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Clinical pattern and neuropsychologic outcome of moderate traumatic brain injuries treated in conakry

Abstract

Cognitive impairment and behavioral changes following post-traumatic brain injury are disabling sequelae of traumatic brain injury. Processing speed, attention, executive functions and memory are usually the most impaired functions and may go unnoticed during a routine follow up neurologic consult. The aim of this study was to evaluate the degree of impairment of cognitive functions in a Guinean population of moderate traumatic brain injury by assessing the adaptability of classical Western neuropsychological tests to Guinean socio-cultural context. Twenty-three patients treated in neurosurgery at the Ignace Deen Hospital of Conakry were retrospectively assessed with a mean follow-up of 8.2months, a sex ratio of 4.6.1 and a mean age of 30.5years. Patients were subjected to the Bell test, and to the measurement of verbal and visio-spatial memory scores compared to a group of 23 control patients. The results showed significant differences between the two groups with impaired short recall memory and intact attention functions although quickly exhausted (mental fatigability). Our results designate these 3 tests as simple and reliable neuropsychological evaluation tools to be put in place early during the skull trauma care network, to improve the neuropsychological outcomes in Africa.

Keywords: Traumatic brain injury, neuropsychologic outcome, epidemiology, Guinea

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Introduction

Traumatic Brain Injury (TBI) accounts for 1.5million deaths a year worldwide.[1] In France, the annual incidence of head injuries is estimated at 200 cases per 100 000 inhabitants of which a little less than 10% are severe.[2] In Belgium, it is estimated at 30 000 cases, 10% of which have severe motor, sensory and cognitive sequelae.[3] In Guinea, Béavogui et al recorded 2576 cases of head injuries in the Donka hospital during 2009.[4] In Ignace Deen hospital in the same city, 1182 head injuries were admitted in the surgical emergencies department between March 2015 and June 2016.[5]

Depending on the violence of the impact and the extent of the lesions, the clinical consequences are quite variable ranging from simple post-concussive syndrome to physical sequelae (motor, sensory, speech or epileptic) and in severe cases a persistent vegetative state. These clinical elements are well documented in the African and Guinean medical literature.[6,7]

However, there is one clinical entity that is undervalued in our context and may go unnoticed on a neurological examination in a recent traumatic brain injured patient: neurocognitive deficit, referred as the "hidden disability".[8] It is a combination of different factors associating attention disorders, concentration, impaired learning abilities of new information, and behavioral disorders.

Deficits resulting from these cognitive sequels have an impact on daily life and seriously compromise the social, family, school, and professional reintegration of this usually young population. The difficulties for the social entourage, the patient himself and sometimes for the doctors to identify this handicap and to attribute it to the causal traumatic brain injury are an aggravating factor.

The increasing incidence of TBI in our country and the lack of a previous Guinean study specifically focused on the mid-term neuropsychological outcome motivated this study to determine the cognitive function and generally describe the clinical and epidemiological pattern of neurosurgically treated traumatic brain injured patients in the country.

Patients and methods

We retrospectively reviewed epidemiological, clinical, therapeutic data and neurologic and neuropsychologic outcomes of patients aged between 18 and 60years, treated surgically for isolated moderate traumatic brain injury in our department in a 12months period from January to December 2015. Patients with profound obvious neuropsychological disorders, previous history of brain trauma, stroke, neurologic or psychiatric disorders were excluded.

Moderate TBI was defined by a Glascow Outcome Scale between 9 and 13. At a minimum of 6months follow up, the clinical neurologic parameters were evaluated according to the Markwalder Grading Scale. At the same time each participant neuropsychologic outcome were assessed by 3 standardized tests:

The bells test has proved to be effective in assessing the visuospatial pattern of the attention component of cognition. The patient is required to cross out the bells that are scattered among several different shapes on a sheet of paper.[9]

The digit-span task assesses the verbal working memory, the ability of holding information in memory while using it and performing more or less complex cognitive operations.[10] Participants see or hear a sequence of numerical digits and are tasked to recall the sequence correctly, with increasingly longer sequences being tested in each trial. The participant's span is the longest number of sequential digits that can accurately be remembered. Digit-span tasks can be given forwards or backwards, meaning that once the sequence is presented, the participant is asked to either recall the sequence in normal or reverse order.

