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Head CT Scan Procedure in Post-Traffic Accident Head Trauma Cases: A Case Study at Siloam Sriwijaya Hospital, Palembang

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Abstract

Head trauma resulting from traffic accidents is an emergency condition that requires rapid imaging to exclude life-threatening intracranial injuries. This study aims to describe the procedure and findings of non-contrast head computed tomography (NCCT) in a post-traffic accident head trauma case at the Radiology Department of Siloam Sriwijaya Hospital, Palembang. A descriptive case study design was applied. Data were obtained from NCCT images and validated radiology reports of a 25-year-old male patient examined on May, 2025, complemented by structured interviews with radiographers regarding technical protocols and workflows. The examination was performed using 120 kV, 350 mAs, 5-mm slice thickness for axial acquisition with 1–2 mm multiplanar reconstruction, a field of view of approximately 250 mm, a 512 × 512 matrix, and brain (WL/WW ≈ 40/80 HU) and bone window (WL/WW ≈ 400/2000 HU) settings. NCCT findings demonstrated no intracranial hemorrhage, midline shift, or mass effect. The main pathological findings were nasal bone fracture, septal deviation, and hemosinus involving the bilateral ethmoid sinuses and the left maxillary sine. The applied protocol was consistent with emergency radiology practice and adhered to the ALARA principle through appropriate parameter optimization and multiplanar reconstruction. These findings highlights the role of NCCT US a reliable first-line modality for rapid exclusion of critical intracranial injury while accurately detecting facial bone trauma in traffic accident-related head injuries.

Key words: Head CT-Scan, Head Trauma, Non-Contrast CT, Radiology Protocol

Abstrak

Trauma kepala akibat kecelakaan lalu lintas merupakan kondisi emergensi yang memerlukan pemeriksaan pencitraan cepat untuk menyingkirkan cedera intrakranial yang mengancam jiwa. Penelitian ini bertujuan mendeskripsikan prosedur dan temuan CT-Scan kepala non-kontras (NCCT) pada kasus trauma kepala pasca kecelakaan lalu lintas di Instalasi Radiologi Rumah Sakit Siloam Sriwijaya Palembang. Desain penelitian bersifat deskriptif studi kasus; data dikumpulkan dari citra NCCT dan laporan radiologi pada satu pasien laki-laki (25 tahun) yang diperiksa pada Mei 2025, serta wawancara terstruktur dengan radiografer terkait protokol teknis dan alur pemeriksaan. Pemeriksaan dilakukan dengan parameter 120 kV, 350 mAs, slice thickness 5 mm (akuisisi) dan rekonstruksi multiplanar 1–2 mm; FOV ≈ 250 mm; matriks 512×512; brain window (WL/WW ≈ 40/80 HU) dan bone window (WL/WW ≈ 400/2000 HU). Hasil NCCT menunjukkan tidak adanya perdarahan intrakranial, midline shift, atau efek massa; ditemukan fraktur os nasal, deviasi septum nasi, dan hematosinus (ethmoidalis bilateral, maksilaris kiri). Protokol yang diterapkan konsisten dengan praktik radiologi emergensi dan prinsip ALARA melalui penyesuaian parameter dan rekonstruksi multiplanar. Temuan bersifat deskriptif dan merekomendasikan pencatatan metrik dosis (CTDIvol/DLP) pada studi lanjutan.

Kata kunci: CT-Scan kepala, Trauma kepala, CT Non Kontras, Protokol radiologi

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INTRODUCTION

Head trauma is an injury to the head structure due to external mechanical energy that can cause damage to the scalp, skull and brain tissue, thus triggering acute neurological disorders or long-term complications such as intracranial bleeding. And edema cerebral Which requires rapid imaging evaluation. Head trauma includes spectrum clinical start from injury mild to severe injuries that are potentially fatal and impact the patient's cognitive and physical function (Putri et al., 2024).

Accident Then cross is Wrong Head trauma is one of the most dominant mechanisms of head trauma in many countries, including Indonesia, and is a major contributor to the number of emergency hospital admissions. In clinical studies conducted in Indonesia, the proportion of head trauma due to traffic accidents can reach more than three-quarters of all head injury cases treated in hospitals. emergency unit (Permana et al., 2025).

