CRANIAL COMPUTED TOMOGRAPHY AND OBSERVATION ARE REDUNDANT IN THE MANAGEMENT OF MINOR HEAD TRAUMA

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SUMMARY

During a recent 2 year period, 405 patients with blunt trauma and suspected closed head injury were evaluated by cranial computed tomography (CT). All patients had a Glasgow Coma Scale of 14-15 but had a history of loss of consciousness (LOC), amnesia for the event or neurologic findings at the time of presentation. Following completion of CT studies, all patients were admitted for 24 hour observation.

Results. Initial CT was abnormal in 17 (4%) patients including 2 patients without a LOC but with neurologic symptoms at presentation (weakness on the left side inone and headache with decreased responsiveness in the other) and 3 patients who had questionable LOC in the field but were intact upon presentation. There were 388 patients with normal cranial CT scans. One patient returned twice to the emergency unit with a headache and was scanned on the second return visit. CT demonstrated a contra-coup intracerebral contusion requiring re-admission, but no specific treatment. A second patient with a normal CT developed a delayed hemorrhage from a cavernous hemangioma subsequently detected on magnetic resonance (MRI). Craniotomy was required.

Conclusions. The incidence of CT detectable intracranial abnormalities in patients with LOC in the field but with HCS 14/15 is low (<4%). CT was reliable in identifying significant post traumatic intracranial abnormalities and patients with negative cranial CT scans had little likelihood of requiring invasive treatment (1 of 388 in this series). Patients with a history of LOC in the field or amnesia for the incident who are neurologically intact and have a normal cranial CT may be safely discharged from the hospital provided there are no concurrent injuries requiring further management.

Key words: Computed tomography. Cranial trauma. Cranial computed tomography.

Minor head trauma accounts for at least 300,000 hospital visits per year[1]. In order to assure that patients suffering from minor head trauma do not go on to deteriorate, many of them undergo head CT and/or are admitted to the hospital for observation. When there is confirmed or suspected prehospital loss of consciousness or amnesia for the event, cranial CT and hospital admission is a common practice. We looked at the incidence of intracranial abnormality and subsequent deterioration in our population of mildly head injured patients and examined the role of subsequent 24 hour hospital observation.

METHODS

A retrospective review of medical records of trauma patients who presented between January 1995 and March 1997 and were victims of blunt trauma and suspected closed head injury. Inclusion criteria for the study included Gloscow Coma Scale of 14-15 as well as history of loss of consciousness, amnesia of the event, or neurologic findings. Additionally, patients must have been evaluated with a cranial CT followed by admission for observation. An abnormal cranial CT for the purposes of this study was defined as one which demonstrated damage, physical or functional, of cranial contents, including but not limited to intracerebral hemorrhage, epidural or subdural hemorrhage, or cerebral contusion.

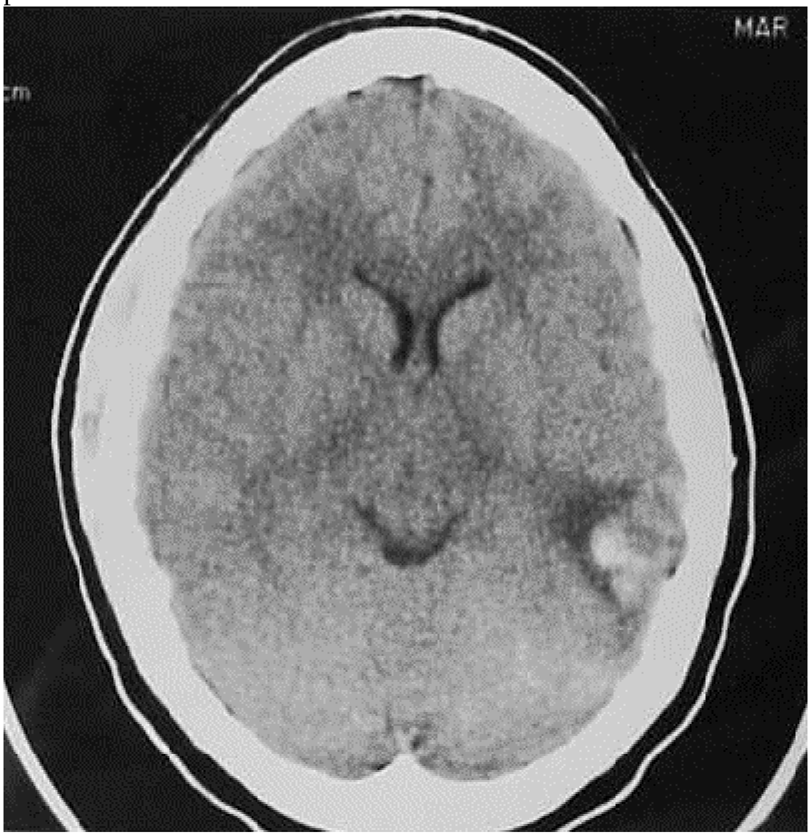
Excluded with this definition were patients with CT scans which showed soft tissue swelling or non-displaced fracture of skull or facial bones, without cerebral compromise.