The spatial span by the Corsi Blocks tasks assessing the visuospatial working memory capacity. The participant is presented with a three-dimensional tool comprising a board on which nine identical cubes are arranged. The cubes are placed in a disordered manner, the numbered face in front of the examiner so that the subject cannot distinguish the cubes by the assigned number. The examiner administers an example sequence and the test can begin with the sequence of 2 cubes, and then the subject should immediately reproduce the sequence. Each cube presentation is spaced about 1 second apart. The person has two attempts to correctly reproduce the sequence. When two attempts fail, the test is stopped, and the score is obtained by taking the number of cubes corresponding to the last successful sequence. If the subject fails to sequence 8, he gets a score of 5.[11]

At the end of retrospective data collection, 23 healthy individuals matching the age, gender, schooling level and sociocultural environment of the patient's group were selected and subjected to the same 3 neuropsychological tests to serve as baseline for comparison. Individual scores were computed as a Mean for each group and each test and compared using the Student t-test (GraphPad prism 6). The differences were significant for a p value under 0.05.

Results

During the study period 175 patients were treated in General Surgery for isolated moderate head injury. Of these, we were able to access data of 122 patients from our archives (69.7%) and 42 of them (34.4%) patients had available neurological and cognitive assessment data with a follow up of 9.7months (7-14). Ten patients had motor and sensory sequelae, and 9 patients were not able to take the neuropsychological tests due to a profound impairment of their cognitive functions. The application of all our criteria allowed us to select for this study 23 patients whose average age is 30.5years (8-63) with a sex ratio of 4.7. The demographic clinical data are summarized in the Table 1.

Table 1 Clinical and demographic data of our sample of TBI patients. (MGS: Markwalder Grading Scale)

Epidemiology and clinical data		**n**	**%**
Population		23	
Sex Ratio		4.7	
Age < 20		5	9
21-Age-40		15	65.21
Age> 40		3	27
Direct choc		8	34.79
Indirect choc		15	65.21
Mean hospital stays		16 days (6-33)	
Etiology	MVA	20	86.95
	Others	3	13.04
MGS admission	< 3	17	73.91
	≥ 3	6	26.08
Imaging			
Acute subdural hematoma		8	59
Chronic subdural hematoma		7	30.43
Epidural hematoma		5	21.73
Depressed skull fracture		7	30.43
Frontal Contusions		5	21.73
Temporal Contusions		3	13.04
Treatment			
Medical		23	100
Intensive Care		7	34.78
Surgery		12	52.17
Outcome			
MGS follow up n=23	0	22	95.65
	1	1	4.34
	2	0	0
	4-Mar	0	0

The results obtained show a significant difference between the two groups for the digit span task and the spatial span both forward and backward (Table 2).

In the bell test 1 patient achieved a perfect score compared to 4 in the control group. The scores obtained in the patient group are good and are not significantly different from the control group. Regardless of the number of barred bells, it is the bell crossing strategy that shows a noticeable difference: 20 patients (86.9%) crossed the bells in a disorganized manner (disorganized strategy) compared to 5(21.7%) individuals in the control group (Figure 1).

Table 2 Student t test analysis of the 3 mean scores

Test		Patients	Controls	P value
Digit Span	Forward	2.26+-0.79	2.82+-0.48	0.00014
	Backward	1.43+-0.57	1.86+-0.53	0.00467
Spatial Span	Forward	3.43+-1.01	4.65+-0.69	0.00011
	Backward	2.17+-0.81	3.60+-0.7	0
Bells Test		27	27.957	0.5