Indonesian national statistical data shows that amount accident Then fixed line tall, with dozens thousand victim wound and a number of victims die every year, Which in a way direct related with the burden of head trauma in health care facilities (BPS, 2025).

In the context of acute evaluation, computed tomography of the head without contrast media is the primary imaging modality in head trauma due to its ability to provide rapid imaging and high sensitivity for detecting structural abnormalities such as intraparenchymal hemorrhage. hematoma subdural or epidural skull fractures and other mass effects that require handling quick. Inspection This was chosen because it is rapidly available in radiology installations and is effective in identifying findings relevant to emergency clinical decisions (NICE, 2023).

The latest clinical guidelines from the National Institute for Health and Care Excellence (NICE) recommend the use of head CT as choice main investigation beginning on trauma patients head Which show factor risk certain, including score Glasgow Coma Scale low vomiting, repeated focal neurological deficits and signs of skull base fracture, and suggest that examination be performed as soon as possible if risk factors are identified.

Similar guidelines are recommended in practice clinical international strengthen that Head CT is the primary non-invasive examination in deciding the initial management strategy in moderate to severe head trauma and in patients with clinical presentations indicating possibility injury significant intracranial (NICE, 2023).

Another scientific reason to choose head CT in trauma is Because MRI although superior in some situations is not recommended as an initial examination in acute trauma cases due to limitations in examination time and accessibility as well as less efficiency in detecting acute lesions compared to CT (Ainsworth & Brown, 2021). Although head CT is recognized in clinical guidelines as the primary diagnostic modality, there is debate and studies showing variation in clinical implementation, especially on trauma light so that a clear understanding of the appropriate examination indications is required to minimize unnecessary radiation exposure without compromising diagnostic quality (Khan et al., 2023).

the brain window and bone window image windows , and determination of the scanning range also play an important role in producing quality diagnostic images. so that standardization protocol Technical expertise in radiology installations is essential to ensure consistency quality picture And accuracy of radiological interpretation (Willacy, 2024).

On context service radiology national In Indonesia, detailed and systematic documentation of CT examination procedures for head trauma is still lacking. relatively limited in literature scientific local which is generally available, so that research describing this procedure is important to provide a picture of the real practice of radiology services in regional referral hospitals.

Based on clinical needs and documentation gaps, this study aims to determine and analyze examination procedures. computed tomography scan Head trauma in cases of head trauma after traffic accidents at the Radiology Installation of Siloam Sriwijaya Hospital, Palembang, with an emphasis on patient preparation, technical parameters, image reconstruction positioning, and diagnostic quality criteria used in clinical practice.

RESEARCH METODS

Study This use design qualitative descriptive with a case study approach to systematically document the audit procedures computed tomography head in patients trauma head post accident Then cross in Installation Radiology House Sick Siloam Sriwijaya Palembang. Approach studies case chosen because it is possible observation details to clinical and technical imaging practices without intervention, so that the research results describe real practices in the field even though their generalization is limited to the context of the installation where the research was conducted.

The study was conducted in May 2025 at the Radiology Unit of Siloam Sriwijaya Hospital, Palembang. The study population was all patients diagnosed with post-traumatic head trauma. Then cross Which undergo CT head examinations during the study period. Samples were selected using a purposive sampling technique based on the availability of non-contrast CT head image documentation and complete radiology reports stored in the Picture Archiving and Communication System (PACS).

The research data included non-contrast CT head images and radiological interpretation reports taken from PACS as secondary data, plus procedural observation data and the results of structured interviews with radiographers on duty to obtain technical information regarding examination protocols, procedural constraints, and adjustments to technical parameters during practice.

