

Assessment of Closed Head Injury in Trauma-related Spinal Cord Injury

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Summary

The complete medical records of 122 patients who sustained traumatic spinal cord injuries were reviewed to determine the frequency and results of emergency room assessments for loss of consciousness (LOC) and post-traumatic amnesia (PTA). Eighty-eight percent of the patients were assessed for LOC and 19% were assessed for PTA. Fifty patients (41% of the total population) admitted to LOC, PTA or both. Fourteen of these 50 patients underwent subsequent radiographic examinations of the skull, all of which were negative. Because of the association of intracranial complications and long-term cognitive sequelae with even brief LOC or PTA, early recognition of craniocerebral trauma is an important component of the acute management of spinal cord injured patients.

Key words: Traumatic spinal cord injury; Closed head injury; Traumatic amnesia.

Introduction

Patients who sustain a mild closed head injury are at risk from the development of intracranial complications and the effects of direct cerebral trauma. The intracranial sequelae, including haematoma and infection, are potentially reversible with prompt medical and surgical intervention when recognized early. Likewise, direct cerebral injury, as evidenced by even brief loss of consciousness or anterograde (post-traumatic) amnesia, may be associated with significant disturbances in cognitive functioning (Russell, 1932; Denny-Brown, 1945; Russell and Smith, 1961; Steadman and Graham, 1970; Gronwall and Wrightson, 1974; Rimel *et al.*, 1981) and emotional (Lishman, 1973; Dikman and Reitan, 1977; Levin, 1978; Fordyce *et al.*, 1983). These disturbances may be amenable to therapy following early identification of patients at risk with cerebral dysfunc-

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tion. This would allow for timely referral for further neuropsychological evaluation which can facilitate appropriate modification in rehabilitation programmes.

Previous studies have demonstrated that many traumatic spinal cord injured patients may have sustained a concomitant head injury (Guttmann, 1963; Meinecke, 1968; Harris, 1968; Silver *et al.*, 1980; Young *et al.*, 1982; Schueneman and Morris, 1982; Dubo and Delaney, 1984; Wagner *et al.*, 1984; Wilmot *et al.*, 1984). Early recognition of craniocerebral trauma in the spinal cord injured patient is important in order to plan appropriate evaluation and treatment. The present study was undertaken to determine the frequency of assessment and prevalence of closed head injury in patients presenting to an emergency department with traumatic spinal cord injury. This study was stimulated by an emerging awareness of the implications of concomitant head and spinal cord injuries by the acute spinal cord injury care team.

Method

A review was conducted of the complete medical records of 122 patients presenting to the Northwestern Memorial Hospital Emergency Room (NMH-ER) between August 1981 and October 1983 with traumatic spinal cord injuries. All patients were admitted to the NMH-ER within 7 days of injury; 92% were admitted within 48 hours of injury. All patients were transferred from the NMH-ER to the Northwestern Memorial Hospital Spinal Cord Injury Unit for acute care and then to the Rehabilitation Institute of Chicago for initial rehabilitation. During this period, the NMH-ER admitted 71% of all patients with acute spinal cord injuries that occurred in Chicago, Illinois, and 39% of all patients with spinal cord injuries that occurred in the state of Illinois (Mid-west Regional Spinal Cord Injury Care System, 1980). All patients were 17 years of age or older at the time of admission to the NMH-ER.

A review of the emergency room (ER) assessments was conducted. Data were obtained regarding aetiology of injury and level of injury, defined as the last complete level of intact neurologic function or the most inferior intact vertebral level on myelography (whichever was more cephalad). The data base included whether inquiries for loss of consciousness (LOC) and post-traumatic amnesia (PTA) were documented, and if so, the results of these inquiries. The state of post-traumatic amnesia is characterized by an inability to store new memories. If a positive history of LOC and/or PTA was noted during the ER assessment, a review of the radiographic reports was conducted to determine whether further investigations for head injury, including plain radiography or computed tomography of the skull, was performed. In the ER, the spinal cord injured patients were evaluated by physicians from the departments of neurosurgery, orthopaedics, critical care, and trauma. Assessment of LOC or PTA was considered to have been performed if any of these physicians documented such an assessment in the medical record.

