Demographical profiles of adult severe traumatic brain injury patients: implications for healthcare planning

Lee K K, Seow W T, Ng I

ABSTRACT

Introduction: In Singapore, severe traumatic brain injury (TBI) continues to be a major public health problem and devastating condition, with significant mortality and morbidity. By understanding the incidence, prevalence and implications of severe TBI in Singapore, strategic plans to meet the unique needs of these patients in the local context may be developed.

Methods: The demographical profiles of the adult severe TBI patients in Singapore were studied in this retrospective review of 528 patients admitted to the National Neuroscience Institute (NNI) from January 1999 to December 2003.

Results: There were 420 male and 108 female patients, age ranging from 15 to 96 years old, with a mean and standard deviation (SD) of 44.6 ± 19.9 years, admitted to NNI during the study period. Motor vehicle and fall-related accidents were the leading causes of severe TBI. Three high-risk groups identified were young adults, elderly, and foreign workers.

Conclusion: Preventive measures targeting at these high-risk groups are important to reduce the incidence of severe TBI.

Keywords: accidents, brain injury, motor vehicle accidents, trauma

Singapore Med J 2006; 47(1):31-36

INTRODUCTION

Trauma is the fifth highest killer in Singapore[1] and the highest killer in adults under 40 years of age. Traumatic brain injury (TBI), broadly defined as brain injury from externally inflicted trauma, is thus a major public health problem as it accounts for one-half of trauma-related deaths in Singapore and a further unquantified proportion of severe and permanently disabled survivors. The loss of human potential, the long-term impairments and disabilities associated with TBI, had created a tremendous impact on the family and cost society millions of dollars each year. Direct costs include those due to initial diagnosis and follow-up, treatment, and rehabilitation. Indirect costs include societal losses secondary to restricted or lost productivity. The physical and psychological suffering from lifelong disabilities endured by TBI patients and their significant others are tremendous and the costs incalculable.

Over the past decades, TBI prevention programmes, increased knowledge in understanding the pathophysiology of TBI and their applications to reorganise healthcare infrastructure and expertise to effect on-the-scene rescue, rapid transportation, initial resuscitation in trauma-designated hospital emergency departments, have improved the care of patients with TBI. Improved treatment within the "golden hours" and aggressive neurocritical care management have led to increased survival from injuries which would have been fatal previously. This increase in survivors places a challenge to the healthcare system to define more sophisticated treatment options during the recovery period and the rehabilitative services required by the brain injured persons.

Within the Singapore context, data of the demographical profiles of TBI is currently lacking. Understanding the demographics will have an impact on healthcare planning and the provision of resources, and may help us meet the unique needs of these patients and their significant others. With this in mind, we studied the demographical profiles of adult severe TBI patients in Singapore in a retrospective review of these patients admitted to the National Neuroscience Institute (NNI), which has the highest number of severe TBI admissions in Singapore.

METHODS

The research design was a retrospective study using a prospectively maintained severe TBI database of patients with Glasgow Coma Scale (GCS) score of 8 or less following non-surgical resuscitation (endotracheal intubation, administration of mannitol, and volume support), or a GCS score deteriorating to

Department of Nursing Administration
National Neuroscience Institute
11 Jalan Tan Tock Seng
Singapore 308433

Lee K K, BNFHS
Head Injury Nurse Clinician

Department of Neurosurgery
National Neuroscience Institute

Seow W T, MBBS, FRACS, FAMS
Senior Consultant

Ng I, FRCS
Senior Consultant

Correspondence to:
Ms Lee Kah Keow
Tel: (65) 6357 7545
Fax: (65) 6357 7137
Email kah_keow_lee@nni.com.sg

Table I. Demographical data.

