A Survey of Mild Traumatic Brain Injury Treatment in the Emergency Room and Primary Care Medical Clinics

Guarantor: Jan Elizabeth Kennedy, PhD
Contributors: Jan Elizabeth Kennedy, PhD; Robin James Lumpkin, BA; COL Joyce Rothleder Grissom, USAF MC

This study surveyed health care providers about their evaluation and treatment of mild traumatic brain injury (TBI) in adults. We presented two vignettes describing mild TBI cases to staff in the emergency department (N = 22) and primary care clinics (N = 16) at Wilford Hall Air Force Medical Center and asked how they would evaluate and treat these patients. Most providers said they would assess visual changes, nausea/vomiting, headache, and neck pain. More emergency department personnel than primary care clinic providers would make referrals to different specialties, whereas more primary care clinic providers would schedule a follow-up appointment. Neither group of providers mentioned assessing common postconcussive symptoms of fatigue, emotional changes, and problems sleeping. Comparing findings to current literature suggest that added focus on emotional, cognitive and psychosocial factors, and education of the patient and family could improve early identification of mild TBI patients at risk for poor recovery.

Introduction

The annual incidence of traumatic brain injury (TBI) is estimated at 1.4 million, >10 times the incidence of breast cancer. The number of hospitalizations for TBI (230,000 annually) is >20 times the number for spinal cord injuries. It is one of the most common neurological conditions, surpassed in incidence only by migraine headache and herpes zoster. Approximately 75% of all TBIs are mild. Recent incidence figures have estimated 1 million emergency department (ED) visits for TBI not subsequently hospitalized, most of which would be in the mild TBI category. Approximately 1 of every 200 people in the United States will be seen in a medical care setting after a mild TBI in any given year. A survey of two national databases from EDs and clinics from 1995 to 1997 estimated 1.4 million visits per year, with more than twice as many visits for mild TBI in the ED compared to outpatient clinic settings. Given these statistics, proper care and treatment of mild TBI in EDs and outpatient clinics is an important priority for medical education and administration.

Methods

To determine how providers evaluate and treat mild TBI, we developed a survey consisting of two mild TBI case scenarios that was presented to military ED (N = 22) and primary care clinic (PCC; N = 16) providers at military treatment facilities (see "Appendix"). Surveys were individually administered to providers attending a continuing education lecture on TBI. After reading case 1, they answered questions about what additional complaints, historical data, and physical examination data they would solicit from the described case. Providers then reviewed case 2 and were asked what additional consultations or referrals they would consider, if they would request neuroimaging and if they would appoint the patient for follow-up or prescribe medication. Answers from the survey were compiled and entered into an Excel database (Microsoft, Redmond, Washington). Each answer to a question was placed in a corresponding category and the frequencies of each category across ED and PCC providers were computed.

Results

In evaluating case 1, the providers identified 17 potential symptoms as important for examination. Of these 17 symptoms, 4 were mentioned by more than one-half of the providers, including headache, neck pain, nausea, and visual changes. All of these symptoms correspond to factors identified in the literature as associated with risk for clinical deterioration and/or poor subsequent outcome.

Relating risk factors for clinical deterioration as identified in the TBI literature (Table I) to the results of our survey, we found that providers varied somewhat in their solicitation of these factors (Tables II and III). The first symptomatic risk factor of drowsiness, confusion, lethargy, or altered consciousness was labeled "mental status changes" in our survey results and was included in only 29% of providers' responses. Neurological deficit, including unspecified and specific focal findings, was mentioned by 37% of the sample. One specific focal disturbance that was mentioned by two-thirds of the providers surveyed was visual changes. In addition, 53% of the providers stated that they would conduct a neurological examination, without specifying the components included. This examination would normally include an assessment of the level of consciousness and focal neurological deficits, raising the rate of evaluation of these risk factors for deterioration.

Important risk symptoms of nausea and headache were each mentioned by slightly more than one-half of the providers. Thirty-two percent of the providers mentioned assessing memory/ posttraumatic amnesia. The scenario indicated that the patient did not remember many details of the accident, which may have reduced the number of providers including this symptom. The
risk factor of skull fracture was evaluated via assessment for blood/fluid discharge, mentioned by about one-fourth of the providers in this study that is not symptom frequently cited by providers. Other symptoms that were frequently cited by providers included fatigue, sleep disturbance, emotional lability/irritability, anxiety or depression, changes in sexual function/motivation, anosmia or dysosmia, and lack of insight (as evaluated by the provider and/or the patient's family). These symptoms often become more evident and important as indicators of poor outcome as the time after injury increases. It is therefore expected that they would become more prominent in the clinic as compared to the ED setting.

