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# The Management of Minor Closed Head Injury in Children

Committee on Quality Improvement, American Academy of Pediatrics and Commission on Clinical Policies and Research, American Academy of Family Physicians

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**ABSTRACT. The American Academy of Pediatrics (AAP) and its Committee on Quality Improvement in collaboration with the American Academy of Family Physicians (AAFP) and its Commission on Clinical Policies and Research, and in conjunction with experts in neurology, emergency medicine and critical care, research methodologists, and practicing physicians have developed this practice parameter. This parameter provides recommendations for the management of a previously neurologically healthy child with a minor closed head injury who, at the time of injury, may have experienced temporary loss of consciousness, experienced an impact seizure, vomited, or experienced other signs and symptoms. These recommendations derive from a thorough review of the literature and expert consensus. The methods and results of the literature review and data analyses including evidence tables can be found in the technical report. This practice parameter is not intended as a sole source of guidance for the management of children with minor closed head injuries. Rather, it is designed to assist physicians by providing an analytic framework for the evaluation and management of this condition. It is not intended to replace clinical judgment or establish a protocol for all patients with a minor head injury, and rarely will provide the only appropriate approach to the problem.**

**The practice parameter, "The Management of Minor Closed Head Injury in Children," was reviewed by the AAFP Commission on Clinical Policies and Research and individuals appointed by the AAFP and appropriate committees and sections of the AAP including the Chapter Review Group, a focus group of office-based pediatricians representing each AAP District: Gene R. Adams, MD; Robert M. Corwin, MD; Diane Fuquay, MD; Barbara M. Harley, MD; Thomas J. Herr, MD, Chair; Kenneth E. Matthews, MD; Robert D. Mines, MD; Lawrence C. Pakula, MD; Howard B. Weinblatt, MD; and Delosa A. Young, MD.**

**The supporting data are contained in a technical report available at http://www.pediatrics.org/cgi/content/full/104/6/e78.**

ABBREVIATIONS. AAP, American Academy of Pediatrics; AAFP, American Academy of Family Physicians; CT, cranial computed tomography; MRI, magnetic resonance imaging.

Minor closed head injury is one of the most frequent reasons for visits to a physician.[1] Although >95 000 children experience a traumatic brain injury each year in the United States,[2] consensus is lacking about the acute care of children with minor closed head injury. The evaluation and management of injured children may be influenced by local practice customs, settings where children are evaluated, the type and extent of financial coverage, and the availability of technology and medical staffing.

Because of the magnitude of the problem and the potential seriousness of closed head injury among children, the AAP and the American Academy of Family Physicians (AAFP) undertook the development of an evidence-based parameter for health care professionals who care for children with minor closed head injury. In this document, the term Subcommittee is used to denote the Subcommittee on Minor Closed Head Injury, which reports to the AAP Committee on Quality Improvement, and the AAFP Commission on Clinical Policies, Research, and Scientific Affairs.

While developing this practice parameter, the Subcommittee attempted to find evidence of benefits resulting from 1 or more patient management options. However, at many points, adequate data were not available from the medical literature to provide guidance for the management of children with mild head injury. When such data were unavailable, we did not make specific recommendations for physicians and other professionals but instead we presented a range of practice options deemed acceptable by the Subcommittee.

An algorithm at the end of this parameter presents recommendations and options in the context of direct patient care. Management is discussed for the initial evaluation of a child with minor closed head injury, and the disposition after evaluation. These recommendations and options may be modified to fit the needs of individual patients.

### PURPOSE AND SCOPE

This practice parameter is specifically intended for previously neurologically healthy children of either sex 2 through 20 years of age, with isolated minor closed head injury.

The parameter defines children with minor closed head injury as those who have normal mental status at the initial examination, who have no abnormal or focal findings on neurologic (including fundoscopic) examination, and who have no physical evidence of

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

skull fracture (such as hemotympanum, Battle's sign, or palpable bone depression).

This parameter also is intended to address children who may have experienced temporary loss of consciousness (duration <1 minute) with injury, may have had a seizure immediately after injury, may have vomited after injury, or may have exhibited signs and symptoms such as headache and lethargy. The treatment of these children is addressed by this parameter, provided that they seem to be normal as described in the preceding paragraph at the time of evaluation.

