GUIDELINES FOR THE MANAGEMENT OF HEAD INJURIES IN REMOTE AND RURAL ALASKA

Approximately 800 patients with head injuries die or are hospitalized in the state of Alaska each year[1]. In addition, thousands of others with minor head injuries are seen in emergency rooms or clinics and released after evaluation. Throughout the United States the evaluation of head injured patients has come to rely increasingly on CT scanning. As scanners have become more available, clinicians'anxiety over missing rare but potentially serious injury in patients with minor trauma has increased. Many, often contradictory recommendations regarding the optimal approach to the evaluation of the head injured patient have been proposed [234]. The evidence cited is in most cases from retrospective reviews or from prospective nonrandomized trials. There are no prospective randomized trials currently available for review. Additionally, many recommendations regarding when to obtain a CT scan are based on the supposition that CT imaging and neurosurgical care is readily available.

Management of head injured patients in Alaska is made more difficult by several factors that complicate care and evaluation. First, there are many small hospitals and clinics in remote areas that do not have CT scanners. Most of these facilities are off of the road system and patient transfer requires aeromedical evacuation. While there are very good air ambulance services around the state there is a limit to this resource and inefficient use reduces their availability for patients with time critical emergencies. In addition, because of weather, terrain and the vast distances involved, flying in Alaska is inherently more dangerous for flight crews and patients. The National Institutes of Occupational Safety and Health reported that commercial pilots flying on commuter airlines or charters in Alaska have a mortality rate 5 times that of pilots in the rest of the U.S[5]. Finally, neurosurgical specialty care is limited to the Anchorage area. Currently, there are only three providers to cover most of the state and the number and distribution of neurosurgeons is unlikely to change greatly in the foreseeable future.

These guidelines are the efforts of representatives of the Alaska medical community to recommend a reasonable approach to head injured patients in the rural and remote regions of our state. The recommendations are based on our reading of the current medical literature and the experience of clinicians from around the state. These guidelines are not meant to replace clinical judgement but to offer a reasonable approach to these patients.

METHODS

In February 2003 the Alaska Trauma Systems Review Committee convened an ad hoc group to develop consensus recommendations for the evaluation of head injured patients in remote and rural locations. The group consisted of 18 physicians from around the state; all with many years' experience working in this unique environment. Representatives of emergency medicine, trauma surgery, radiology, pediatrics and neurosurgery were present. Prior to the meeting, a literature review was done by two committee members and pertinent articles were distributed to the full committee for

study. Articles were chosen for their quality and relevance. Included were selections of guidelines by U.S. and international specialty groups. The guidelines presented here represent the consensus of the committee.

LIMITATIONS

Alcohol and drug use – All clinicians are aware that heavy alcohol and drug use severely limit the utility of the Glasgow Coma Scale as a triage tool in patients with suspected head injury. However, in patients who are severely impaired the presence of risk factors as defined in these guidelines should still suggest the need for CT imaging. In the absence of risk factors active observation by medical personnel is a reasonable approach to impaired patients with a depressed GCS. Failure to show some improvement in the GCS over 6 hours even in severely intoxicated patients is a cause for concern.

Small Children and Infants – Evaluation of head trauma in infants and small children also presents challenges. Consensus was not reached in the approach to children under 5 years old with mild head injuries or for children under two with minimal injuries. The main reason was the relative lack of good studies available for review in this age group. Several points are relevant however.

1. Younger children are at a significantly higher risk for cerebral edema.
2. Sedation may be required for CT scanning in the very young and carries a small but significant risk.
3. The risk of radiation from CT scanning is theoretically higher in the very young. Estimates are one additional fatal malignancy for every 1000-10,000 head CT scans[11].
4. In any head injured child < 5y.o.the possibility of non accidental trauma must be considered.

Recommendations by the American Academy of Pediatrics are available and there is a discussion of these issues and the merits of various approaches to these patients[6]. Close observation is one proposed option in the AAP guidelines for children less than 5 years old with minor head trauma.

DEFINITIONS

1. **Acute head injury –** Brain trauma as a result of the head being hit, striking an object or being violently shaken. An acute injury is one that is evaluated <u>within 24 hours</u> of the traumatic event. These guidelines do not apply to strokes or hemorrhage not associated with trauma.
2. **Remote facility** – Medical providers are available but no there is no CT scanning capability on site. There may or may not be routine x-ray availability.
3. **Rural facility –** Medical providers and CT scanner are available but no neurosurgeons are on staff.
4. **Glasgow Coma Scale –** The most commonly accepted assessment tool for documenting neurologic status of the head injured patients. (attachment 1).
5. **Minimal Head Injury –** GCS 15 without loss of consciousness and no risk factors present.
6. **Mild Head Injury –** GCS 14-15 with loss of consciousness and no risk factors present or a GCS of 14 without loss of consciousness and no risk factors present.

7. **Moderate Head Injury –** GCS 9-13 or GCS 14-15 with risk factors present.
8. **Severe Head Injury –** GCS 8 or less.
9. **Neurotrauma consultant –** clinician experienced in the care of brain injured patients, for example neurosurgeons, trauma surgeons, emergency physicians or neurologists.