Data were analysed using the chi-square technique.

Results

Classification data of all spinal cord injured patients included in the study are

Table 1 Description of Study Population: 122 acute trauma-related spinal cord injured patients

Age (years)	Sex		Level of Injury		Aetiology of injury	
	Male	Female	C1-T6	T7-S2		
17-75	106 (87%)	16 (13%)	95 (78%)	27 (22%)	Motor Vehicle Accidents	46(38%)
					Falls	34(28%)
					Sports and Diving	21(17%)
					Gunshot Wounds	20 (16%)
					Assaults	1(1%)

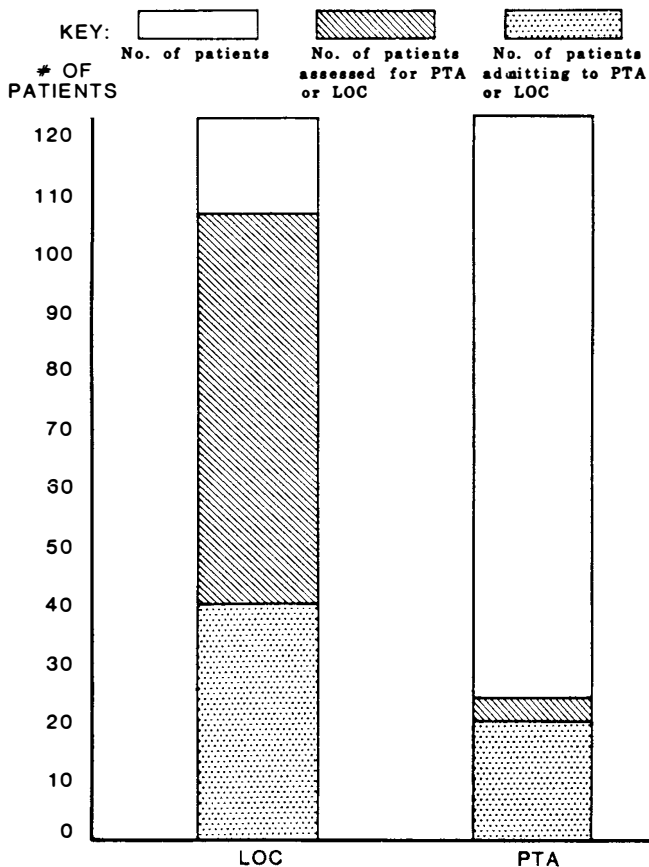


Figure 1. ER Assessment of LOC and PTA for Total Population.

presented in Table 1. Seventy-eight percent of the patients sustained injuries between the C1 and T6 levels and 22% sustained injuries between the T7 and S2 levels. Spinal cord injuries were caused, in descending order of frequency, by motor vehicle accidents, sports and diving injuries, falls, gunshot wounds, and assaults.

Frequency and results of closed head injury assessments are presented in Figures 1-3. Eighty-eight percent of all patients were assessed for LOC and