This parameter is not intended for victims of multiple trauma, for children with unobserved loss of consciousness, or for patients with known or suspected cervical spine injury. Children who may otherwise fulfill the criteria for minor closed head injury, but for whom this parameter is not intended include patients with a history of bleeding diatheses or neurologic disorders potentially aggravated by trauma (such as arteriovenous malformations or shunts), patients with suspected intentional head trauma (eg, suspected child abuse), or patients with a language barrier.

The term brief loss of consciousness in this parameter refers to a duration of loss of consciousness of 1 minute or less. This parameter does not make any inference that the risk for intracranial injury changes with any specific length of unconsciousness lasting <1 minute. The treatment of children with loss of consciousness of longer duration is not addressed by this parameter.

Finally, this parameter refers only to the management of children evaluated by a health care professional immediately or shortly after (within 24 hours) injury. This parameter is not intended for the management of children who are initially evaluated >24 hours after injury.

## METHODS FOR PARAMETER DEVELOPMENT

The literature review encompassed original research on minor closed head trauma in children, including studies on the prevalence of intracranial injury, the sensitivity and specificity of different imaging modalities, the utility of early diagnosis of intracranial injury, the effectiveness of various patient management strategies, and the impact of minor closed head injury on subsequent child health. Research was included if it had data exclusively on children or identifiable child-specific data, if cases were comparable with the case definition in the parameter, and if the data were published in a peer-reviewed journal. Review articles and articles based solely on expert opinion were excluded.

An initial search was performed on several computerized databases including Medline (1966–1993) using the terms head trauma and head injury. The search was restricted to infants, children, and adolescents, and to English-language articles published after 1966. A total of 422 articles were identified. Titles and abstracts were reviewed by the Subcommittee and articles were reviewed if any reviewer considered the title relevant. This process identified 168 articles that were sent to Subcommittee members with a literature review form to categorize study design, identify study questions, and abstract pertinent data. In addition, reference lists in the articles were reviewed for additional sources, and 125 additional articles were identified. After excluding review articles and other studies not meeting entry criteria, a total of 64 articles were included for review. All articles were reabstracted by the methodologists and the data summarized on evidence tables. Differences in case definition, outcome definition, and study samples precluded pooling of data among studies.

The published data proved extremely limited for a number of study questions, and direct queries were placed to several authors for child-specific data. Because these data have not been formally published, the Subcommittee does not rest strong conclusions on them; however, they are included in the Technical Report. The Technical Report produced along with this practice parameter contains supporting scientific data and analysis including evidence tables and is available at http://www.pediatrics.org/cgi/content/full/104/6/e78.

## SUMMARY

### Initial Evaluation and Management of the Child With Minor Closed Head Injury and No Loss of Consciousness

*Observation*

For children with minor closed head injury and no loss of consciousness, a thorough history and appropriate physical and neurologic examination should be performed. Observation in the clinic, office, emergency department, or at home, under the care of a competent caregiver is recommended for children with minor closed head injury and no loss of consciousness. Observation implies regular monitoring by a competent adult who would be able to recognize abnormalities and to seek appropriate assistance. The use of cranial computed tomography (CT) scan, skull radiograph, or magnetic resonance imaging (MRI) is not recommended for the initial evaluation and management of the child with minor closed head injury and no loss of consciousness.

### Initial Evaluation of the Child With Minor Closed Head Injury With Brief Loss of Consciousness

*Observation or Cranial CT Scan*

For children with minor closed head injury and brief loss of consciousness (<1 minute), a thorough history and an appropriate physical and neurologic examination should be performed. Observation, in the office, clinic, emergency department, hospital, or home under the care of a competent caregiver, may be used to evaluate children with minor closed head injury with brief loss of consciousness. Cranial CT scanning may also be used, in addition to observation, in the initial evaluation and management of children with minor closed head injury with loss of consciousness.

The use of skull radiographs or MRI in the initial management of children with minor closed head injury and loss of consciousness is not recom-

mended. However, there are limited situations in which MRI and skull radiography are options (see sections on skull radiographs and on MRI).

