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Application of CT Diagnosis in Early Diagnosis of Patients with Craniocerebral Trauma

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Abstract: *To study the diagnostic value of CT in the early diagnosis of patients with traumatic brain injury, fifty patients with traumatic brain injury admitted to our hospital from September 2021 to September 2022 were selected, these patients underwent CT diagnosis to analyze the value of CT diagnosis in the early diagnosis of traumatic brain injury patients. Through surgical analysis and comparison of surgical results, the diagnostic accuracy of cranial trauma was found to be 100%. As the CT score increases, the prognosis of patients becomes worse. The use of CT examination in the early diagnosis of traumatic brain injury patients has a positive effect on their later treatment and lays a solid foundation. Through CT diagnosis, patients can better determine their surgical plan, choose scientific treatment methods, ensure their prognosis, and have a good guarantee of their quality of life.*

Keywords: *CT Diagnosis; Craniocerebral Injury; Early Diagnosis; Application Value*

1. Introduction

Craniocerebral injury is a disease that occurs in the head and skull. There are many factors that can lead to traumatic brain injury in patients, among which various problems such as traffic accidents, natural disasters, and high-altitude falls are the main causes of traumatic brain injury. There are many symptoms of traumatic brain injury, and most patients may experience vomiting, headache, skull fractures, scalp lacerations, and thinking disorders[4]. Some patients may experience drowsiness or coma. There are various situations of traumatic brain injury, which can be divided into several common types based on their different states. Due to the unique physiological functions of brain tissue, it can cause serious physiological reactions after corresponding injuries, which can seriously threaten the patient's life and health. Craniocerebral injury can have a certain impact on the skull, and the diagnosis is mainly through lumbar puncture or skull plain film. But the diagnostic effect of this method is not ideal. With the development of clinical CT diagnosis, it is widely used in the diagnosis of traumatic brain injury. CT has a clear understanding of the actual situation of traumatic brain injury, judges the impact on the injury, and formulates scientific treatment plans based on the injury situation to scientifically reduce mortality.

Craniocerebral injury is a type of injury with a high incidence rate in clinical practice. The causes of injury include traffic accidents, falls, high-altitude falls, or natural disasters. Patients with traumatic brain injury are accompanied by symptoms such as headache, dizziness, nausea and vomiting, disorder of vital signs, and consciousness disorders. Early diagnosis is needed to determine the location and degree of injury, and targeted treatment should be given to actively prevent brain herniation, intracranial infection, and other related symptoms Complications such as hydrocephalus and pulmonary infection can improve the quality of life of patients[3]. X-ray is the most widely used and routine examination method in clinical practice. In the past, clinical doctors mainly made early judgments on patients based on their clinical symptoms, laboratory examination results, physical examination results, and X-ray examination results. Laboratory examination mainly checked whether patients had infections and understood their basic physical condition; Physical examination mainly determines the size, location, depth, and bleeding of the wound; X-ray examination has certain diagnostic value in the early diagnosis of patients with traumatic brain injury, which can detect skull fractures, intracranial bone slices, and intracranial gas accumulation. However, in order to make a clearer and more scientific diagnosis of patients, it is necessary to use more effective examination techniques and diagnostic methods to obtain more accurate diagnostic results.

In recent years, CT technology has become increasingly mature and gradually applied in the clinical diagnosis of patients with traumatic brain injury. CT is non-invasive, easy to operate, and repeatable[1]. It can not only improve the accuracy of clinical diagnosis, but also make clear and accurate judgments

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of intracranial hemorrhage and brain injury in patients, clarify the degree of injury, determine the amount of bleeding, and determine the specific range of brain contusion, thereby providing reliable diagnostic and treatment basis for doctors [2]. The results of this study suggest that the diagnostic accuracy of patients with traumatic brain injury who underwent CT examination is 100.0%, and the patient's satisfaction with the diagnostic method is also 100.0%, reflecting the clinical significance of CT examination from both subjective and objective aspects.