	No	%
Gender		
Male	420	79.5%
Female	108	20.5%
Ethnic group		
Chinese	368	69.7%
Malay	64	12.1%
Indian	46	8.7%
Others	50	9.5%
Age group		
0-20	44	8.3%
21-40	217	41.4%
41-60	137	26%
>61	130	24.6%
Nationality		
Singaporean	389	74%
Non-Singaporean	139	26%

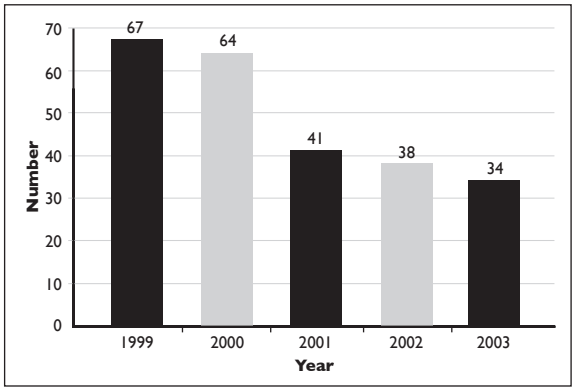
Table II. Details of injury.

	No	%
Source of referral		
Emergency department	399	75.6%
Regional local hospitals	118	22.3%
Neighbouring countries	11	2.1%
Location of accident		
Home	78	14.8%
Street/highway	268	50.8%
Work/school	52	9.8%
Others	130	24.6%
Mechanism of injury		
*MVA	244	46.2%
Fall from height	67	12.7%
Fall	163	30.9%
Assault	18	3.4%
Others	36	6.8%
MVA victims (No=244)		
Driver of car/bus etc	19	7.8%
Motorcyclist	96	39.3%
Passengers of car/bus etc	14	5.7%
Pillion rider	9	3.7%
Pedestrian	85	34.8%
Bicyclist	21	8.6%

* MVA: motor vehicle accident.

8 or less within 48 hours of head trauma. 528 severe TBI patients with head computed tomography (CT) evidence of TBI consecutively admitted to the neuro intensive care unit (NICU) between January 1999 to December 2003 from the emergency department, general ward or through inter-hospital transfer were

Fig. 1 Number of yearly motor vehicle accidents admissions from 1999 to 2003.



studied. Since 1996, a severe TBI protocol based on the 1995 Guidelines on the Management of Severe TBI[2] defining care paths from admission to definitive care for the management of severe TBI patients and discharge of patients has been used in the NICU. The protocol emphasises the early detection, prevention and aggressive management of systemic insults (e.g. hypotension and hypoxia), as well as aggressive cerebral perfusion/intracranial pressure management in the intensive care setting[3].

Demographical data, details of injury, presence of hypoxia (defined as SPO2 <90) and hypotension (defined as systolic blood pressure <90mmHg), treatment details, length of hospital stays, discharge disposition were collected and coded in the SPSS software version 12.0 (MapInfo MapX™, MapInfo Corporation, Troy, NY, USA) and subsequently analysed. Outcome of these patients was measured using a dichotomised Glasgow Outcome Scale (GOS) at six months post-injury. GOS 1 indicated death, GOS 2 (vegetative) and GOS 3 (severe disability) were used to indicate unfavourable outcomes, while GOS scores of 4 (moderately disabled) and 5 (good recovery) indicated a favourable outcome[4]. This scale was chosen as it is widely accepted as a standard means of describing outcome in TBI, and had established validity and inter-observer variability[5].

RESULTS

528 severe TBI patients with a median GCS of 7 and head CT evidence of TBI were admitted to the NICU in NNI over a five-year period from January 1999 to December 2003. The demographical data of these patients are summarised in Table I. Their ages ranged from 15 to 96 years old, with a mean and standard deviation (SD) of 44.6 ± 19.9 years. The majority of the severe TBI population was male. The young and active (21 to 60 years old) constituted 67.4% of the cohort. 26% were foreign workers

from neighbouring countries, such as Bangladesh, China, India, Indonesia, Malaysia and Thailand.