**Patient Management Considerations**

Many factors may influence how management strategies influence outcomes for children with minor closed head injury. These factors include: 1) the prevalence of intracranial injury, 2) the percentage of intracranial injuries that need medical or neurosurgical intervention (ie, the percentage of these injuries that, if left undiagnosed or untreated, leads to disability or death), 3) the relative accuracy of clinical examination, skull radiographs, and CT scans as diagnostic tools to detect such intracranial injuries that benefit from medical or neurosurgical intervention, 4) the efficacy of treatment for intracranial injuries, and 5) the detrimental effect on outcome, if any, of delay from the time of injury to the time of diagnosis and intervention.

This last factor, delay of diagnosis and intervention, is particularly relevant when trying to decide between a clinical strategy of immediate CT scanning of all patients as opposed to a strategy that relies primarily on patient observation, with CT scanning reserved for rare patients whose conditions change. To our knowledge, no published studies were available for review that compared clinically meaningful outcomes (ie, morbidity or mortality) between children receiving different management regimens such as immediate neuroimaging, or observation. Although some studies were able to demonstrate the presence of intracranial abnormalities on CT scans or MRIs among children with minor head injury, no known evidence suggested that immediate neuroimaging of asymptomatic children improved outcomes for these children, compared with the outcomes for children managed primarily with examination and observation.

**Initial Management of the Child With Minor Closed Head Injury and No Loss of Consciousness**

Minor closed head injury without loss of consciousness is a common occurrence in childhood. Available data suggest that the risk of intracranial injury is negligible in this situation. Population-based studies have found that fewer than 1 in 5000 patients with minor closed head injury and no loss of consciousness have intracranial injuries that require medical or neurosurgical intervention. In 1 study of 5252 low-risk patients, mostly adults, none were found to have an intracranial injury after minor head injury.[3] Comparably sized studies do not exist for children. In 2 much smaller studies of children with minor head injury, among those with normal neurologic examination findings and no loss of consciousness, amnesia, vomiting, headache, or mental status abnormalities, no children had abnormal CT scan findings.[4,5]

*Observation*

Among children with minor closed head injury and no loss of consciousness, a thorough history and appropriate physical and neurologic examination should be performed. Subcommittee consensus was that observation, in the clinic, office, emergency department, or home under the care of a competent observer, be used as the primary management strategy. If on examination the patient's condition appears normal (as outlined earlier), no additional tests are needed and the child can be safely discharged to the care of a responsible caregiver. The recommended duration of observation is discussed in the section titled "Disposition of the Child With Minor Head Injury."

*CT Scan/MRI*

With such a low prevalence of intracranial injury, the Subcommittee believed that the marginal benefits of early detection of intracranial injury afforded by routine brain imaging studies such as CT or MRI were outweighed by considerations of cost, inconvenience, resource allocation, and possible side effects attributable to sedation or inappropriate interventions (eg, medical, surgical, or other interventions based on incidental CT findings in asymptomatic children).

*Skull Radiographs*

Skull radiographs have only a very limited role in the evaluation of children with minor closed head injury, no loss of consciousness, and no signs of skull fracture (ie, no palpable depression, hemotympanum, or Battle's sign). The substantial rate of false-positive results provided by skull radiographs (ie, a skull fracture detected on skull radiographs in the absence of intracranial injury) along with the low prevalence of intracranial injury among this specific subset of patients, leads to a low predictive value of skull radiographs. Most children with abnormal skull radiographs will not harbor significant intracranial lesions and conversely intracranial injury occurs in the absence of a skull fracture detected on skull radiographs.

There may be some clinical scenarios in which a practitioner desires imaging such as the case of a child with a scalp hematoma over the course of the meningeal artery. In situations such as these, the Subcommittee believes that clinical judgment should prevail. However, given the relatively low predictive value of skull radiographs, the Subcommittee believes that, if imaging is desired, cranial CT scan is the more satisfactory imaging modality.