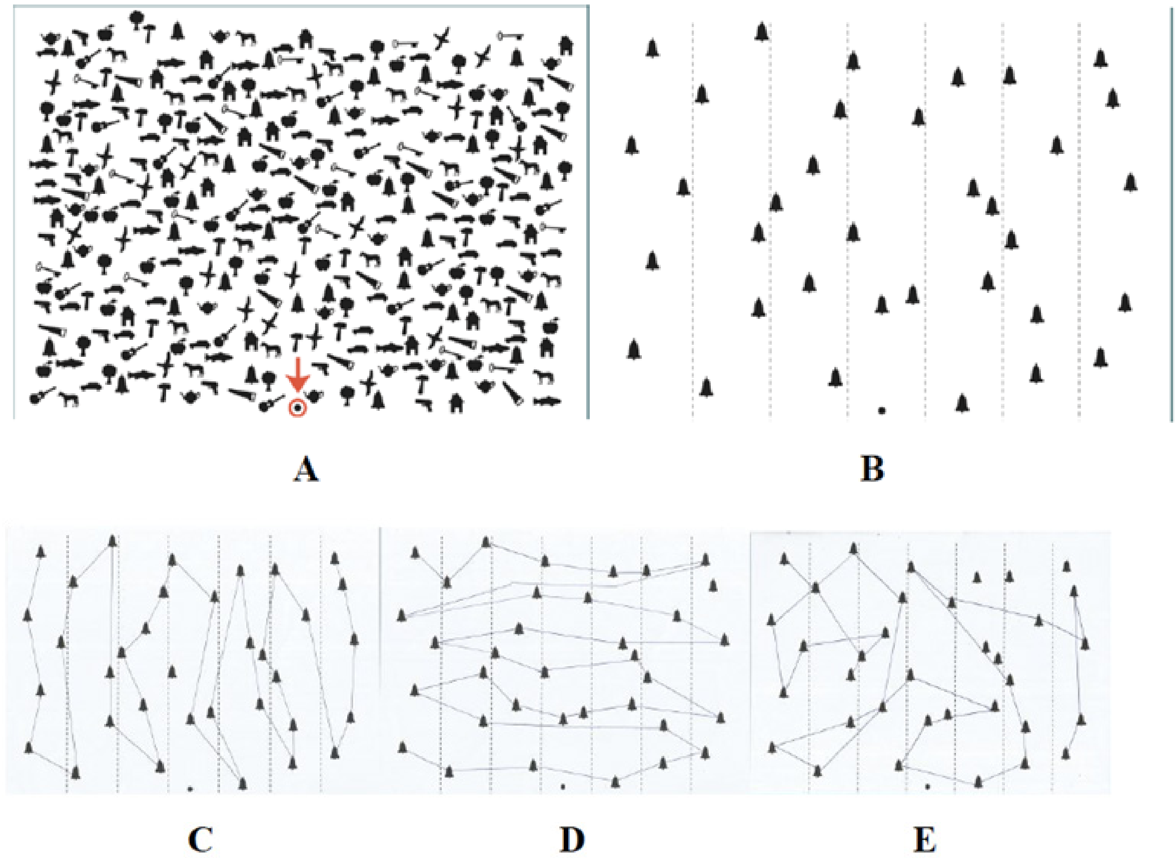

Figure 1 Graph representation of the Bells Test.

Discussion

Traumatic brain injury is a major public health issue with increasing incidence worldwide. In Europe, the total number of annual hospital admissions for TBI has been estimated as 262 per 100,000 populations. Outside the western countries, epidemiological studies on TBI are less precise and frequent.[12] However, in 2004, an epidemiological study involving 77 hospitals showed a very high incidence of TBI in eastern China.[13]

In most published series like the present, TBI was found to be predominant in young male.[14,15] Motor vehicle accidents (MVA) is the principal cause in our study and the most reported etiology in USA[16] and Australia.[17] The preponderance of moderate TBI (compared to mild TBI and severe TBI) in previous Guinean studies[4] as well as the current one is a direct consequence of the low level of development of local resources in neurosurgery. Very few cases of severe TBI could be seen to the hospital alive, due to the lack of intensive pre hospital and intra hospital care. And patient with mild TBI barely come to the emergency room to seek neurosurgical opinion.

Cognitive and emotional perception deficits in the aftermath of severe TBI have been well studied.[18] Most studies have focused on deficits in memory, processing speed, visual spatial abilities, concentration, learning abilities, and abstract reasoning.[19] There is an emerging interest in evaluating the impact of these cognitive disorders on the patient's life using self-rated HRQoL (Health Related Quality of Life) tool after TBI[20] and the importance of early screening of cognitive function for rehabilitation planning in a clinical setting at a stage were the neuroplasticity is at its maximum.[21]

Many standardised neurocognitive tests have been developed in the western countries.[21] Their use elsewhere in the world can be biased by the socio-cultural differences in the perception of individuals about their quality of life.[22] We therefore choose to perform simple assessment of cognitive deficits in this first study (without analysing the impact on HRQOL) and compare the scores to a demographically identic group of healthy individuals, instead of direct transposition of normative western scores mean values.