Procedure Inspection Radiography

CT head examination procedure for trauma cases is carried out according to the installation's SOP. The patient is positioned supine with orientation head first and head fixation was performed to minimize motion artifacts during acquisition. Scanning was performed in helical/spiral mode with a scan range from the foramen magnum to the vertex. For non-contrast examinations on the multislice CT machine used in the installation, the technical parameters recorded included a tube voltage of 120–140 kV and a tube current of 250–350 mAs with automatic current modulation according to the device policy; standard slice thickness For evaluation parenchyma set 5 mm and bone reconstruction was performed at 1–2 mm; field of view customized 20–25 cm with 512 × 512 matrix (NICE, 2023). Soft reconstruction algorithm used For appearance brain window and a more stringent reconstruction algorithm was used for the bone window. The window level and window width values applied to the brain parenchymal evaluation followed the WL range of 35–40 HU and WW of 80–100 HU, and for bone of 500–600 HU and WW of 2000–3000 HU, as noted in the local protocol. Coronal and sagittal axial multiplanar reconstructions were stored in the PACS for diagnostic assessment and research documentation. Statement of Use CT non contrast as modality First-line imaging in head trauma is supported by international guidelines and radiology practice guidelines due to its speed of examination and sensitivity to bleeding and fracture (Shih et al., 2021).

Technique Collection Data

Data collection includes direct observation of the examination flow from receiving the patient in the ER to transferring to the desk. CT For take notes process preparation patient, positioning, use immobilization cervical if necessary, and radiation safety measures. Documentation image And report radiological interpretations are collected from PACS for analyzed technical and diagnostic aspects. Structured interviews with radiographer aim gather narrative technical about decision -making parameter exposure, constraint technical frequently occurring issues, and modifications to protocols applied to trauma patients. All data were recorded on observation sheets and in the research database.

Criteria Image Assessment CT Head

Image assessment was performed descriptively based on radiological criteria for head trauma evaluation. The assessment criteria included aspects of the technical feasibility of the image, including image contrast, spatial resolution, noise level, and the presence of artifacts that could interfere with interpretation. Additionally, scan coverage was examined to ensure accuracy. all over structure cranial followed in the scan. Diagnostically the assessment assesses the presence and characteristics of intracranial hemorrhage such as

epidural subdural subarachnoid and intracerebral fractional skull fracture midline shift cerebral edema as well as ventricular changes relevant for the retrieval of blood. decision clinical I. Criteria These technical and diagnostic guidelines are formulated in line with the recommendations of international guidelines and head CT protocol reference books to ensure that image fulfil condition evaluation diagnostics in trauma cases (Flammia et al., 2022).

Technique Analysis Data

Data analysis was conducted qualitatively and descriptively using the Miles and Huberman interactive analysis model, which includes data reduction, data presentation, verification, and conclusion drawing. In the data reduction stage, observational findings and technical parameters were categorized based on technical and diagnostic indicators. Data presentation was conducted in the form of narrative descriptions of radiological findings. Data triangulation between observational interviews and radiological reports was used to enhance the credibility of the findings (NICE, 2023). Conclusions were drawn inductively and linked to relevant literature and clinical guidelines for head trauma.

Research Ethics

The research obtained official permission from the Radiology Unit of Siloam Sriwijaya Hospital, Palembang. All patient data used was anonymized, with identity codes replaced with research codes, and was used solely for the purpose of this study. needs scientific. No There is intervention clinically to patients because this study used secondary data from routine diagnostic services, so the risk to subjects is minimal.

RESULTS AND DISCUSSION

This research was conducted at the Radiology Installation of Siloam Sriwijaya Hospital, Palembang, Wrong One House Sick private A referral hospital in the South Sumatra region under the auspices of the Siloam Hospitals Group . This hospital is equipped with modern diagnostic imaging facilities, including multislice Computed Tomography Scan (CT-Scan), and is supported by by power health professional experienced. The availability of these facilities and infrastructure allows for the rapid and effective implementation of emergency radiology examinations. accurate, specifically in case trauma head due to traffic accidents .

A radiological examination was performed on a 25-year-old male patient (Mr. A) who presented with a history of blunt head trauma following a traffic accident. A non-contrast head CT scan (NCCT) was performed in May 2025. The radiologist's reading revealed no intraparenchymal hemorrhage, no midline shift, and no signs of ventricular compression. The cerebral parenchyma (including the corpus callosum, basal ganglia, thalamus, brainstem, and cerebellum) appeared within normal limits; the ventricles, cisterns, and sulci also show configuration normal without Evidence of mass effect. The main pathological findings were nasal bone fractures and nasal septum deviation, as well as hematomas in the bilateral ethmoidal sinuses and left maxillary sinus. This interpretation is consistent with a blunt trauma mechanism to the facial region. anterior And confirm role NCCT to get rid of lesions intracranial Which threaten soul as well as detecting facial osseous injuries (Tsiouris & Lui., 2024).