Most of the patients were admitted through the emergency department, and the rest were transferred from regional local hospitals and neighbouring countries. Common mechanisms of injuries were motor vehicle and fall-related accidents (Table II). In the year 1999, there were a total of 67 motor vehicle accident admissions. However, in the year 2003, the number dropped to only 34 (Fig. 1). Motorcyclists and pedestrians were the most vulnerable group of road users. It is not surprising that street/highway was the main location of accident, followed by home, and work/school.

Comparison of mechanism of injury with age group (Table III) revealed that in the >60 years age group, falls occurred in more than one-half of those (65%) who suffered TBI. Similarly, the leading causes of mechanism of injury in the foreign worker groups were motor vehicle (38%) and fall-related (42%) accidents (Table IV). It was however interesting to note that 63% (42 out of 67) of the total incidence of falling from a height in the severe TBI population came from the foreign worker group.

Alcohol use was present in 12.5% of the total severe TBI population where more than one-half of them (51.5%) were involved in motor vehicle accidents. 22.2% of the severe TBI victims sustained multiple injuries. Radiological-proven cervical injuries were seen in 5.9% of all cases. Out of the 54 patients who had hypoxia on presentation, 74.1% of them died, while of 55 patients who had hypotension on presentation, 74.5% of them died.

The mean ICU stay was 4.7±4.7 days with mean ventilation days of 4.3 (SD±4.1, range 1-27 days). The length of hospital stay was higher in the foreign workers group, compared to the locals (Table V). There was one foreign worker who stayed as long as 1,173 days before he was repatriated. Patients with poorer outcome tended to stay longer in the hospital (Table VI). On follow-up at six months post-injury, 36.7% had died, 12.1% had poor outcome (moderate to severe disability), and 51.2% had good outcome (slight or no disability) (Table VII).

DISCUSSION

Our results are consistent with other trauma epidemiological studies conducted locally[6] and internationally[7-9]. Ethnic group distribution in our TBI population was similar to that of the general population in Singapore. The incidence of TBI peaked in the young and active group (21 to 60 years old), and was more common in males. Much of this gender and age difference may be related to their

Table III. Comparison of age group with mechanism of injury.

Mechanism of injury	Age group			
	<20	21-40	41-60	>60
MVA	31 (70%)	109 (50%)	69 (50%)	35 (32%)
Fall from height	5 (11%)	43 (20%)	16 (12%)	3 (1%)
Fall	6 (14%)	30 (14%)	43 (32%)	84 (65%)
Assault	0 (0%)	13 (6%)	2 (1%)	3 (1%)
Others	2 (5%)	22 (10%)	7 (5%)	5 (1%)
Total	**44**	**217**	**137**	**130**

Table IV. Comparison of nationality with mechanism of injury.

Mechanism of injury	Nationality	
	Singaporean	Non-Singaporean
MVA	191 (49%)	53 (38%)
Fall from height	25 (6%)	**42** (30%)
Fall	147 (38%)	16 (12%)
Assault	8 (2%)	10 (7%)
Others	18 (5%)	18 (13%)
Total	**389**	**139**

Table V. Length of stay.

	Hospital stay	Day range
Mean ICU Stay (Day)	4.7±4.7	1 - 34 days
Mean Hospital Stay (Day)	23.6±63.0	1-1,173 days
Singaporean	20.5±28.8	1-206 days
Non-Singaporean	32.5±114.6	1-1,173 days

Table VI. Comparison of outcome with length of hospital stay.

	Hospital stay	Day range
GOS 1 (Dead)	8.2±17.1	1 – 129 days
GOS 2 (Vegetative)	102.1±99.4	6 – 1,173 days
GOS 3 (Severe disability)	46.2±34.0	5 – 152 days
GOS 4 (Moderate disability)	32.5±23.2	3 – 114 days
GOS 5 (Good recovery)	14.1±13.8	3 – 84 days

Table VII. Outcome at 6 months post-injury.