**Initial Management of the Child With Minor Closed Head Injury and Brief Loss of Consciousness**

Among children with minor closed head injury, loss of consciousness is uncommon but is associated with an increased risk for intracranial injury. Studies performed since the advent of CT scanning suggest that children with loss of consciousness, or who demonstrate amnesia at the time of evaluation, or who have headache or vomiting at the time of evaluation, have a prevalence of intracranial injury detectable on CT that ranges from 0% to 7%.[5–8] Although most of these intracranial lesions will remain clinically insignificant, a substantial proportion of children, between 2% and 5% of those with minor

head injury and loss of consciousness, may require neurosurgical intervention.[6–8] The differences in findings among studies are likely attributable to differences in selection criteria, along with random variation among studies with limited sample size. Although these findings might have been biased somewhat if more seriously injured patients were preferentially selected for CT scans, even studies in which patients were explicitly stated to be neurologically normal and asymptomatic found children with clinically significant injuries that required intervention.[6]

In past studies of children with minor head injury, patient selection may have led to overestimates of the prevalence of intracranial injury. Many of these studies looked at patients referred to emergency departments or trauma centers, patients brought to emergency departments after examination in the field by emergency personnel, or patients for whom the reason for obtaining CT scans was not clearly stated. These factors may have led to the selection of a patient population at higher risk for intracranial injury than the patients specifically addressed in this practice parameter.

As evidence of this, population-based studies before the widespread availability of CT scanning found the prevalence of clinically significant intracranial injury after minor closed head injury to be far less than estimated by the aforementioned studies. One study found a prevalence of intracranial injury that required neurosurgery to be as low as .02%.[9] This discrepancy is consistent also with the fact that many lesions currently identified with cranial CT were not recognized before the availability of this technology. Because most of these lesions do not progress or require neurosurgical intervention, most would not have been diagnosed in studies before the availability of CT scan.

*Observation*

As discussed earlier, the Subcommittee did not find evidence to show that immediate neuroimaging of asymptomatic children produced demonstrable benefits compared with a management strategy of initial observation alone. In light of these considerations, there was Subcommittee consensus based on limited evidence that for children who are neurologically normal after minor closed head injury with loss of consciousness, patient observation was an acceptable management option.

If the health care practitioner chooses observation alone, it may be performed in the clinic, office, emergency department, hospital, or at home under the care of a competent observer, typically a parent or suitable guardian. If the observer seems unable to follow or comply with the instructions for home observation, observation under the supervision of a health care practitioner is to be considered.

*CT Scan*

Data that support the routine use of CT scanning of children with minor head injury and loss of consciousness indicate that children with intracranial lesions after minor closed head injury are not easily distinguishable clinically from the large majority with no intracranial injury.[10,11] Children with nonspecific signs such as headache, vomiting, or lethargy after minor closed head injury may be more likely to have intracranial injury than children without such signs. However, these clinical signs are of limited predictive value, and most children with headache, lethargy, or vomiting after minor closed head injury do not have demonstrable intracranial injury. In addition, some children with intracranial injury do not have any signs or symptoms. Because of these findings, many investigators have concluded that the physical and neurologic examination are inadequate predictors of intracranial injury, and that cranial CT is more sensitive than physical and neurologic examinations for the diagnosis of intracranial injury.

The most accurate and rapid means of detecting intracranial injury would be with a clinical protocol that routinely obtained intracranial imaging for all children after head injury. Rapid diagnosis and treatment of subdural hematomas was found in 1 study to significantly reduce morbidity and mortality among severely injured adults.[12] However, this result was not replicated in other studies of subdural or epidural hematomas[13–15] and similar studies have not addressed less severely head injured children, or children with minor closed head injury.

CT itself is a safe procedure. However, some healthy children require sedation or anesthesia, and the benefits gained from cranial CT should be carefully weighed against the possible harm of sedating and/or anesthetizing a large number of children. In addition, CT scans obtained for asymptomatic children may show incidental findings that lead to subsequent unnecessary medical or surgical interventions. To our knowledge, no data are available that demonstrate that children who undergo CT scanning early after minor closed head injury with loss of consciousness have different outcomes compared with children who receive observation alone after injury. A clinical trial comparing the risks and benefits of immediate CT scanning with simple monitored observation for children with minor closed head injury has not been performed, primarily because intracranial injury after minor closed head injury is so rare that the cost and logistics of such a study would be prohibitive. As a result, the risk–benefit ratio for the evaluation and management modalities of CT scanning or observation is unknown.