The providers in our sample cited seven different historical factors as important (Table IV). The first, mechanism of injury, included the cause of injury, such as motor vehicle collision or assault, and specifics of the injury, such as speed and location of impact. These details contribute to an overall assessment of the severity of the head injury. Significantly more ED providers (54%) compared to PCC providers (6%) said alcohol and drugs are important historical factors. Factors shown to be important to long-term outcome not elicited by our sample included existing or ongoing litigation, previous psychiatric history, and stress assessment.

As illustrated in Table V, providers mentioned several different consultations. The consults reflect different concerns of acute and subacute care of mild TBI patients. More than one-half of both ED and PCC providers would consider requesting a consultation from neurology. Approximately 21% would consider a neurosurgery consultation and 16% a radiology consultation. Fourteen percent of ED providers would make referrals to primary care. A few providers (4-6%) said they would consider consults to trauma, general surgery, and neuropsychologists.
evaluating ease 2, Somewhat more PCC providers would make a most all providers said that they would obtain neuroimaging in follow-up treatment in ease 2 are summarized in Table VI, Al-

ogy. Six percent of the PCC providers would also consider refer-
mendings. Six percent of the PCC providers would also consider referrals to orthopedic and ophthalmology services.

Responses to the questions regarding specific evaluation and follow-up treatment in case 2 are summarized in Table VI. Almost all providers said that they would obtain neuroimaging in evaluating case 2. Somewhat more PCC providers would make a return follow-up appointment with this patient. More ED than PCC providers would prescribe medication to the patient.

Discussion

Mild TBI Care in the ED

The traditional goal for acute care of TBI in the ED is physi-
ological stabilization followed by minimizing further injury from secondary factors such as a drop in blood pressure, lack of oxygen, seizures, and the introduction of infection in the brain through a skull fracture. Patients who are at risk for intracra-
ninal hemorrhage and increased intracranial pressure requiring surgical intervention must be accurately identified. Recent incidence statistics from a large series of approximately 1,100 mild TBI patients in Barcelona, Spain, report a 7.5% incidence of acute intracranial lesions. The incidence of clinical deterioration due to intracranial pathology in mild TBI patients is reported edly low (1.5%), but most of these cases (87%) do require surgery.

TABLE V

| SPECIALIST REFERRALS OF CASE 2 BY ED (n = 22) AND PCC (n = 16) PROVIDERS |
|--------------------------|------------------|------------------|
| Specialist Referrals     | ED (%) reporting | PCC (%) reporting | Total (%) reporting |
| Neurology                | 55               | 60               | 58               |
| Neurosurgery             | 23               | 20               | 21               |
| Neurosurgery, if indicated | 23             | 7                | 16               |
| Radiology                | 18               | 13               | 16               |
| Ophthalmology            | 5                | 7                | 5                |
| Primary care             | 14               | n/a              | 8                |
| Trauma team              | 5                | 0                | 3                |
| Surgery                  | 5                | 0                | 3                |
| Neuropsychology          | 5                | 0                | 3                |
| Orthopedics              | 5                | 0                | 3                |

The Food and Drug Administration conducted a large-scale investigation of clinical deterioration following TBI, involving >7,000 patients with head injury from 31 hospitals. Outcome data from >3,600 of these patients were used to divide the sample into low-, moderate-, and high-risk groups and each was given appropriate management recommendations. The low-risk group included individuals with no symptoms or only mild headache, dizziness, or superficial bumps, bruises, or cuts. The panel recommended that these individuals be discharged without admission, given written information about signs of possible intracranial lesion, and observed for these signs by another responsible individual.

The moderate-risk group included patients with severe/wors-
ening headache, vomiting, altered consciousness, intoxication, amnesia, skull fracture, and/or seizures. The recommendation for these patients was repeated and extended observation, consideration for CT scan, or neurosurgical consultation. Characteristics of the high-risk group were similar to the moderate group but were clearly present and more specifically defined. An additional characteristic of this group was the presence of focal neurological signs. Recommendations for this high-risk group included obtaining an immediate CT scan and neurosurgical consult. Mental status changes and focal neurological findings are once again included as important clinical risk factors, consistent with findings of the previously cited studies.

More recently, the Neurotraumatology Committee of the World Federation of Neurosurgical Societies (WFNS) proposed a classification system for mild TBI in adults including categories of low-risk, medium-risk, and high-risk mild injuries. With minor variations, these guidelines are similar to those developed earlier. Low-risk patients are those with a Glasgow Coma Scale (GCS) score of 15 without loss of consciousness, amnesia, vomiting, or diffuse headache. Recommended treatment for these patients is release to home with written instructions. Medium-risk patients are those with a GCS of 15 and one or more of the symptoms of loss of consciousness, posttraumatic amnesia, vomiting, and diffuse headache. The high-risk category is reserved for patients with admission GCS of 14 or 15 with a skull fracture or neurological deficits. In addition, patients with co-

Brain Injury Treatment in the Emergency Room

Military Medicine, Vol. 171, June 2006
agulopathy, drug or alcohol consumption, previous neurosurgical procedures, pretrauma epilepsy or over the age of 60 are also considered to be in the high-risk group, regardless of other aspects of their clinical presentation.