Evaluation of attention disorders

The bells test didn't show any difference between patients and controls with good performances in both groups in term of score. The disorganized and chaotic pattern of the bells crossing out strategy in the patient's group despite a good quantitative score is a form of mental exhaustion.[23] Increased fatigability in attentional functions results in a global decline in cognitive performance, affecting all phases of information processing.[24] Patients shows traits of additional efforts to compensate the slowdown and difficulties they face in daily life. They become more irritable and experience an increase in the frequency and intensity of headaches.[25]

Assessment of memory disorders

The ability to process serially ordered information is fundamental to many aspects of our lives, including spelling and orientation to a new environment.[10] We tested the verbal short-term memory (STM), with the digit span task (DST) that involves recalling sequences of digits, and the ability to retrieve visuospatial information by the Corsi span task (CST) that involves recalling sequences of blocks.[26] The choice of these two tests were based on the Baddeley's Working Memory model that postulates the existence of two domain-specific subsystems involved in the storage of verbal and visuospatial information: the *phonological loop* and the *visuospatial sketchpad*, respectively. These two components are linked with the *central executive system* that integrates and manipulates information.[27]

Our data shows statistically significant low scores in the patient group in both tasks, backward and forward and concorded with studies reported in the literature.[18] For other authors, these poor performances reflect more a deficit in the implementation of memory processes (perhaps secondary to attentional and dysexecutive disorders) than a true disintegration of the memory stock.[29] Patients develop a poor strategy of learning and retrieving information, especially in double sided task (forward and backward), with poor use of mental imaging (visio-spatial sketch) and coding of spatial and temporal information in episodic memory.[30,31]

Conclusion

This work is a first step towards the impact of TBI on the long-term cognitive functions of patients in our context and opens up prospects for a deep analysis of the consequences of these subtle cognitive declines on the Health-Related Quality of life and activity of daily living.

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Conflicts of interest

Author Declare there are no conflicts of interest towards publication of this article.

References

1. Brain Injury Association of America (BIAA): Facts about traumatic brain injury. 2015.
2. Mathé JF, Richard I, Rome J. Serious brain injury and public health, epidemiologic and financial considerations, comprehensive management and care. *Ann Fr Anesth Reanim*. 2005;24(6):688–694.
3. Gilles C, Lancelot C, Sellier C. Metacognition: Therapeutic intervention around the awareness of disorders in patients with severe cranio–cerebral trauma. *Journal of Medical Rehabilitation*. 2014;34(3):145–154.
4. Béavogui K, Koivogui A, Loua TO. Traumatic Brain Injury related to motor vehicle accidents in Guinea: Impact of treatment delay, access to healthcare, and patient financial capacity on length of hospital stay and in–hospital mortality. *J Vasc Interv Neurol*. 2015;8(4):30–38.
5. Koidio AR. Becoming a Neuropsychological Traumatic Injury Trauma at Ignace Deen Hospital in Conakry. Thesis UGANC-FMPOS. 2017. p. 51.
6. Beavogui K, Koivogui A, Souare IS. Profile of cranio–cerebral trauma and spinal cord related road accident in Guinea. *Neurochirurgie*. 2012;58(5):287–292.
7. Kachungunu C, Kuyigwa TG, Kabuya P. Management of Post Traumatic Intracranial Hematomas. About 52 cases in the Democratic Republic of Congo. 3rd Congress of the Senegalese Society of Neurosurgery. C47, 2013. p 70
8. Bourrelier M. The invisible handicap: A concept to be defined for head trauma. Memory of University Diploma Disability, Fragility and Rehabilitation. France: University of Medicine Créteil–Paris; 2008. p. 32
9. Mancuso M, Damora A, Abbruzzese L, et al. A New Standardization of the Bells Test: An Italian Multicenter Normative Study. *Front Psychol*. 2019;9:2745.
10. Robin A. Kiefer C, Cochepin–Martins K. 2008. Psychological disorders of severe cranial traumatized. Psychiatry 37–546–A–10
11. Berch DB, Kriskorian R, Huha EM. The Corsi block–tapping task: methodological and theoretical considerations. *Brain Cogn*. 1998;38(3):317–338.
12. Peeters W, van den Brande R, Polinder S. Epidemiology of traumatic brain injury in Europe. Acta Neurochir (Wien). 2015;157(10):1683–1696.
13. Wu X, Hu J, Zhuo L. Epidemiology of traumatic brain injury in eastern China in 2004: A prospective large case study. *J Trauma*. 64(5):1313–1319.
14. Stryke J, Stalnacke BM, Sojka P. Traumatic Brain Injury in a well–defined population: epidemiological aspects and severity. *J Neurotrauma*. 2007;24(9):1425–1436.