Simple observation by a reliable parent or guardian is the management option with the least initial costs, while CT scans typically cost less than observation performed in the hospital. A study that compares costs of CT and observation strategies would need data on the cost of following up children with positive CT scans, as well as the potential costs associated with late detection and emergency therapy among those managed by observation alone.

Because of these considerations, there was Subcommittee consensus based on limited evidence that for children who are neurologically normal after minor closed head injury with loss of consciousness, cranial CT scanning along with observation was also an acceptable management option.

*Skull Radiographs*

Before the availability of CT imaging, skull radiographs were a common means to evaluate children with head injury. Skull radiographs may identify skull fractures, but they do not directly show brain injury or other intracranial trauma. Although intracranial injury is more common in the presence of a skull fracture, many studies have demonstrated that intracranial lesions are not always associated with skull fractures and that skull fractures do not always indicate an underlying intracranial lesion.[7,8,16]

Large studies of children and adults have shown that the sensitivity of skull radiographs for identifying intracranial injury in children is quite low (~25% in some studies). More recent studies limited to children have reported sensitivities between 50% and 100%, with the latter higher figure reported from studies of adolescent patients.[7,8,15,16] The specificity of skull radiographs for intracranial injury (the proportion of patients without intracranial injury who have normal radiographs) has been reported as between 53% and 97% in these same studies. Given the limited specificity of skull radiographs and the low prevalence of intracranial injury, the skull radiographs would likely be interpreted as abnormal for a substantial proportion of patients without intracranial injury. Furthermore, the low sensitivity of the radiographs will result in the interpretation of skull radiographs as normal for some patients with intracranial injury.

The Subcommittee consensus was that skull radiographs have only a limited role in the management of the child with loss of consciousness. If imaging is desired by the health care practitioner and if CT and skull radiographs are available, the Subcommittee believes that CT scanning is the imaging modality of choice, based on the increased sensitivity and specificity of CT scans. When CT scanning is not readily available, skull radiographs may assist the practitioner to define the extent of injury and risk for intracranial injury. In this situation, there was Subcommittee consensus that, for a child who has suffered minor closed head injury with loss of consciousness, skull radiographs are an acceptable management option. However, as noted, skull fractures may be detected on skull radiographs in the absence of intracranial injury, and intracranial injury may be present when no skull fracture is detected on skull radiographs. These limitations should be considered carefully by physicians who elect to use skull radiographs. Regardless of findings on skull films (should the physician elect to obtain them) close observation, as described previously, remains a cornerstone of patient management.

*MRI*

MRI is another available modality for neuroimaging. Although MRI has been shown to be more sensitive than cranial CT in detecting certain types of intracranial abnormalities, CT is more sensitive for hyperacute and acute intracranial hemorrhage (especially subarachnoid hemorrhage). CT is more quickly and easily performed than MRI, and costs for CT scans generally are less than those for MRI. The consensus of the Subcommittee was that cranial CT offered substantial advantages over MRI in the acute care of children with minor closed head injury.

As is the case with skull radiographs, there may be situations in which CT scanning is not readily available and the health care professional desires to obtain imaging studies. There was Subcommittee consensus that, for a child who has experienced minor closed head injury with loss of consciousness, MRI to evaluate the intracranial status of the child was an acceptable management option.

**Disposition of Children With Minor Closed Head Injury**

*Children Managed by Observation Alone*

Children who appear neurologically normal after minor closed head injury are at very low risk for subsequent deterioration in their condition and are unlikely to require medical intervention. Therefore, although observation is recommended for patients after the initial evaluation is completed, such observation may take place in many different settings. The strategy chosen by the health care practitioner may depend on the resources available for observation. Other factors, such as the distance and time it would take to reach appropriate care if the patient's clinical status worsened, may influence where observation occurs.

Historically, when hospitalization has been used to observe children after head injury, the length of stay averaged 12 to 48 hours. This practice was based on the reasoning that most life-threatening complications occur within 24 hours after head injury. The Subcommittee believes that a prudent duration of observation would extend at least 24 hours, and could be accomplished in any combination of locations, including the emergency department, hospital, clinic, office, or home. However, it is important for physicians, parents, and other guardians to have a high index of suspicion about any change in the patient's clinical status for several days after the injury. Parents or guardians require careful instruction to seek medical attention if the patient's condition worsens at any time during the first several days after injury.