	No	%
Dead	**194**	**36.7%**
Unfavourable	**64**	**12.1%**
Vegetative	33	51.5%
Severe disability	31	48.5%
Favourable	**270**	**51.2%**
Moderate disability	50	18.5%
Good recovery	220	81.5%

risk-taking behaviour. Motor vehicle accidents were the main leading causes of TBI, although there was a decreasing trend over the latter few years in this TBI population. This trend is also evident in the road accident statistics from the Singapore traffic police[10]. This may be due to increased public awareness about the importance of safety belts, and massive public education about road safety and drink driving. Motorcyclists and pedestrians were the most vulnerable group of road users. Negligence on the part of the motorcyclists, such as failing to have proper control of their vehicles, speeding, failing to keep a proper lookout were the likely causes of accidents[10].

The next common cause of TBI was fall-related injury that mainly affected the elderly population. This may be associated with cognitive impairment, treatment with psychotrophic or antihypertensive medicine in this group[11]. The elderly were more likely to injure themselves in falls, and this had a significant impact on the mortality and morbidity. An earlier study by our group showed that elderly persons aged 65 years and above with severe TBI had a higher mortality as compared to their younger counterparts[12]. With the increasing ageing population in Singapore, the number of elderly admitted for falls might be expected to increase in the near future.

Currently, more than 450,000 foreign workers from countries in the region, including Bangladesh, China, India, Indonesia, Malaysia, Myanmar, Pakistan, Philippines, Sri Lanka and Thailand, work in Singapore on work permits[13]. The results showed that more than one-half of the incidents of falling from heights involved foreign workers at work. In many cases, it is likely that these foreign workers were new to high-rise building construction and were less aware of the importance of protective measures such as helmet and safety belts. Many were not highly educated and came mainly from rural areas in their own countries. It is also likely that they might not understand or be familiar with the road traffic regulations in Singapore, which would explain why motor vehicle accidents and falling from heights were the leading causes of TBI in the foreign workers group.

Upon admission to hospital, alcohol consumption was clinically evident in 12.5% of the patients. Use of alcohol or other drugs can impair judgement, diminish reaction time, and reduce neuromuscular control, thereby increasing the risk of TBI[14,15]. Alcoholic intoxication at the time of diagnosis hampers the assessment of the severity of brain injury because of depression of the GCS score. As a result, realistic clinical assessment may not be possible. Moreover, the concern is the impact of alcohol on the accuracy of diagnosis, selection and implementation of the therapy, and the eventual outcome after TBI.

Prolonged ICU and hospital stays were common in this cohort of patients as a result of the complexity of the illness processes. Economically, huge costs were incurred in the care of these patients[15], as management of severe TBI often required significant systemic and neuro monitoring[2,16-19]. Several studies have highlighted that admissions to an ICU are stressful for patients' families and that the number of equipment and lines attached to the patients often shocked the families[20-22]. The sudden unexpected onset of severe TBI, coupled with its unstable nature and the strong probability of death, make the family members ill prepared to handle the immediate crisis and to come to terms with the critical illness and the months ahead. Many studies identified specific needs of these families and highlighted the importance of social support, the need for hope and provision of accurate and honest information about the patients' condition to family members by healthcare workers during this critical period[20-32]. With regard to the finding that foreign workers have longer hospital stays as compared to locals, this is possibly attributable to the lack of caregivers, workmen compensation claims, as well as to repatriation issues that most possibly prolonged the length of hospitalisation.

It is obvious that survivors with poor outcome require further definitive care and support. It is note worthy that 18.5% of patients with good outcome, but who have moderate disability, also required further help. The long-term impairments and disabilities associated with TBI can be quite serious and the full human costs are inestimable. These disabilities, arising from cognitive, psychological, sensory and motor impairments, frequently persist for years following a TBI[15] and often permanently alter a person's vocational goals and ability to work. They have profound effects on social, economic and family relationships[23,32-37]. Since TBI occurs in a considerable number of young persons who potentially have many years ahead and would be expected to have a similar life expectancy as a normal person, vocational outcome is important. In a local study on the rehabilitation outcome following TBI, it was found that only 25% of the patients returned to work one-year post injury[38].