A recently published outcome study with 5,578 mild TBI patients presenting to EDs has validated these guidelines. The predictor variables recommended by the WFNS of GCS, posttraumatic amnesia, diffuse headache, vomiting, loss of consciousness, neurological deficits, and skull fracture combined with risk factors including age >60 years, alcohol or substance abuse, dangerous mechanism, previous neurosurgery or epilepsy, and coagulopathy were highly accurate in predicting outcome. Three separate ways of defining outcome were examined: (1) presence of posttraumatic lesions on CT scan, (2) need for neurosurgical intervention, and (3) unfavorable clinical outcome at 6 months, defined as death, permanent vegetative state, or severe disability. The predictor variables showed good sensitivity and specificity for identifying risk of all three outcomes: positive CT, need for neurosurgery, and poor clinical outcome.

Rosenthal has provided comprehensive, holistic recommendations for evaluation and treatment of TBI in the ED that are consistent with the major goals of acute evaluation and the guidelines based on risks for poor outcome. He recommends a thorough neurological examination, which should (1) address the major risk factors for clinical deterioration (altered consciousness, skull fracture, older patient age, increasing severe headache, vomiting, focal signs), (2) assess cognitive and behavioral functioning, and (3) include family and witness interviews to obtain accurate and complete information about the details and mechanism of injury and any change or loss of consciousness. Rosenthal also recommends that written information be provided about possible cognitive and behavioral changes that can be expected following TBI, in addition to the information provided about the signs of clinical deterioration. He also recommends that the provider give reassurance that symptoms will likely dissipate in days or weeks. This information can prevent the development of an exaggerated psychological reaction to common symptoms experienced during the short-term recovery of TBI. Finally, instruction to seek further evaluation if symptoms persist for 4 to 6 weeks addresses cases that do not follow the normal course of recovery and need further evaluation and intervention to prevent the development of persistent postconcussive syndrome.

In summary, in the ED setting, attention should be paid to acute indications of clinical deterioration, which include a GCS score <15, loss of consciousness, amnesia, vomiting, diffuse headache, skull fracture, or neurological deficits. Historical/associated factors that are correlated with risk for deterioration include age >60 years, alcohol or substance abuse, dangerous mechanism, previous neurosurgery or epilepsy, and coagulopathy. To facilitate recovery, written information should be provided about commonly expected post-TBI cognitive and behavioral changes. The patient and family should be provided reassurance that symptoms will likely dissipate in days or weeks and should be instructed to seek follow-up if symptoms persist beyond 1 month.

**Mild TBI Care in the PCC**

At least one-half of all individuals will have postconcussive symptoms immediately after a mild TBI. Although most individuals recover quickly, some have continuing symptoms. A major challenge in the subacute care of mild TBI is to identify patients who will have a poor course of recovery and provide the appropriate interventions. Kay has discussed the complex issue of symptom persistence in terms of "individual vulnerability" and emphasizes the importance of preinjury conditions, sociodemographic factors, and compensation/litigation issues. Symptoms of headache, dizziness, and nausea in the ED have been shown to be associated with increased risk of posttraumatic complaints 6 months later.

Research studies that have looked at the incidence of postconcussive symptoms after mild TBI are somewhat inconsistent in terms of the numbers of patients who continue to have symptoms, but they all indicate that symptoms do persist in some cases. The percentages of patients with symptoms at 3 months after mild TBI range from 23 to 90% across different investigations. However, the base rate of some of these symptoms is also high. For example, most people do occasionally have headaches, irritability, low energy, etc. However, one study suggests that approximately 15% of individuals with mild TBI continue to exhibit disabling symptoms 1 year after injury. Ruff et al. have labeled these as the "miserable minority." These individuals often have more, rather than fewer symptoms as time goes on. In addition, the symptoms are frequently not as responsive to traditional treatment as expected. These patients will often show no objective evidence of abnormality on neuroimaging, in neurological examination, or on neuropsychological testing. It is theorized that these individuals develop an oversensitization to common symptoms, misattributing them to the TBI. Frequently, they have prominent emotional reactions, including depression, anxiety, and mood lability. Factors that have been identified in one study as predictive of persistent postconcussive syndrome include neck and head pain, depression and anxiety, and stress at the time of the accident. Other predictive factors included previous mild TBI, initially longer hospital stay, longer sick leave, greater morbidity at 1 and 3 months, female gender, ongoing litigation, and low socioeconomic status.