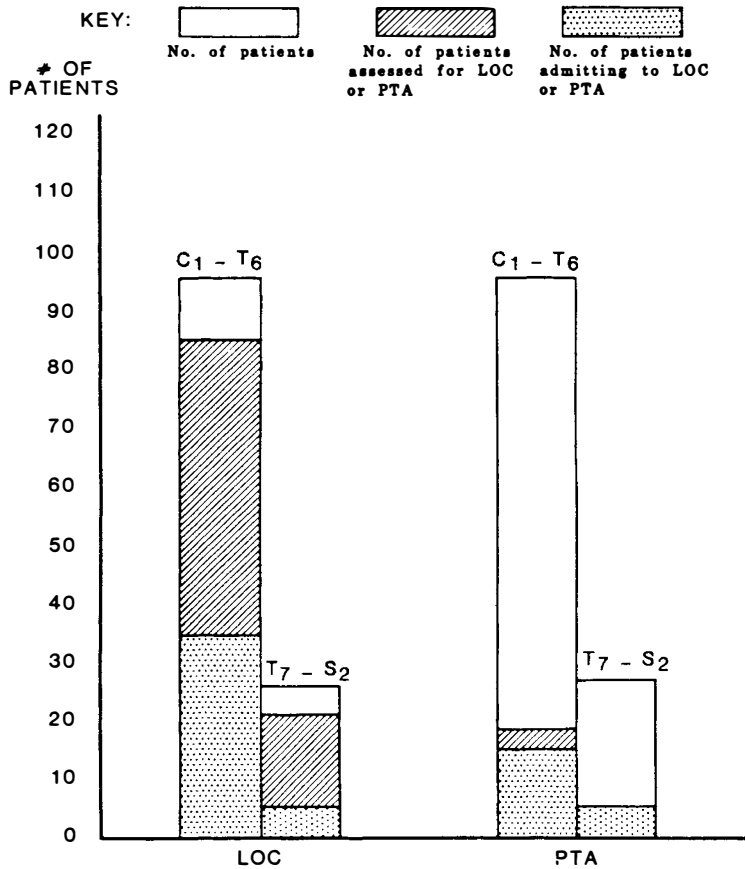


Figure 2. ER Assessment of LOC and PTA by Level of Injury.

19% were assessed for PTA. Level of injury did not influence assessment, but aetiology did. LOC was assessed in 55% of gunshot wound victims and in 94% of all other patients ($p < .001$). PTA was assessed too infrequently to provide a meaningful comparison of its assessment between aetiologic types.

Thirty-eight percent of those patients who were assessed admitted to LOC and 87% of those assessed admitted to PTA. Level of injury did not influence the presence or absence of these symptoms, but aetiology did. None of the gunshot wound victims for whom assessments were performed lost consciousness, but 42% of all non-gunshot wound patients who were assessed admitted to LOC ($p < .02$).

Of the 122 patients evaluated in the ER, 30 admitted to LOC alone, 10 admitted to PTA alone, and an additional 10 admitted to having sustained both LOC and PTA. Fourteen of these 50 patients underwent subsequent radiological examinations, including plain radiography and/or computed tomography of the skull (Figure 4). None of these radiographic studies demonstrated a skull fracture or midline shift.

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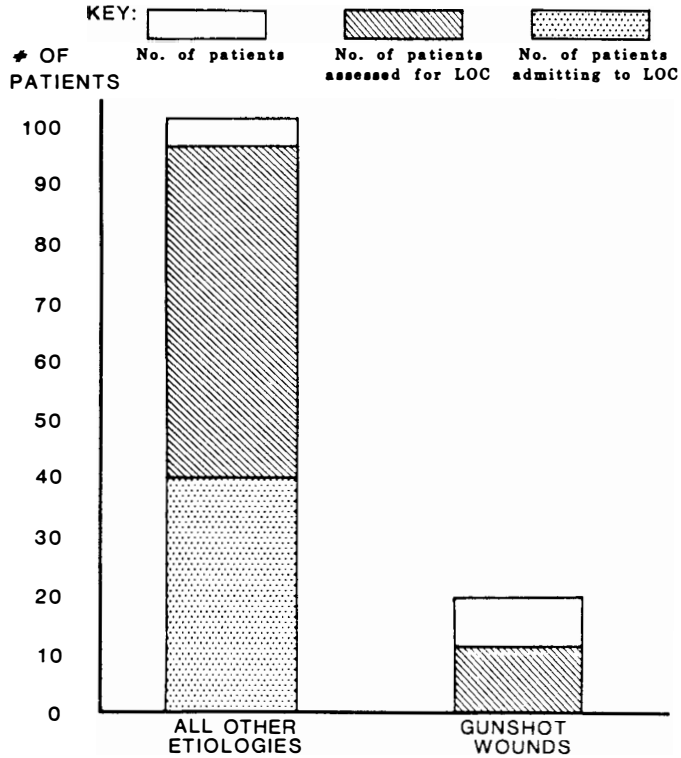


Figure 3. ER Assessment of LOC by Etiology of Injury.