As TBI is largely preventable, public awareness and prevention programmes targeting the high-risk groups are of paramount importance. Awareness programs can be incorporated into the school educational

curriculum to modify risk-taking behaviour among the young. Fall prevention and home safety issues in the frail elderly should be highlighted and taught to the caregivers. Geriatricians and primary healthcare providers, such as general practitioners and nurses, play important roles in the education of these groups of patients through regular educational talks in hospitals, polyclinics or during their daily contacts with the elderly and their caregivers.

Since a quarter of our patients are foreign workers, considerable efforts to educate and conduct safety awareness campaigns among the foreign workers in their native languages may be useful in highlighting potential dangers at work. They should be taught safety drills and to inculcate good safety habits at work. The foreign workers need to be briefed on the dangers associated with high-rise construction, living in high-rise buildings, and on road safety regulation in Singapore. Organisations such as the National Safety Council, Singapore Construction Association, Housing Development Board (HDB), and the Ministry of Manpower may potentially play a critical role in ensuring the above. The mandatory use of helmets and seat belts have significantly reduced the incidence of trauma-related deaths[14]. With stricter enforcement of speed limits, more severe penalties for drink driving, jaywalking and discourteous driving habits, the roads can be made much safer.

The key to effectively manage families of TBI persons during acute hospitalisation phase is early assessment and appropriate intervention through providing current and honest information about the extent of the patient's injury and prognosis, active listening, facilitating flexibility in visiting, and family conferences[20-37]. A structured TBI education program may be initiated to ensure healthcare workers provide honest and reliable information to the brain injured person and their significant others. A specialised neuroscience-trained nurse equipped with TBI knowledge would be a valued resource and support to them and help reinforce understanding and clarify misconceptions about TBI commonly held by family members[39].

From the time of injury, psychological support of the patient, family and significant others are imperative during all phases of care. The families affected need emotional support and information to cope with their afflicted member who is now different or disabled[30,40-43]. Referring the patients and families to local support groups, such as the Brain Injury Society (Singapore) consisting of people who have been involved in one way or another with the traumatic experience of TBI, may be helpful in the acute setting and even after discharge from hospital. Early discharge planning and identification of caregivers, together with a structured caregiver training programme and support from multi-disciplinary personnel, may help to reduce length of hospitalisation especially among those patients with expected poorer outcomes.

Managing foreign workers with TBI presents a significant challenge that is normally not seen in other health conditions locally. Limited insurance cover, workmen compensation claims, problems with consent and caregiver availability, and repatriation of the patients, are issues that need to be carefully looked into to facilitate early discharge planning. Many severe TBI patients are young people who are expected to survive for many years. Long-term care of this group of patients is important. Furthermore, the needs of their family will continue to evolve as the brain-injured persons recover, and return to the community. Their families may adjust or fail to adjust to changes in the social, emotional, and cognitive functioning of the patient[36]. Follow-up care to provide ongoing support in the community, monitoring for medical complications, behavioural and personality issues, social reintegration, caregiver's coping skills and return-to-work issues may be facilitated through the use of technology such as telephone, email and other telecommunication devices.

The results in this study represent data from one institution and thus may only represent the tip of the iceberg. Development of new, more effective, targeted strategies to prevent TBI and continuation of initiatives with proven success require ongoing, standardised surveillance of TBI incidence, risk factors, causes, and outcomes. Accurate assessment of the scope of the TBI problems would be improved by the development of a national TBI database to guide implementation of prevention strategies locally. Improved data about circumstances surrounding falls of the elderly will assist in establishing successful strategies to prevent falls in this high-risk group. Future studies are also needed to look into the long-term impact of severe TBI on survivors and their caregivers.