RESULTS

Four hundred five patients met study inclusion criteria. Two hundred twenty eight patients (56%) had a history of LOC, 93 patients (23%) had no LOC but presented with confusion, headache, or other neurologic abnormality, and 84 patients (21%) ahd a questionable history of LOC. CT scan demonstrated abnormalities in 17 patients (4%), including 2 patients without LOC but who presented with neurological findings (weakness and decreased sensation on the left side in one, and headache with decreased responsiveness in the other) and 3 patients with questionaable LOC in the field but with an intact neurologic status upon presentation. Cranial CT was interpreted as normal in 388 patients. All patients with a normal CT were discharged after a stable neurologic hospital course. Following discharge, one patient with an initially normal cranial CT returned twice to the emergency department with the complaint of headache (Figure 1). A repeat scan on her second visit demonstrated a contra-coup intracerebral contusion which did not require intervention (Figure 2). A second patient with an initially normal cranial CT developed a delayed hemorrhage from a cavernous angioma subsequently detected on magnetic resonance imaging (MRI). The patient required craniotomy and recovered without deficit.

Figure 1. Cranial CT in a 27 year old woman with history of loss of consciousness at scene and GCS = 15 at arrival to emergency unit. Other than soft tissue swelling on right side, CT shows no abnormality.

Figure 2. Cranial CT in same patient 5 days post injury. Note residual soft tissue swelling and left parietal contusion.



DISCUSSION

For years, physicians have known that some patients are lucid prior to deteriorating and progressing to neurologic death. These patients have come to be known as patients who talk and die. Prior to the era of CT scanning, these patients were studied by post-mortem examination. In 1975, Reilly[2], working with Jennett in Glasgow, looked at a series of 151 patients who had succumbed to traumatic brain injury. He found that 58 of the patients had talked at some point prior to dying. Traumatic hematomas were present in 44 of these patients.

In 1977, Rose[3] also working with Jennett, looked at 166 patients who died from traumatic brain injury and had talked prior to dying. He concluded that undetected intracranial hematoma was the principle cause of death in this group.

Patients who talk prior to succumbing are disturbing. Because they are lucid at some point after their injury, the presumption is that their cerebral hemispheres have not sustained critical initial injuries as a result of the primary trauma. Rather, their deaths may be due to secondary injury and thus, are potentially preventable. Both studies emphasized that the major cause of secondary injury was undetected hematoma and that the major strategy for preventing these deaths was a high level of suspicion leading to early diagnosis with timely removal of the hematomas.

Both of these studies were based on autopsy data from a group of patients who had died of traumatic brain injury. These studies showed that there are patients who die from traumatic brain injury who talk at some point prior to death and thus suffer potentially preventable deaths. However, these studies could not critically answer the question of how many patients who are lucid progress to neurologic death.

With CT came the opportunity to study large numbers of head injured patients who did not undergo operation. Patient selection was pertinent because not all head injured patients were initially scanned. In 1987, Rockswald[4] lookedat he CT scans of 215 severely head injured patients. Of these, he found 33 who had talked prior to deteriorating to a severe head injury state, 25 of whom had operable lesions on CT. Lobato[5] looked at 838 patients with severe head injuries and found 211 who had talked prior to deteriorating; 170 had operable lesions.

These studies confirmed that a significant source of preventable secondary brain injury was undetected mass lesions which were allowed to progress. As a result, the centerpiece for management of head trauma became a low threshold for using cranial CT coupled with the emergent removal of all clinically significant lesions.

Because of the potential for adverse outcome, patients with mild head injury warrant careful evaluation. Fear of further deterioration has resulted in CT scans and hospital admission for millions of patients.

The importance of assessing the risk of intracranial hemorrhage and subsequent deterioration was highlighted by Klauber in 1989[6]. He studied a large number of hospitalized head injured patients and their mortality due to head injury. He compared actual mortality with expected mortality based on a logistic regression analysis of all the hospitals in his data set and identified hospitals with high and low mortality. He found that the key feature separating high mortality from low mortality hospitals was not the management of severely head injured patients, but the management of the low risk patient. That is, hospitals that were good at identifying and preventing deterioration of the low risk patient were the hospitals with the lowest mortality form head injury.

In our study, we looked at 405 consecutive patients who were the victims of blunt trauma and suspected closed head injury. All of these patients presented with Glasgow Coma Scores (GCS) of 14 or 15. A GCS of 14 or 15 strictly defines patients with only mild head injury. Culotta[7] recently pointed out that the patient population with a GCS of 15 may have distinctly different characteristics than those patients with GCS of 13 or 14. Feuerman[8] and Dunham[9] also have commented on clinical differences within the mild head injury group.