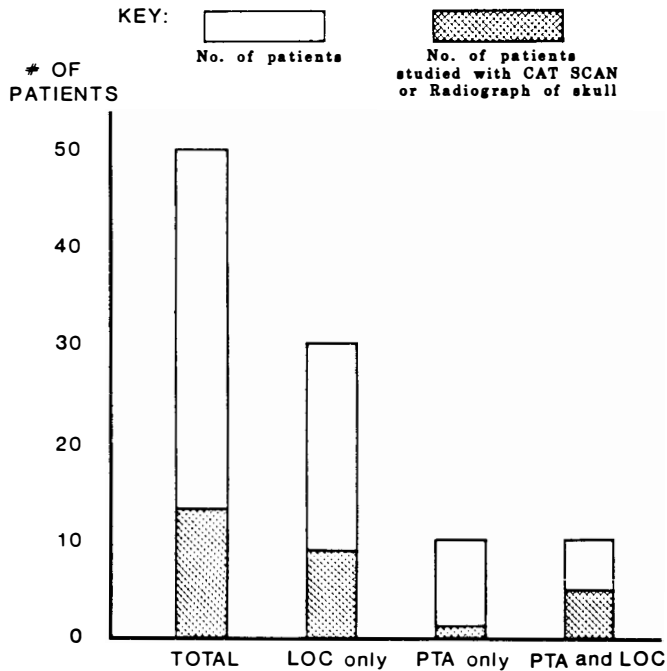


Figure 4. Radiological study of Head Injury in Acute Traumatic SCI.

Discussion

A thorough emergency department evaluation of patients who sustain central nervous system injuries directs the acute management of these injuries and modifies long-term rehabilitation approaches. Findings of the present study support the results of several previous reports (Guttman, 1963; Meinecke, 1968; Silver *et al.*, 1980; Young *et al.*, 1982; Schueneman and Morris, 1982; Dubo and Delaney, 1984; Wagner *et al.*, 1984; Wilmot *et al.*, 1984) that patients who present to emergency rooms with trauma-related spinal cord injuries frequently sustain a concurrent head injury at the time of trauma.

In the present investigation, loss of consciousness (LOC) was assessed far more consistently than post-traumatic amnesia (PTA). Level of spinal cord injury did not influence assessment, but aetiology did. LOC was assessed half as often in gunshot wound victims as compared with all other etiologies combined. PTA was infrequently assessed despite its sensitivity in detection and estimation of severity of head injury (Russell, 1932; Russell and Smith, 1961; Smith, 1961; VonWowern, 1966; Steadman and Graham, 1970).

Forty-one percent of the 122 patients evaluated in the emergency room provided histories consistent with closed head injury, defined as LOC, PTA or both, sustained at the time of trauma. This is probably a conservative estimate because PTA assessment was infrequently performed; patients who denied LOC may have sustained a PTA period that was not assessed, as suggested by the finding that 50% of the patients who admitted to PTA denied LOC.

Early identification of patients with presumptive evidence of even a mild closed head injury affects the emergency room management of these patients. Altered consciousness is often considered a criterion for radiographic skull examinations (Bell and Loop, 1971; FDA Drug Bull., 1978). Several authors have reported a 5–13% incidence of radiographic abnormalities in patients with histories consistent with mild head injuries and no neurological deficits (French and Dublin, 1977; Strang *et al.*, 1978; De Lacey *et al.*, 1980; Jennett, 1980; Rimel *et al.*, 1981). Skull fracture is a significant risk factor associated with complications following head injuries in adults. The vast majority of patients with intracranial haematomas present with linear skull fractures (Galbraith, 1973; Galbraith and Smith, 1976; Jennett, 1980), and depressed skull fractures carry an added risk of complications (Miller and Jennett, 1968; Braakman, 1972; Jennett and Miller, 1972). In the present study, 28% of the 50 patients with presumptive evidence of a closed head injury underwent radiological evaluation of skull fracture, none of which had positive findings.