Many TBI survivors are in the 21 to 60 year age group. Specialised TBI services are needed to meet the unique needs of the young population. Currently, they shared the same rehabilitative and community services as the elderly. The effectiveness of current TBI service provision and those aspects deemed important by TBI survivors and their caregivers need to be explored as the placement of these

young TBI patients in the predominantly elderly-orientated community services may not adequately address the problems they face. Refinement of preventive measures and regional trauma care continue to be a challenge to healthcare professionals. Preliminary findings of the local demographics profile of severe TBI highlight pertinent issues that will allow healthcare planners to better formulate strategic TBI prevention programmes and establish specialised services to address the unique needs of TBI survivors and their family members.

ACKNOWLEDGEMENTS

We would like to acknowledge our colleagues, who were involved in the care of these patients, at the National Neuroscience Institute and Tan Tock Seng Hospital.

REFERENCES

1. Ministry of Health. 2003 Health Facts Singapore. Available at: app2.internet.gov.sg/scripts/moh/newmoh/asp/sta/sta0102.asp. Accessed September 24, 2004.
2. Bullock R, Chestnut RM, Clifton G. Guidelines for the management of severe head injury: Brain Trauma Foundation. J Neurotrauma 1996; 13:639-734.
3. Ng I, Lew TW, Yeo TT, et al. Outcome of patients with traumatic brain injury managed on a standardised head injury protocol. Ann Acad Med Singapore 1998; 27:332-9.
4. Jennett B, Bond M. Assessment of outcome after severe brain damage. A practical scale. Lancet 1975; 1:480-4.
5. Mass AIR, Braakman R, Schouten HJA, et al. Agreement between physicians on assessment of outcome following severe head injury. J Neurosurg 1983; 58:321-5.
6. Wong E, Leong MK, Anantharaman V, et al. Road traffic accident mortality in Singapore. J Emerg Med 2002; 22:139-46.
7. Sosin DM, Sacks JJ, Smith SM. Head injury-associated deaths in the United States from 1979 to 1986. JAMA 1989; 262:2251-5.
8. Tate RL, McDonald S, Lulham JM. Incidence of hospital-treated traumatic brain injury in an Australian community. Aust N Z J Public Health 1998; 22:419-23.
9. Thurman DJ, Jeppson L, Burnett CL, et al. Surveillance of traumatic brain injuries in Utah. West J Med 1996; 165:192-6.
10. Singapore Traffic Police. Road accident situation for the year 2003. Available at: www.spf.gov.sg. Accessed September 20, 2004.
11. Luukinen H, Viramo P, Koski K, et al. Head injuries and cognitive decline among older adults: a population-based study. Neurology 1999; 52:557-62.
12. Gan BK, Lim JH, Ng IH. Outcome of moderate and severe traumatic brain injury among the elderly in Singapore. Ann Acad Med Singapore 2004; 33:63-7.
13. Ministry of Manpower (2004). Available at: www.mom.gov.sg. Accessed September 20, 2004.
14. Barker, FG. Traumatic brain injury. In: Batchelor T, Cudkowicz ME. Principles of Neuroepidemiology. Boston: Butterworth Heinemann, 2001.
15. McQuillan KA, Mitchell PH. Traumatic brain injuries. In: McQuillan KA, Rueden KTV, Hartsock RL, Flynn MB, Whalen E. Trauma Nursing from Resuscitation through Rehabilitation. 3rd ed. Philadelphia: WB Saunders, 2002.
16. Matz PG, Pitts L. Monitoring in traumatic brain injury. Clin Neurosurg 1997; 44:267-94.
17. Sheinberg M, Kanter MJ, Robertson CS, et al. Continuous monitoring of jugular venous oxygen saturation in head-injured patients. J Neurosurg 1992; 76:212-7.