Although most people successfully return to work after mild TBI, one older study estimated that approximately one-third do not return by 13 months after injury. More than 10% of patients in this sample could be considered chronically disabled, not returning to work even after 8 years. Most of the patients who do not return to work are those with the most severe levels of mild TBI, as indicated by initial GCS scores of 13 and 14. When mild TBI was defined by duration of posttraumatic amnesia, thereby excluding most individuals with GCS scores <15, approximately 86% were back to work by 3 months after injury. As a measure of outcome, return to work may not be as sensitive as quality of work, which is often compromised after TBI by cognitive, behavioral, interpersonal, and physical problems.

Another indication of residual problems after TBI is reflected in the rate of subsequent military discharge for behavior problems. The incidence of military discharge for service members without injuries is approximately 3%, whereas the rate for individuals with TBI is 7%. For individuals who received a TBI during a physical fight, the rate of discharge for behavior problems is approximately 10%. Although this figure is elevated due
Evidence that mild TBI can be associated with symptom persistence, failure to return to work, and increased rates of military discharge suggests that attention should be paid to the accurate identification and treatment of such patients when they present to an acute care medical setting. Educating these individuals about recovery from TBI, what symptoms to expect, and where and when to get help has been shown to improve the outcome. An early single-session educational approach has been shown to prevent postconcussive syndrome as well as longer-term psychotherapy treatment, which also has proven efficacy. In another approach to treatment, gradual resumption of activities is emphasized. Patients given information about TBI and instructed to rest in bed for 1 week with gradual return to usual activity during the second week have lower rates of postconcussive symptoms at 6 months than controls simply told to rest without more specific guidance.

Guidelines for evaluation of mild TBI in an outpatient setting emphasize that somatic, neurological, neuropsychological, emotional, motivational, and social factors need to be considered in evaluating the patient. Both patient and family should be provided with education on the rationale for treatment and expected outcome. In addition, persistent cognitive and emotional problems should be thoroughly evaluated and treated. A multidisciplinary approach to the treatment of persistent postconcussive syndrome is recommended, and in some cases an evaluation of the ability to return to work or school or drive is indicated.

Mild TBI Care: Summary

Research has suggested that evaluation of the mild TBI patient in the ED setting should focus on specific signs and symptoms that indicate risk for clinical deterioration. In addition, in both the ED and outpatient clinic settings, risk factors for poor functional and psychosocial outcome should be assessed and educational information given to the patient and family members about the expected symptoms and course of recovery from mild TBI. Persistent postconcussive syndrome should be addressed with comprehensive multidisciplinary assessment and treatment.

Conclusion

Most providers in our sample endorsed the most frequently cited major risk factors for poor outcome from mild TBI. However, few providers in our study mentioned the assessment of stress, psychosocial factors, emotional changes, and neurovegetative signs such as changes in energy, sleep, and sexual functioning. Particularly in the clinic setting, these factors are important correlates of recovery. Providers need to consider these factors and provide screening and referral if indicated. Another area overlooked by the majority of providers was evaluation of specific cognitive deficits. Determining the type and extent of postconcussive cognitive changes as well as screening for emotional difficulties can be accomplished by referral to neuropsychology. Although extensive formal testing early in the course of recovery from TBI may be limited, cognitive and emotional screening is appropriate and useful for the mild TBI patient. Later testing can determine the extent of recovery when compared to early acute test results.

In addition, increased emphasis should be placed on family and patient education about expected symptoms and course of recovery after mild TBI. A positive expectation for recovery should be emphasized. Misattribution of common symptoms to the TBI should be corrected. Family members should be included as sources of information and support for the patient.

Appendix

Practice Survey

Scenario 1

You are a clinical practitioner who typically sees trauma patients in the ED of a large hospital. A young adult male presents with a bruise on his forehead but no evidence of skull fracture. He was involved in a motor vehicle accident a few hours before and currently seems fully conscious and alert. He does not, however, remember many details of the accident. In the following interview and physical examination...

— What symptomatic complaints and physical examination data would you solicit?
— What historical information would you want to have?

Scenario 2

Assume that the above patient was in fact unconscious for a minute or so and was not intoxicated at the time. He has a headache and slightly blurred vision, and is also somewhat anxious.

— What, if any, referrals to specialists might you make, not limited by availability of personnel?
— Would you request any imaging be done in this case?
— Would you schedule to see this patient for a follow-up appointment?
— Would you prescribe medication for this patient?

Acknowledgments

This project was supported by the Defense and Veterans Brain Injury Program (DVBIP), Henry M. Jackson Foundation for Military Medicine, and Uniformed Services University of the Health Sciences. We thank the Wilford Hall Medical Center providers and DVBIP Program staff for project assistance and DVBIC headquarters for oversight and support.

References

5. Guerrero J, Thurman DJ, Sniezek JE: Emergency department visits associated...