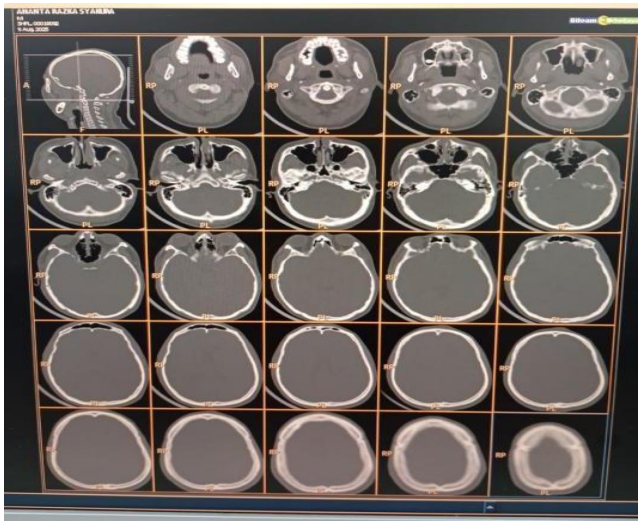

Figure 1. Axial Projection Results (Bone Window)

Figure 1 shows a bone window projection showing the contours of the skull bones without evidence of calvarial fracture. The focus of attention is on the facial region. anterior show existence fracture nasal bones and deviation/injury to the nasal septum, which in this image is clearly visible as a cortical discontinuity in the nasal structures. Furthermore, a

hematosinusal density pattern is seen in the bilateral ethmoidal sinuses and in the left maxillary sinus, indicating bleeding/obstruction of the sinus cavity related to facial trauma. No bone fragments are visible. calvaria Which indicates fracture Skull vault. The image quality in the bone window is adequate without significant motion artifacts, allowing for reliable evaluation of the details of the cortical continuity of the bone.

To complete the evaluation of intracranial soft tissues and rule out life-threatening injuries, images are also reconstructed on a brain window. This projection is chosen to assess existence bleeding intraparenchymal, edema, or shift line middle (midline shift) requiring surgical intervention or other emergency measures.

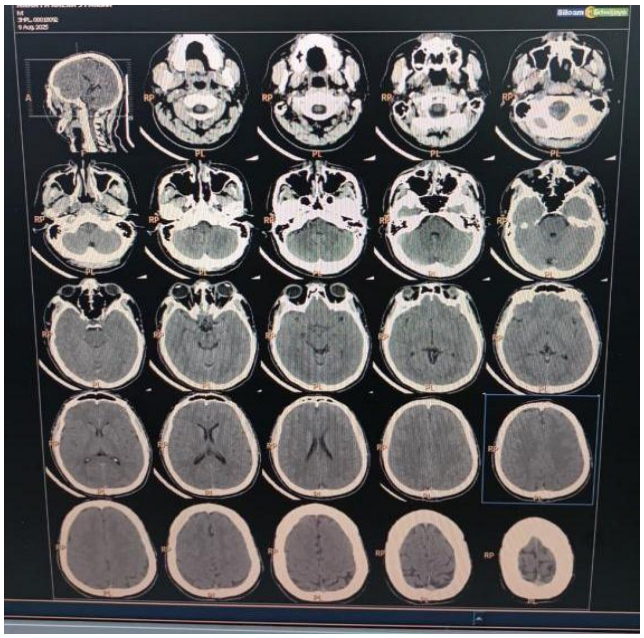

Figure 2. Axial Projection Results (Brain Window)

Figure 2 shows an axial projection of the brain window. No acute intracranial hemorrhage, intraparenchymal hyperdensity, or evidence of subdural/epidural hematoma was found. The ventricular system appeared within normal limits without compression, and there was no apparent midline shift or mass effect. Cerebral parenchymal structures included the corpus callosum , basal ganglia , and thalamus. as well as stem brain show density and contour Which within normal limits. These findings support the conclusion that there was no life-threatening intracranial injury on examination. NCCT moment That. Combination results bone window and brain window showed that the injury Which most stand out is on facial structures (fractures of the nasal bones and nasal septum) with local hematoma, while there is no evidence of intracranial hemorrhage or acute space-occupying lesion.