15. Andelic N, Anke A, Skandsen T, et al. Incidence of hospital–admitted severe traumatic brain injury and in–hospital fatality in Norway: A National Cohort study. *Neuroepidemiology*. 2012;38(4):259–267.

16. Melick D, Gerhart KA, Whiteneck GG. Understanding outcomes based on the post–acute hospitalization pathways followed by persons with traumatic brain injury. *Brain Inj*. 2003;17(1):55–71.

17. Harradine PG, Winstanley JB, Tate R. Severe traumatic brain injury in New South Wales: comparable outcomes for rural and urban residents. *Med J Aust*. 2004 ;181(3):130–134.

18. Bornhofen C, McDonald S. Emotional perception deficits following traumatic brain injury: A review of the evidence and rationale for intervention. *J Int Neuropsychol Soc*. 2008;14(5):511–525.

19. Steinberg M, Godbolt AK, De Boussard CN. Cognitive impairment after severe traumatic brain injury, clinical course and impact of outcome: A Swedish–Iceland Study. *Behav Neurol*. 2015;2015:680308.

20. Von Steinbuchel N, Ruben GL, Sasse N. German validation of quality of life after brain injury assessment and associated factors. *PLoS One.* 2017;12(5):e0176668.

21. Khan F, Amatya B, Judson R. Factors associated with long–term functional and psychological outcomes in persons with moderate to severe traumatic brain injury. *J Rehabil Med*. 2016;48(5):442–448.

22. Cnossen MC, Polinder S, Vos PE. Comparing health–related quality of life of Dutch and Chinese patients with traumatic brain injury: do cultural differences play a role. *Health Qual Life Outcomes*. 2017;15(1):72.

23. Ahami AOT. Neuropsychological Review of the 9 Types of Bells Strategies Test or Cloche Dam Test. Paris: Consensus France; 2001.

24. Azouvi P, Belmont A. Invisible Disability: Main Cognitive and Behavioral Disorders After Severe Head Injury. In: Expertise after cranial trauma under the direction of Laurent–Vannier A. Paris: Sauramps Medical; 2010. pp 15–20.

25. Belmont A, Agar N, Hugeron C. Fatigue and traumatic brain injury. *Ann Readapt Med Phys*. 2006;49(6):283–288.

26. Donolato E, Giofrè D, Mammarella IC. Differences in Verbal and Visuospatial Forward and Backward Order Recall: A Review of the Literature. *Front Psychol*. 2017;8:663.

27. Baddeley AD, Lieberman K. Spatial working memory. In: R Nickerson, editors, Attention and Performance. 1980. p. 521–539.

28. Marsh NV, Ludbrook MR, Gaffaney LC. Cognitive functioning following traumatic brain injury: A five–year follow–up. *NeuroRehabilitation*. 2016;38(1):71–78.

29. Baker–Collo S, Jones K, Theadom A. Neuropsychological outcome and its correlated in the first year after adult mild traumatic brain injury: A population–based New Zealand study. *Brain Inj*. 2015;29(13–14):1604–1616.

30. Berch DB. Coding of spatial and temporal information in episodic memory. In: HW Reese, LP Lipsitt, Editors, Advances in child development and behavior. 13th edn, New York: Academic Press; 1979. p. 46

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