Diagnosis of a mild closed head injury concurrently in patients presenting with a traumatic spinal cord injury influences their physiatric care. A LOC of 20 minutes or a PTA of 24 hours has been associated with deficits in attention, concentration, memory, higher cognitive functions and prolonged time off work (Russell, 1932; Denny-Brown, 1945; Russell and Smith, 1961; Steadman and Graham, 1970; Gronwall and Wrightson, 1974; Rimel *et al.*, 1981). Some of these sequelae may impede the learning of new skills and information during the acute care and rehabilitation hospitalization. Determination of patients who sustain LOC and/or PTA would permit early identification of patients at risk for these sequelae. This information would allow for in-depth neuropsychological

testing and would facilitate appropriate modifications of psychiatric treatment strategies.

The multiplicity of problems with which the acute spinal cord injury patient presents to the emergency room necessitates the establishment of priorities in evaluation and care. The apparently "less critical" closed head injury may be overlooked during this period. Results of the present study confirm those of other investigators that a mild closed head injury may frequently be associated with a traumatic spinal cord injury. Further, many patients with head injuries remain unrecognized. Failure to identify the presence of a mild closed head injury in spinal cord injured patients may adversely affect their immediate and long-term outcome by enhancing the risk of missing intracranial complications and cognitive impairments.

Addendum

The message of this paper is the importance of a comprehensive initial assessment of the acute spinal cord injury patient for the presence of craniocerebral trauma. Because there is no clear association between level of spinal injury and evidence of craniocerebral trauma, paraplegic patients warrant the same rigor of assessment as quadriplegics. Radiographic assessment may identify individuals at risk for intracranial complications who may benefit from more intensive monitoring of craniocerebral function.

Résumé

On a revu la fiche médicale complète de 122 malades qui avaient subi des blessures traumatiques de la moelle épinière pour déterminer la fréquence et les résultats des évaluations en salle d'urgence de perte de connaissance (LOC) et d'amnésie post-traumatique (PTA). On a évalué quatre-vingt-huit pour cent des malades sous la LOC et 19% sous la PTA. Cinquante malades (41% de la population totale) ont avoué LOC, PTA ou toutes deux. Quatorze de ces 50 malades ont subi un examen radiographique ultérieur du crâne, dont tous se sont montrés négatifs. A cause de l'association des complications intracrâniennes et des séquelles de longue durée pour la connaissance avec LOC ou PTA, même brève, reconnaître le plus tôt possible le traumatisme cérébrocrânien est un élément important du traitement en cas aigu des malades qui souffrent de blessures de la moelle épinière.

Zusammenfassung

Man hat die vollständigen medizinischen Archiven von 122 Patienten, die an traumatischen Rückenmarkverletzungen gelitten hatten, durchgeschaut, um die Häufigkeit und die Ergebnisse von Notraumbewertungen für Bewusstseinsverlust (LOC) und posttraumatische Amnesie (PTA) zu bestimmen. Achtundachtzig Prozent der Patienten sind für LOC und 19% für PTA bewertet worden. Fünfzig Patienten (41% der Gesamtpatientenbevölkerung) haben LOC, PTA oder beide zugegeben. Vierzehn von diesen 50 Patienten haben sich späteren Röntgenuntersuchungen des Schädels unterzogen, wovon alle negativ waren. Wegen der Verbindung von intrakraniellen Komplikationen und dauerhaften für das Erkennungsvermögen schädlichen Folgeerscheinungen mit LOC bzw. PTA, auch wenn diese kurzfristig sind, ist eine frühzeitige Erkennung von kraniozerebralem Trauma ein wichtiges Element der akuten Behandlung von rückenmarkverletzten Patienten.

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