Analysis Results Interview

Analysis of interviews with installation radiographers Radiology Hospital Siloam Sriwijaya Palembang shows that inspection CT Scan Head trauma in traffic accident cases (KLL) is carried out through a structured clinical process and in accordance with emergency service protocols. The radiographer explained that "procedure reception patient accident Then cross (KLL) with trauma "The head's process begins with the receipt of an examination request from the ER, accompanied by the patient's clinical data and identity verification," indicating that cross-unit coordination is a critical component in ensuring speed and accuracy of treatment. In addition to initial triage , interviews are also conducted. also emphasizes the patient safety aspect, especially the possibility of cervical injury, as stated that "patients are immobilized, especially if suspected presence of cervical injury," as well as the involvement of accompanying medical personnel for unconscious patients.

On the technical aspect, the interview revealed that CT Scan head non-contrast (NCCT) Head) is modality main in assessing acute head trauma, with the radiographer stating that CT Scan Head Non-Contrast is the first standard for assessing bleeding, fractures, edema, and brain injury." The technical protocols used include helical/ axial mode , thickness slices axial 5 mm with 1–2 mm reconstruction, coverage from the foramen magnum to the vertex , and the use of two windows (bone window And brain window), which clinically provides an optimal combination of soft tissue and bone evaluation. A clinically based examination prioritization system is also identified through the quote that "patients with unconsciousness, a low GCS , severe vomiting, seizures, or signs of increased intracranial pressure will be immediately triaged," demonstrating the practice's alignment with the principles of neurologic emergency triage .

Technical challenges during the examination primarily stemmed from patient factors, such as uncooperativeness, seizures, or decreased consciousness, which, according to the

radiographer, "can cause motion artifacts in the images." To address this, mitigation strategies included immobilization using a head block and neck collar , and, in certain circumstances, light sedation to ensure "the image results are not affected by movement." These efforts demonstrate that optimizing image quality is not solely determined by exposure parameters, but also by non-technical interventions inherent in the clinical context of trauma patients. Furthermore, interviews provided information. quantitative about duration examination, namely "patient preparation 5 minutes, scanning 3 minutes and image reconstruction 2 minutes," Which reflect ability services to respond quickly to emergency cases. Overall, the interview results support Examination data and technical findings of the study show that NCCT head examination in KLL trauma patients at Siloam Sriwijaya Hospital, Palembang was carried out through a systematic process, integrating aspects of clinical triage , protocols technical, And mitigation constraint technical to achieve adequate image quality for diagnostic interpretation. Consistency between interview results And findings image show that clinical practices at the facility comply with emergency radiology service standards.

Discussion

Siloam Sriwijaya Hospital Palembang is a referral facility equipped with a multislice CT scanner (128 slices) and experienced personnel, enabling emergency NCCT head examinations with a consistent protocol. In this case, the acquisition parameters were: 120 kV, 350 mAs, slice thickness 5 mm (acquisition axial) with reconstruction multiplanar 1–2 mm, FOV ≈ 250 mm, and 512 × 512 matrix; brain window (WL ≈ 40 HU, WW ≈ 80 HU) and bone window (WL/WW ≈ 400/2000 HU). Combination of coarse acquisitions for triage (5 mm) And reconstruction thin For Multiplanar fracture evaluation is a common practice in emergency examinations to balance the speed of examination and the ability to detect subtle fractures. Literature and guidelines state NCCT as an examination beginning choice on trauma head acute and recommend coverage of the foramen magnum until vertex as well as utilization bone & brain windows For evaluation comprehensive (Shih et al., 2021).

The practical difference (practical mAs are higher than some theoretical figures) can be explained by the characteristics of the 128-slice scanner: a higher number of detectors and a high acquisition rate that allows for precise multiplanar reconstruction, but also demands exposure adjustments to maintain SNR and reduce artifacts, especially when patient moving. A 128-slice performance evaluation study showed that the use of iterative reconstruction techniques and optimized mAs settings can maintain image quality while reducing dose—thus, the assumption of high mAs should be evaluated alongside the hospital's dose optimization strategy (e.g., AEC, iterative reconstruction). The ALARA principle remains the primary guideline through the use of noise reduction algorithms and periodic dose audits (DRL/CTDIvol, DLP) (Singh & Sukkala, 2021).