In our series, 17 of the 405 (4%) patients, were found to have an intracranial abnormality on CT scan. This number compares favorably with similar series in the literature[9-11].

Additionally in our series, 2 (0.5%) patients, were found on follow-up CT to have a lesion not visualized on the initial CT. Both of these repeat CT scans were obtained because the patient returned with subsequent complaints after discharge. One of the lesions proved to be a cavernous angioma which bled and required surgery. The relationship of this hemorrhage to the trauma is indeterminate. Aside from this patient, none of our patients had a surgically significant lesion, nor did any deteriorate. In the one patient who developed a late lesion not detected on the first CT, the lesion proved not to be surgical nor to result in significant nor lasting morbidity.

Our findings again agree with the literature. In 1986, Dacy[12] found that 3% of his 610 mild head injured patients required surgery. He did not scan this entire group, but instead relied on skull films to screen some of these patients. Mohanty[11] scanned all of his patient population. None of his patients deteriorated nor required operation. Taheri[13] scanned only those patients with neurologic deficits and found a 2% incidence of operative intervention. Miller[10] scanned all of his patients and 0.2% required surgery. Dunham[9] scanned 2,032 patients and found 8 (0.4%) who required craniotomy.

Feuerman[8] found that 1% of his 373 mild head injured patients required operation and an additional 1% deteriorated. Distinguishing between clinical deterioration and the need for operation is an important concept. Some patients have their surgical lesion discovered prior to deterioration and require operation. Others deteriorate without a surgical lesion. The most feared group however, includes patients with surgical lesions who deteriorate without the benefit of timely surgical intervention.

Overall, the incidence of operable lesions is low in mild head injured patients. Our numbers again compare favorably with those studies with similar patient selection criteria. The slightly higher operation rates (2-3% vs. 0.2%) occurred in those studies which did not scan all of their patients. These higher rates appear to be a patient selection artifact.

We agree with Feuerman[8] that despite the availability of advanced technology, patients still need to be examined because a major predictor of subsequent deterioration is an abnormal neurologic examination. Both Feurman[8] and Taheri[13] demonstrated that patients with a GCS of 15 but with other neurologic abnormality were more likely to deteriorate neurologically and/or require surgery. What is evident is that if a policy of hospital discharge after an initial normal cranial CT is to be considered, the patients must truly be neurologically normal prior to discharge. Jennett reminded us 20 years ago that a GCS of 15 is not the same as being neurologically normal. Patients can be alert, lucid, coherent, and following commands and be totally amnestic. These patients are not neurologically normal, and together with those patients who are nauseated or vomiting, are indeed at a higher risk for an evolving traumatic brain lesion. The patients in either of these subsets are more likely to harbor a contusion which may not be evident on CT for at least 24 hours. Patients with a GCS of 15 but with focal abnormalities are also at higher risk for a surgically significant bleed.

Since advances in EMS have led to shorter transport times, more patients are scanned very early post injury. There is legitimate concern regarding the "hyperacute" scan, that is, the scan which is obtained before bleeding becomes identifiable. Snoew[14] cites several examples which confirm the development of surgically significant lesions after an initially normal head CT. In our study, an in studies with similar patient populations, the incidence of this occurrence is very low and none of the delayed lesions were clinically significant. We suspect that patients who develop surgically significant lesions after having an initially normal CT, do not have normal neurological exams.

CONCLUSION

Head injured patients who present with a GCS of 14 or 15, who have a normal cranial CT scan, and are neurologically normal can be discharged home without being admitted for observation. Both the patient as well as another responsible individual should be provided with proper discharge information including and explanation of the signs of deterioration.

RESUMEN

Durante un período de dos años, se evaluaron con tomografía computadorizada (TC) 405 pacientes con trauma cerrado y sospecha de lesión craneoencefálica cerrada. Todos los pacientes tenían un Glasgow de 14-15 pero con historia de pérdida de la conciencia, amnesia del evento o hallazgos neurológicos. Después de completar los estudios de TC, todos los pacientes estuvieron en observación durante 24 horas.

Resultados. La TC fue anormal en 17 (4%) pacientes, incluyendo dos pacientes sin pérdida del conocimiento pero con signos neurológicos (debilidad izquierda en uno y cefalea con respuesta disminuida en el otro), y tres pacientes con pérdida de la conciencia cuestionable en la escena pero neurológicamente intactos a la presentación. Hubo 388 pacientes con TC craneal normal. Un paciente regresó dos veces a la unidad de urgencias con cefalea y se sometió a escanografía en la segunda visita que mostró contusión intracerebral por contragolpe, que requirió una readmisión pero ningún tratamiento específico. Un segundo paciente desarrolló una hemorragia tardía de un hemangioma cavernoso encontrado de manera subsecuente mediante una resonancia magnética (RM). Se requirió craneotomía.

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