests given his inability to learn and susceptibility to others' influence.

4. Conclusion

Patients with persistent anterograde amnesia have a unique constellation of neurocognitive deficits leaving them unlikely to retain DMC. Compromised declarative and episodic memory confounds their ability to manipulate relevant information on condition, prognosis, and treatment alternatives. Although their historical values structure may be preserved, disrupted learning may prevent informed, value-consistent choices. Patients with bilateral hippocampal damage are likely to demonstrate marked impairment in future orientation. Unable to retain information on the extent of their dysfunction, imagine

future events, and understand the viewpoints and motivations of others, these patients are extremely vulnerable to manipulation and exploitation.

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