18. Tse V. Neurological monitoring and management of intracranial hypertension. Semin Neurosurg 2003; 14:89-98.
19. Van SH, Maas AIR, Avezaat CJJ. Continuous monitoring of partial pressure of brain tissue oxygen in patients with severe head injury. Neurosurgery 1996; 38:21-31.
20. Bond AE, Draeger CRL, Mandleco B, et al. Needs of family members of patients with severe traumatic brain injury: Implications for evidenced-based practice. Crit Care Nurse 2003; 23:63-72.
21. Johnson BP. One family's experience with head injury: a phenomenological study. J Neurosci Nurs 1995; 27:113-8.
22. Wilkinson P. A qualitative study to establish the self-perceived needs of family members of patients in a general intensive care unit. Intensive Crit Care Nurs 1995; 11:77-86.
23. Carson P. Investing in the comeback: parent's experience following traumatic brain injury. J Neurosci Nurs 1993; 25:165-73.
24. Engli M, Kirsivali-Farmer K. Needs of family members of critically ill patients with and without acute brain injury. J Neurosci Nurs 1993; 25:78-85.
25. Hayes E. Needs of family members of critically ill patients – a Northern Ireland perspective. Intensive Care Nurs 1990; 6:25-9.
26. Hopkins AG. The trauma nurse's role with families in crisis. Crit Care Nurs 1994; 14:35-43.
27. Jamerson PA, Scheibmeir M, Bott MJ, et al. The experiences of family with a relative in the intensive care unit. Heart Lung 1996; 25:467-73.
28. Johnson LH, Roberts SL. Hope facilitating strategies for the family of the head injury patient. J Neurosci Nurs 1996; 28:259-66.
29. Maitz EA, Sachs P. Treating families of individuals with traumatic brain injury from a family systems perspective. J Head Trauma Rehabil 1995; 10:1-11.
30. Norris LO, Grove SK. Investigation of selected psychosocial needs of family members of critically ill adult patients. Heart Lung 1986; 15:194-9.
31. Serio CD, Kreutzer JS, Gervasio AH. Predicting family needs after brain injury: Implications for intervention. J Head Trauma Rehabil 1995; 10:32-45.
32. Testani-Dufour L, Chappel-Aiken L, Guelderner S. Traumatic brain injury: a family experience. J Neurosci Nurs 1992; 24:317-23.
33. Acorn S, Roberts E. Head injury: impact on the wives. J Neurosci Nurs 1992; 24:324-8.
34. DePalma JA, Fedorka P, Simko LC. Quality of life experienced by severely injured trauma survivors. AACN Clinical Issues 2003; 14:54-63.
35. Martin KM. Loss without death: a dilemma for the head-injured patient's family. J Neurosci Nurs 1994; 26:134-9.
36. Witol AD, Sander AM, Kreutzer. A longitudinal analysis of family needs following traumatic brain injury. NeuroRehabilitation 1996; 7:175-87.
37. Zeigler EA. Psychosocial issues for spouses of brain injury survivors. J Neurosci Nurs 1999; 31:106-9.
38. Chua KS, Kong KH. Rehabilitation outcome following traumatic brain injury – the Singapore experience. Int J Rehabil Res 1999; 22:189-97.
39. Springer JA, Farmer JE, Bouman DE. Common misconceptions about TBI among family members of rehab patients. J Head Trauma Rehabil 1997; 12:41-50.
40. Ergh TC, Hanks RA, Rapport LJ, et al. Social support moderates caregiver life satisfaction following TBI. J Clin Exp Neuropsychol 2003; 25:1090-101.
41. Harvey C, Dixon M, Padberg N. Support group for families of trauma patients: a unique approach. Crit Care Nurs 1995; 15:59-63.
42. Kwasnica CM, Heinemann A. Coping with traumatic brain injury: representative case studies. Arch Phys Med Rehabil 1994; 75:384-9.
43. Moreci G. A model system of traumatic brain injury peer support importance, development and process. NeuroRehabilitation 1996; 7:211-8.