2. Materials and Methods

2.1 General Information

Fifty patients with traumatic brain injury admitted to our hospital from September 2021 to September 2022 were included in the study, including 30 males and 20 females; Age range from 24 to 69 years, with an average age of (43.5 ± 9.8) years; Causes of injury: 15 cases of high-altitude falls, 21 cases of traffic accidents injuries, 6 cases of injuries caused by falls, 6 cases of injuries caused by heavy object strikes, and 2 cases of injuries caused by fights. All patients experienced varying degrees of clinical manifestations such as nausea, vomiting, dizziness, and pain.

2.2 Method

The CT machine was used to examine the patient after admission. The patient was placed in a supine position and the auditory orbital line was selected as the baseline. The scanning range was from the base of the skull to the top of the skull. The scanning parameters were set as follows: tube current of 25mA, tube voltage of 120kV, layer thickness of 2.5-3.0mm, pitch of 1.0, scanning time of 50s, delay time of 5s. Normally, the superior sagittal sinus and anterior cerebral artery were selected as the output vein and input artery as the control, and retrospective reconstruction interval of 10mm and layer thickness of 10mm was performed, Draw the time density curve to obtain relevant parameters such as average transit time and local cerebral blood flow volume. Afterwards, in the workstation, subtract the source image and CT plain scan image to obtain clear and intuitive color images of each parameter.

3. Results

3.1 CT examination results

After surgical testing, it was found that out of 50 patients with traumatic brain injury, 18 had subarachnoid hemorrhage, accounting for about 36%, 13 had cerebral contusion and laceration, accounting for about 26%, 9 had subdural hematoma, accounting for about 18%, 1 had subdural effusion, accounting for about 2%, 4 had epidural hematoma, accounting for about 7%, 1 had skull fracture, accounting for about 2%, and 4 had intracranial hematoma, accounting for about 9%. The coincidence rate between CT exploration results and surgical detection results is 100.00%.

3.2 CT signs

(1) Subarachnoid hemorrhage: The location of the injury is manifested as high-density shadows in the cerebral cistern and sulcus, with longitudinal or lateral cisterns being the most common. A small number of patients will experience midline longitudinal banded high-density shadows in the bleeding site, and the amount of bleeding will affect the CT value; (2) Brain contusion and laceration: The injury site is characterized by scattered low-density patchy edema shadows with a large range, and a small number of patients show patchy high-density bleeding lesions in the low-density area[1]. (3) Subdural hematoma: The damaged area becomes cortical vein enhancement, cerebral cortex is heavily stained, and a clear crescent shaped hematoma can be seen, which can cross the cranial suture but does not exceed the midline. A small number of patients will experience displacement or disappearance of the cerebral sulcus; (4) Subdural effusion: Low density shadows appear under the bilateral or unilateral skull inner plate at the injured site, appearing in a crescent shape and shallow in position. The CT value depends on the cerebrospinal fluid, and there may be compression; (5) Epidural hematoma: A well-defined spindle shaped or biconvex high-density shadow appears at the injury site, generally not exceeding the cranial suture, often accompanied by skull fractures, with a significant space occupying effect, and a small portion presenting as a semi lunar or crescent shape. (6) Intracranial hematoma: well-defined circular or irregular high-density shadows appear at the injury site, with unilateral or

bilateral onset; (7) Skull fracture: The injured area appears as a linear and transparent area, with concave or linear fractures appearing, and some may be accompanied by swelling of brain soft tissue.

During CT plain scan, the typical sign of acute subdural hematoma is a sickle shaped or crescent shaped dense shadow distributed along the surface of the brain, with the outer edge closely attached to the inner plate of the skull. Due to its frequent coverage of most of the hemisphere from the frontal pole to the occipital pole, it compresses the cerebral hemisphere from the periphery. Unilateral subdural hematoma can cause the midline structure to shift to the opposite side, compress and deform the lateral ventricle, and may be accompanied by subarachnoid hemorrhage. Bilateral subdural hematoma, although without midline displacement, the anterior and posterior horns of the lateral ventricles, which were originally biased outward, are pushed inward, causing both ventricles to be parallel on both sides of the midline.