LOSS OF CONSCIOUSNESS

Loss of consciousness has often been considered valuable in differentiating significant head trauma from trivial injury. While absence of LOC is associated with a good outcome an accurate history is often difficult to obtain and notoriously inaccurate in regards to duration of the episode. In addition loss of consciousness has not been shown to be a significant independent risk factor for identifying patients with lesions requiring operative repair. A number of studies show that 99.8% or greater of patients with LOC as their only risk factor will not require surgery[12]. For the purposes of this guideline LOC is useful in differentiating patients with minimal and mild injuries. It reflects the large number of studies that have looked at this factor. It is not considered a risk factor as defined below.

RISK FACTORS

Risk factors are clinical signs, symptoms or history that place the patient at higher risk for clinically significant intracranial injury regardless of their GCS.

- **Penetrating trauma –** All patients with penetrating skull trauma regardless of GCS should be evaluated by CT scan.
- **Age 65 or older –** Older patients with injuries have a small increased risk for significant injuries following minor head trauma when compared with younger adults[2].
- **Historical factors –** Previous neurosurgery, anticoagulant therapy, shunt-treated hydrocephalus and the new onset of seizures place the patient at increased risk following head trauma.
- **Clinical signs of skull fracture –** Only about 3% of patients with mild head injuries have skull fractures and most skull fractures are not associated with intracranial abnormalities requiring surgery. However, in a conscious patient the presence of a fracture increases the small risk of an intracranial hematoma 400 times[7]. Patients with signs of basilar skull fracture, depressed skull fracture or a focal neurologic deficit should have CT imaging as part of their evaluation if possible.

RECOMMENDATIONS

Minimal Head Trauma – Patients over two years of age with a GCS of 15 and no history of loss of consciousness can be discharged without imaging to a competent observer. Head injury instructions should be provided. The incidence of a surgical lesion in this group is reported to approach 0%[8].

Mild Head Trauma – This group of patients presents a difficult challenge. In patients over 5 years of age with a GCS of 14 and no risk factors or in patients with a GCS of 15,

a documented loss of consciousness and no other risk factors, a number of approaches are reasonable.
When a CT scan is available and the GCS is 14 a CT scan is appropriate. Patients with a GCS of 15 can be managed appropriately in several ways including CT scanning, observation under medical supervision or discharge with a competent observer. The decision may need to factor in the patient's social situation as well as local resources.
When a CT scan is not available skull x-rays may be helpful in identifying a subset of patients with mild injuries who have a higher risk of deteriorating. Clinical deterioration in patients with a GCS of 14-15 but no skull fracture has been reported in .2-.7% of patients. In patients that do have a fracture present the deterioration rate is 3.2-10%[9]. Skull x-rays may facilitate the identification of a subgroup of asymptomatic patients who have a small but real risk of clinical deterioration. If skull x-rays are done and a fracture is noted, the patient should have a CT scan. If there is no fracture identifiable or a skull x-ray is not obtained, the patients need to be observed. Patients with a GCS of 14 without a CT scan or skull x-ray need to be actively observed in a medical setting. Patients with a GCS of 15 can be observed in a medical setting or by a competent observer as an outpatient.

Medical Observation – Observation is an active process with documentation of the patient's neurologic status. Indications for transfer of a patient being observed include a GCS drop of 2 points, onset of seizures, development of a focal neurologic deficit, development of signs of skull fracture (i.e. Battle's sign, CSF leak), or failure to obtain a GCS of 15 in 24 hours.

Moderate Head Trauma – Patients of all ages with a GCS of 9-13 and patients with a GCS of 14-15 with risk factors present are evaluated in a similar fashion. All these patients should have CT imaging. If the scan is normal they should be observed in a medical setting. Repeat scanning should be considered if there is deterioration or failure to improve within 24 hours. Abnormal CT findings associated with trauma include skull fracture, parenchymal contusion, subarachnoid blood, epidural or subdural hematoma and pneumocephalus. These patients should be admitted and a neurotrauma consult should be obtained with either a neurosurgeon or clinician experienced in the management of head injured patients. Imaging abnormalities that do not require a neurotrauma consult include

1.) solitary cerebral contusion <10mm or multiple contusions < 5mm.
2.) subarachnoid blood <4mm,
3.) isolated open or closed non depressed skull fractures,
4.) isolated pneumocephalus, or
5.) isolated subdural hematoma < 4mm[10]. Again, these lesions as isolated findings are considered radiologic abnormalities without clinical neurosurgical implication and do not require a neurotrauma consult.