In all cases, the health care professional is to make a careful assessment of the parent or guardian's anticipated compliance with the instructions to monitor the patient. If the caregiver is incompetent, unavailable, intoxicated, or otherwise incapacitated, other provisions must be made to ensure adequate observation of the child. These provisions may differ based on the characteristics of each case.

The physician has an important role in educating the parents or guardians of children with minor closed head injury. Understandable, printed instructions should be given to the parent or guardian detailing how to monitor the patient and including information on how and when to seek medical attention if necessary. All children discharged should be released to the care of a reliable parent or guardian who has adequate transportation and who has the

capability to seek medical attention if the child's condition worsens.

*Children Evaluated by Cranial CT*

Neurologically normal patients with normal cranial CT scans are at extremely low risk for subsequent problems. Although there are many reports of patients with head injuries in whom extradural or intracerebral bleeding developed after an initial stable clinical period,[18–22] there are only a few reports of patients in whom extradural or intracerebral bleeding developed after a postinjury CT scan was interpreted as normal.[23–25] Most often when such cases have been described, the patients had sustained a more severe initial head injury than the patient for whom this parameter is intended, and the neurologic status of the patients was not intact at the initial examination following the injury. A number of studies have demonstrated the safety of using cranial CT as a triage instrument for neurologically normal and clinically stable patients after minor closed head injury.[26–31]

Patients may be discharged from the hospital for observation by a reliable observer if the postinjury CT scan is interpreted as normal. The length of observation should be similar to that described in the preceding section. If the cranial CT reveals abnormalities, proper disposition depends on a thorough consideration of the abnormalities and, when warranted, consultations with appropriate subspecialists.

**Research Issues**

*Classification of Head Injury in Children and Prognostic Features*

Much remains to be learned about minor closed head injury in children. The implications of clinical events such as loss of consciousness and signs or symptoms such as seizures, nausea, vomiting, and headache remain unclear. Data on patients with low-risk head injuries but with loss of consciousness, such as the data provided on a primarily adult population, are not available for children. Moreover, this practice parameter deals with clinically normal patients who did not lose consciousness at the time of injury and with patients who did lose consciousness with injury. Children with minor head injury, who have experienced loss of consciousness, vomiting or seizures have been found to have a prevalence of intracranial injury ranging from 2% to 5%. Questions remain about the selection of patients for many of these studies, and there is considerable uncertainty about the generalizability of these results to patients within this parameter.

Future studies on minor closed head injury should assess the relationship between characteristics such as these and the risk for intracranial injury among children who are clinically asymptomatic. Specifically, studies should address the question of whether such a history of loss of consciousness is associated with an increased risk for clinically significant intracranial abnormalities. Such studies should not be limited to patients seen in referral settings, but instead should cover patients from a wide range of settings, including those managed in clinics and offices, and if possible, those managed over the phone.

These studies should also address the independent prognostic value of other signs and symptoms for which the clinical significance in children is uncertain. In particular, practitioners are often faced with managing patients who are asymptomatic except for episodes of repeated vomiting or moderate to severe headache. The Subcommittee did not find evidence in the literature that helped differentiate the risk status of children with such symptoms from children without such symptoms. If studies are performed on this population, information should be collected on the presence of signs or symptoms including posttraumatic seizures, nausea with or without vomiting, posttraumatic amnesia, scalp lacerations and hematomas, headache, and dizziness, and their relationship to intracranial injury.

*The Benefit of Early Detection of, and Intervention for, Intracranial Lesions in Asymptomatic Children*

The outcome for asymptomatic patients found to have intracranial hematomas is of particular interest. Additional studies are needed to determine whether a strategy of immediate CT scan provides measurably improved outcomes for children with minor closed head injury compared with a strategy of observation followed by CT scan for children whose clinical status changes. Although rapid detection and neurosurgical intervention for intracranial injuries such as subdural hematomas has been shown to improve outcome in some studies of patients with more serious head injuries, it is unclear whether the same benefit would accrue to asymptomatic neurologically normal children.