Hematoma is high-density within 5-10 days after injury. Due to blood clot condensation, the density is highest in the first 1-2 days. 2-4 weeks after the onset of the disease, it is a subacute hematoma that often presents as isodensity and cannot be directly identified. However, extensive compression of the gray and white matter boundary in the affected hemisphere is often observed, with twisting, deformation, and widening of the distance between the gray and white matter boundary and the skull. In addition, among people over the age of 40, the cortical sulcus is more pronounced. In patients with a history of injury, if the cortical sulcus is shallow or disappears, and there is displacement of the midline structure (transparent septum and third ventricle), and the corresponding lateral ventricle has the above deformation, the possibility of equidensity subdural hemorrhage should be highly suspected. When performing enhanced scanning, most cases show an enhancement effect of the hematoma membrane.

4. Discussion

With the continuous improvement of people's living standards, the number of motor vehicles is also increasing, causing various traffic accidents and the main causes of traumatic brain injury are also increasing. Craniocerebral injury has different factors in terms of injury, ultimately leading to different types of traumatic brain injury in patients and causing more serious injury problems. The brain is an important organ in humans, and if severely damaged, it will directly threaten the life of patients. Even mild brain damage can lead to worsening of the condition, with a high mortality rate. Even if the patient survives, their various bodily functions will be severely affected, which will interfere with their future work and life. Due to the complexity of the condition of traumatic brain injury and the lack of obvious specificity in clinical diagnosis, it is often difficult to be detected by clinical examinations. Therefore, in order to further improve the cure rate of traumatic brain injury patients and solve prognosis problems, it is necessary to cooperate with CT exploration methods in the current treatment of traumatic brain injury. Through CT rapid, non-invasive, and repeatable examination methods, the diagnosis of traumatic brain injury diseases can be fully made, and the prognosis of patients can be improved.

The main cause of traumatic brain injury is direct or indirect external effects on the head. Clinical examination and diagnosis of patients in the early stages of injury are beneficial for targeted treatment based on the degree of injury[1], effectively reducing patient mortality and disability rates. In this study, CT detected several types of traumatic brain injuries, including subarachnoid hemorrhage, cerebral contusion and laceration, subdural hematoma, subdural effusion, epidural hematoma, skull fracture, and intracranial hematoma. The results were the same as surgical detection, with a coincidence rate of 100.00%. This indicates that CT exploration has a high coincidence rate in early diagnosis of traumatic brain injury, which helps to diagnose traumatic brain injury in the early stage and provides a basis for the development of treatment plans. Spiral CT mainly uses slip ring technology to connect power cables, signal wires, and different metals in the fixed frame. The moving X-ray and detector slide the brush and lead it to the metal ring. Spiral CT performs a volume scan of the entire organ or a part under one breath hold, without missing any lesion; Meanwhile, spiral CT has a faster scanning speed, which can reduce the incidence of motion artifacts and reduce the dosage of contrast agents used; Spiral CT has the characteristics of high spatial and temporal resolution, short scanning time, and good contrast resolution. It can perform post-processing 3D image reconstruction while scanning the planar structure of intracranial tissue, and can rotate the imaging of intracranial narrow spaces from any angle, thereby improving accuracy and objectivity. In addition, spiral CT can perform arbitrary review and reconstruction, and is not limited by the number of reconstructions and the size of the slice interval; Spiral CT has a relatively powerful volume scan, which can promote the improvement of image quality in multi-directional and three-dimensional reconstruction, and can detect the types of traumatic brain

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injury with a coincidence rate of 100.00%[2]. It can further improve the success rate of surgery and promote patient prognosis recovery. In this study, CT signs of different patients with traumatic brain injury were also analyzed, and the spiral CT detection results of various types of injury patients have strong specificity. Clinicians can judge the location and type of injury based on the ratio of lesion density to surrounding tissue density. At the same time, CT exploration of the shape of the injury tissue, CT values, etc. can also distinguish the type of injury.