The technical parameters used in non-contrast CT head examinations at the Radiology Installation of Siloam Sriwijaya Hospital, Palembang, are tube voltage of 120 kV, tube current of 350 mAs, slice thickness of 5 mm with reconstruction. multiplanar thin, pitch 0.391, field of view 250 mm For brain as well as matrix 512 × 512 and brain settings window WL 40 HU WW 80 HU and bone window WL 400 HU WW 2000 HU in line with protocol clinical For screening Early head trauma requires a balance between the sensitivity of detecting acute hemorrhage and fractures with the acquisition efficiency of modern multislice scanners (Prabsattroo et al., 2023). A 5 mm slice thickness accelerates acquisition and reduces noise in screening examinations, making it suitable for emergency triage, while thin reconstructions are necessary to evaluate subtle fractures of the facial bones, such as the nasal bone and nasal septum fractures seen in this case, as they increase spatial resolution in multiplanar imaging (Prabsattroo et al., 2023). The relatively high mAs value can be explained by the characteristics of the 128-slice device, which requires a larger signal to maintain the image. ratio signal to noise at high acquisition rates but variations between scanner models allow optimization of the use of automatic exposure control and reconstruction algorithms iterative use lower dose without loss of diagnostic capability (Pula et al., 2025). Alignment of the patient supine with the head near the gantry and maintenance of the mid-sagittal plane and meatal reference

alignment improves symmetry anatomical And minimize artifacts movement so that the reliability of the assessment of the ventricles and structure midline become more Good, by Because That

The positioning procedures applied in the field are in accordance with head acquisition positioning guidelines. The use of separate windowing settings for soft tissue and osseous tissue has shown immediate clinical benefit because the brain window facilitates the exclusion of intraparenchymal hemorrhage and the assessment of edema, while the bone window improves the detection of fractures and paranasal sinus hematomas as seen in patient examinations (Qasrawi et al., 2025). Although the images meet the criteria for adequate contrast, spatial resolution, and minimal artifacts for diagnostic interpretation, contemporary literature recommends periodic dose audits and test try protocol dose low Which combined with iterative reconstruction or deep image learning reconstruction For lower radiation exposure while maintaining or even improving diagnostic quality in non-contrast head examinations (Coelho et al., 2026).

Limitations Study

This study has several limitations. First, the research design was a case study with a very limited number of subjects, so the results cannot be generalized to the entire population of head trauma patients. Second, this study used only one imaging modality, namely a non-contrast head CT scan, without comparison with other imaging modalities. modality other like CT contrast or MRI which potential give information additional information under certain conditions. Third, the research evaluation focuses on initial findings and technical aspects of the examination. without accompanied by data action carry on clinical findings and patient therapy outcomes, so the relationship between radiological findings and clinical outcomes could not be further analyzed. Fourth, radiation dose parameters (such as CTDIvol and DLP) were not analyzed quantitatively, so the dose optimization evaluation was only descriptive.

CONCLUSION

Non-contrast head CT scan (NCCT) Which done on case trauma Head post traffic accident at the Radiology Installation of Siloam Sriwijaya Hospital Palembang successfully ruled out acute intracranial bleeding and mass effect during the examination, while identify fracture OS nasal, nasal septal deviation, and local hematosinusal. An acquisition protocol combining 5 mm axial acquisition for rapid triage and 1–2 mm multiplanar reconstruction for subtle fracture evaluation has proven practical in the emergency setting and is consistent with clinical recommendations for head trauma imaging.

Adjustment parameter technical on A 128-slice multislice scanner (e.g., relatively high mAs) seems rational for maintaining image quality under fast acquisition conditions, but should always be balanced with a dose optimization strategy based on the ALARA principle through the use of automatic current modulation, iterative reconstruction, and periodic dose audits. Given the single-case study design, the findings are descriptive and not generalizable; advanced with sample Which moreLarge and dose metric recording (CTDIvol, DLP) is needed to quantitatively evaluate the image quality and radiation safety aspects of the NCCT head protocol in a referral hospital environment.

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