A randomized, controlled trial would provide the most direct information on the risks and benefits of each management strategy. However, such a study would be extremely difficult and expensive to perform because of the rarity of adverse outcomes. Retrospective observational studies among children with minor head injury could be performed more easily and at less cost. However, correct characterization of the patient's clinical status before any treatment strategy or diagnostic procedure would be essential to eliminate bias in the evaluation of the comparison groups.

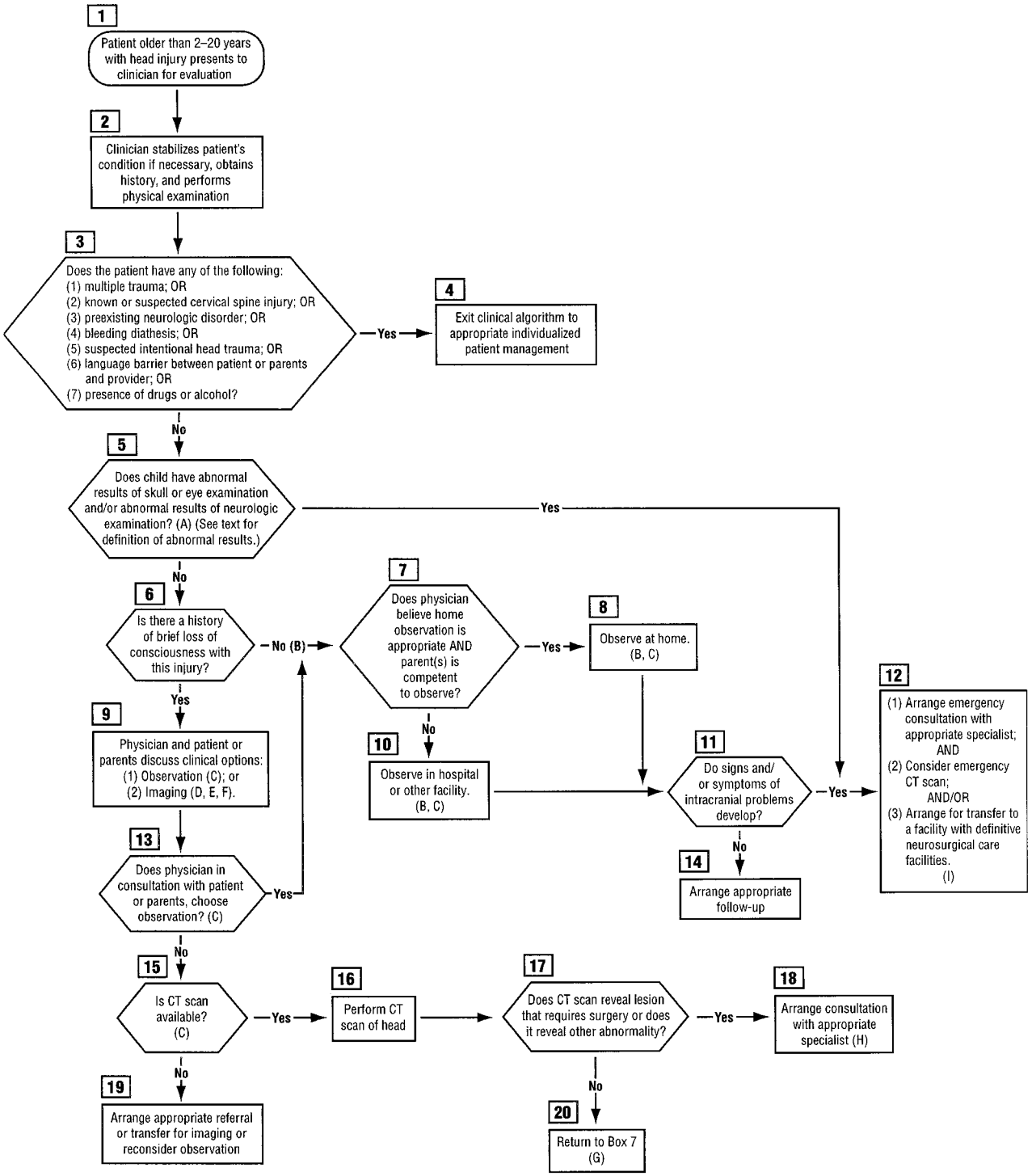
Finally, if such studies are performed to compare different diagnostic and management strategies, the outcomes should include not only mortality and short-term morbidity, but also long-term outcomes such as persistent psychological problems or learning disorders.