As shown in Figure 1,adopting CT examination and reconstructing the obtained image data can clearly and accurately display the location of traumatic brain injury, enabling rapid diagnosis and providing effective and scientific support for formulating rescue plans. This method does not cause trauma and can quickly obtain comprehensive and accurate injury information, especially for patients with cranial top injury. CT reconstruction can obtain sagittal and coronal images, displaying the displacement of the cerebral cortex, making it easy to determine the extent of tissue damage and clarify the extent of epidural hemorrhage. In addition, this technology is highly cost-effective and convenient for clinical popularization [3].

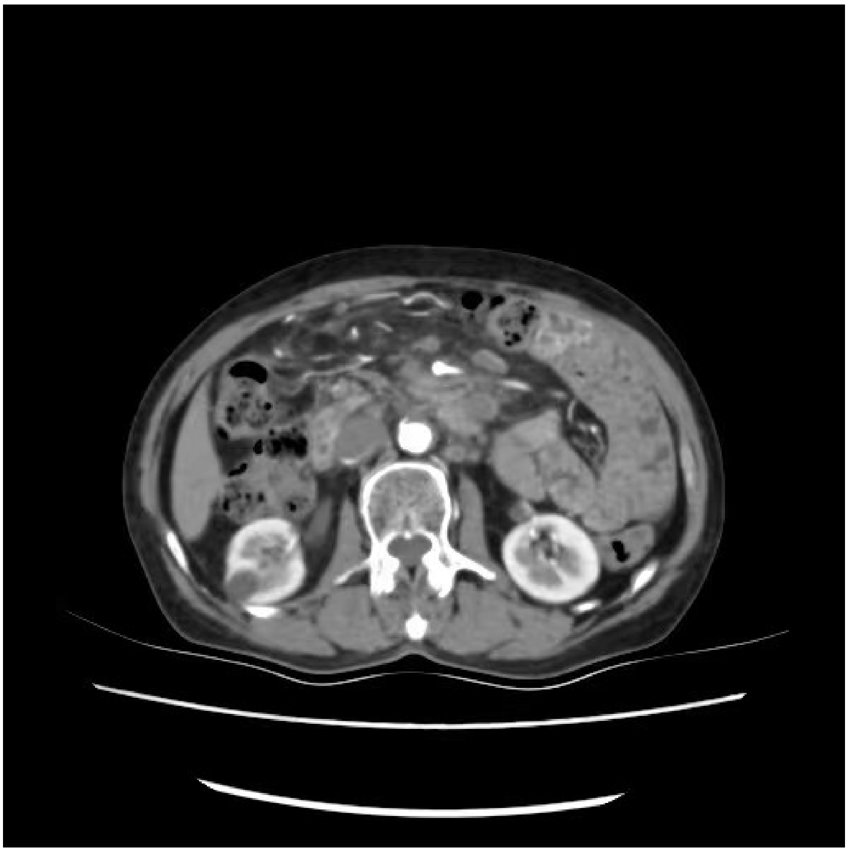

Figure 1: Brain CT

There are multiple types of this disease, including common ones such as subarachnoid hemorrhage and subdural hematoma. There are significant differences in CT manifestations among different types, indicating that CT examination of this disease has specificity, high sensitivity, and can quickly obtain accurate results, providing a basis for clinical diagnosis. Analysis of different types of CT features: ① Epidural hematoma: Affected by head trauma, resulting in rupture of meningeal artery and accumulation of blood in the epidural space. This disease is generally acute. Under the inner plate of the skull, high-density shadows can be observed, presenting a spindle shape, with a CT value generally ranging from 60-80 HU. At the same time, a history of head trauma was analyzed to obtain the results [4]. When this type of patient does not experience a space occupying effect, the symptoms are mild or asymptomatic. If the hematoma is too large and forms a space occupying effect, it may lead to brain herniation, rapid disease progression, and may cause asphyxia, resulting in a high patient mortality rate Submembrane fluid accumulation[3]: CT examination can be performed to observe low-density shadows under the bilateral or unilateral skull inner plate, presenting a crescent shaped shape, generally located in the superficial area, and the patient's CT value tends to be cerebrospinal fluid Intracranial hematoma: Upon CT examination, high-density shadows can be observed in the brain, with uniform texture and clear boundaries. They are usually irregular or circular, visible on both sides and distributed