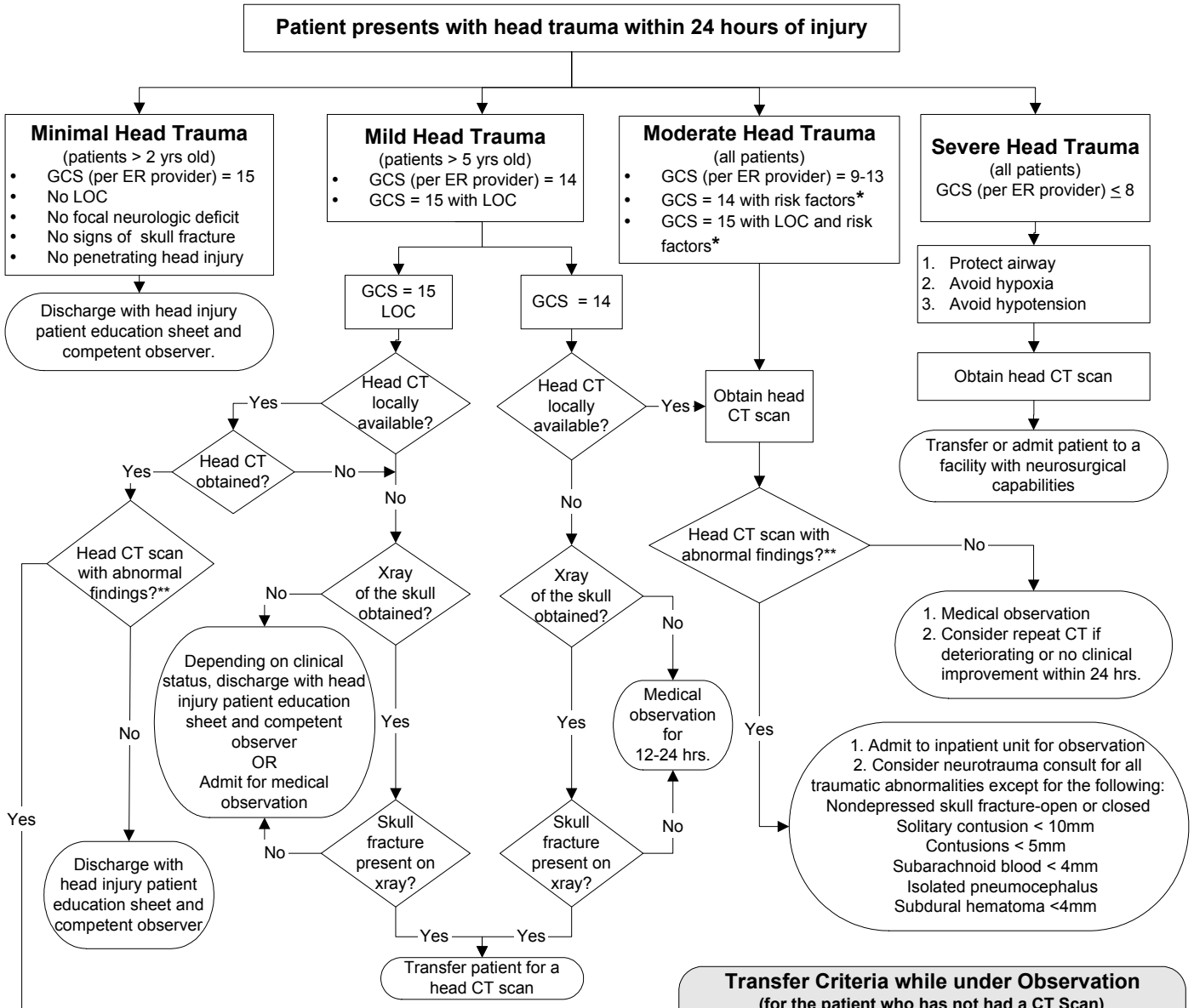
Severe Head Trauma – Head injured patients of all ages with a GCS of 8 or less require CT scanning and should be cared for or transferred to a facility capable of performing craniotomies and intracranial pressure monitoring. In these severely injured patients protection of the airway and avoidance of hypoxia and hypotension are paramount during evaluation and transport. Decompressive craniotomy or burr holes should be a

consideration only if there is an epidural or subdural hematoma, the patient is deteriorating rapidly and neurosurgery is more than two hours away. Most importantly there needs to be a surgeon capable of doing the procedure along with availability of the necessary equipment. Burr holes alone are often insufficient decompression. Burr holes done without CT guidance are even less likely to be of benefit.

CONCLUSIONS

Outlined here is an approach to the evaluation of head injured patients in remote and rural Alaskan health facilities. It is attempt to combine a reading of the current literature with the realities of medical practice and resource availability in our state. It is not meant to replace clinical judgement and indeed the evaluation of the multiply injured patient requires consideration of all aspects of the patient's condition. It does not cover every possible clinical situation and as stated the presence of alcohol or drug intoxication limits its applicability. Our hope is that this will offer some guidance to clinicians that are daily faced with the dilemma of when to call for aeromedical transport. In addition, it will help us utilize our transport and subspecialty resources in a safe, responsible and efficient manner. As with any guideline it will be important to follow-up the impact of these recommendations on patient outcomes and transports.

Management of Acute Head Trauma in Remote and Rural Locations: Alaska State Guideline 5/6/03



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