*The Management of the Asymptomatic Patient With Intracranial Hemorrhage*

The optimal management and prognosis for asymptomatic patients with intracranial hemorrhage is unknown. Because surgery is not always indicated or beneficial, some neurosurgeons and neurologists now advocate an expectant approach of close observation for small intracranial and extradural hemato-

# Evaluation and Triage of Children and Adolescents With Minor Head Trauma

## Algorithm




mas, considering hematoma size, shift of intracranial structures, and other factors.

If all asymptomatic children with minor head injury undergo cranial CT scanning, a substantial number of patients with an abnormal result on CT may undergo surgery that is unnecessary or even harmful. Additional research is needed to determine the proper management of asymptomatic children with intracranial hemorrhage. Outcome measures should include mortality and morbidity outcomes such as seizures, learning disabilities, and behavioral disabilities.

*Research Into Other Imaging Modalities*

As newer modalities for neuroimaging are developed and disseminated, careful evaluation of their relative utility is necessary before they are used for patients with minor closed head injury. Although such new modalities frequently provide new and different types of information to the health care professional, it is important that they be submitted to scientific study to assess their effect on patient outcome.

**Algorithm**

The notes below are integral to the algorithm. The letters in parentheses correspond to the algorithm.

A. This parameter addresses the management of previously neurologically healthy children with minor closed head injury who have normal mental status on presentation, no abnormal or focal findings on neurologic (including fundoscopic) examination, and no physical evidence of skull fracture (such as hemotympanum, Battle's sign, or palpable depression).

B. Observation in the clinic, office, emergency department, or home, under the care of a competent caregiver is recommended for children with minor closed head injury and no loss of consciousness.

C. Observation in the office, clinic, emergency department, hospital, or home under the care of a competent caregiver may be used to manage children with minor closed head injury with loss of consciousness.

D. Cranial CT scanning along with observation may also be used in the initial evaluation and management of children with minor closed head injury with brief loss of consciousness.

E. If imaging is desired by the health care practitioner and if both CT and skull radiography are available, CT scanning is the imaging modality of choice, because of its increased sensitivity and specificity. When CT scanning is not readily available, skull radiographs may assist the practitioner to define the risk for intracranial injury. However skull fractures may be detected on skull radiographs in the absence of intracranial injury, and occasionally intracranial injury is present despite the absence of a skull fracture detected on skull radiographs. These limitations should be considered by physicians who elect to use skull radiographs. Whether the changed probabilities for harboring an intracranial injury based on the results of the skull radiographs is sufficient to alter the management strategy may depend on the preferences of the family and physician.

F. In some studies MRI has been shown to be more sensitive than CT in diagnosing certain intracranial lesions. However, there is currently no appreciable difference between CT and MRI in the diagnosis of clinically significant acute intracranial injury and bleeding that requires neurosurgical intervention. CT is more quickly and easily performed than MRI, and the costs for CT scans generally are less than those for MRI. Because of this, the consensus among the Subcommittee was that cranial CT offered advantages over MRI in the acute care of children with minor closed head injury.

G. Neurologically normal patients with a normal cranial CT scan are at very low risk for subsequent deterioration. Patients may be discharged from the hospital for observation by a reliable observer if the postinjury CT scan is normal. The decision to observe at home takes into consideration the delay that would ensue if the child had to return to the hospital as well as the reliability of the parents or other caregivers. Otherwise, depending on the preferences of the patient and physician, observation also may take place in the office, clinic, emergency department, or hospital.

H. If the cranial CT reveals abnormalities, proper disposition depends on a thorough consideration of the abnormalities and, when warranted, consultation with appropriate subspecialists.

I. If the child's neurologic condition worsens during observation, a thorough neurologic examination is to be performed, along with immediate cranial CT after the patient's condition is stabilized. If a repeat CT scan shows new intracranial pathologic abnormalities, consultation with the appropriate subspecialist is warranted.

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