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in shallow areas. They may be multiple or single, and the changes in hematoma volume are closely related to the patient's age. The density of brain edema areas is generally low Skull fracture: A transparent band can be observed in a linear shape, with bubbles and cerebrospinal fluid visible in the brain parenchyma. Fractures are generally concave or linear, and some brain tissues of the patient may show swelling Subdural hematoma: Under the inner plate of the skull, high-density shadows can be observed, presenting a crescent shape. The CT value is generally 60-80HU, and clinical manifestations should be taken into consideration to determine this type. If equal or mixed density shadows are observed, presenting a crescent shape, it is considered a subacute subdural hematoma. ⑥ Subarachnoid hemorrhage: Trauma is one of the main factors contributing to the formation of this disease. Patients who suffer from trauma usually have subdural hematoma and brain contusion. If the triggering factor is non traumatic, it is generally caused by factors such as cerebral aneurysm rupture and cerebral vascular malformation. If there are high-density changes in the patient's cerebral fissure, cerebral pool, and cerebral sulcus, and the CT value is 60-80HU, then the diagnosis is confirmed[5], as shown in Figure 2.

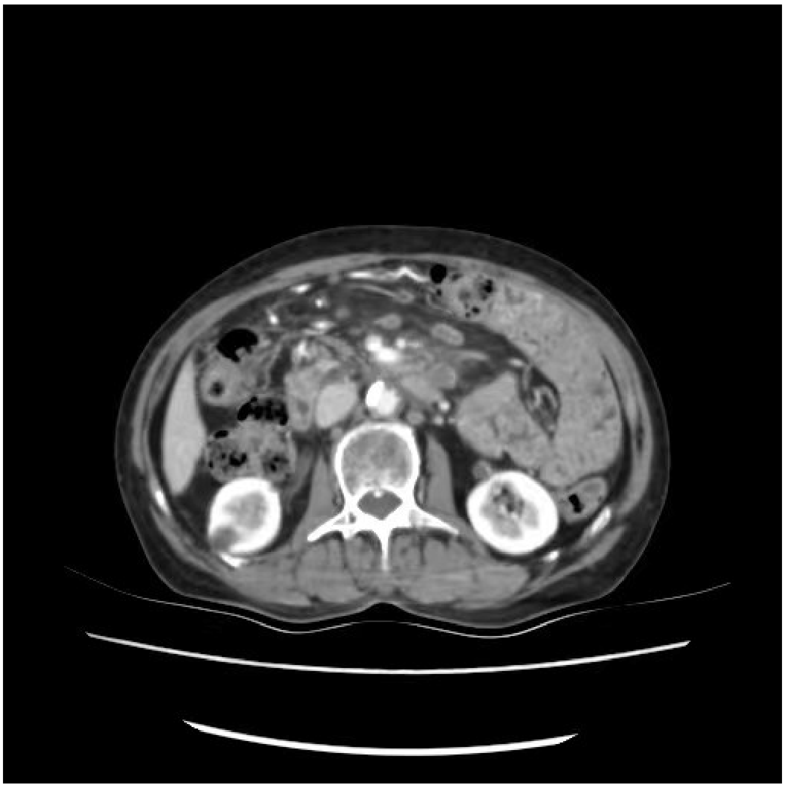

Figure 2: Brain CT examination

The results of this study showed that the detection rates of epidural hematoma, subdural effusion, intracranial hematoma, skull fracture, subdural hematoma, subarachnoid hemorrhage, and overall disease were basically consistent between CT examination and postoperative diagnosis (P>0.05). The application of CT technology has high specificity and can accurately distinguish the type of traumatic brain injury, improving diagnostic effectiveness.

5. Conclusions

Therefore, based on the above CT signs, the type of injury in patients can be determined, which helps doctors develop a reasonable treatment plan. According to CT image scoring, patients are divided into three types: mild, medium, and severe. Research has found that as the severity of the condition worsens, the prognosis also deteriorates, indicating that spiral CT scoring can accurately reflect the patient's prognosis, helping doctors to gain a deeper understanding of the patient's condition and providing a basis for the implementation of subsequent treatment plans.

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