

## Helmet Use Reduces Injury in Mild Head Trauma with Multiple Injuries: A Case Report

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### ABSTRACT

**Introduction** : Patients with head injuries have a high risk of organ trauma. Organ trauma can occur in conjunction with head injuries, especially in cases of accidents involving violent impact. The energy of the impact usually does not affect only one area of the body. The head may be lightly impacted, but other parts of the body may also be injured. Not all parts of the body receive the same severity of impact. The head may suffer minor injuries while other parts of the body may suffer more severe injuries.

**Case precentation** : A 22-year-old man came to the emergency department of Yogyakarta City Hospital delivered by an ambulance with complaints of lower abdominal pain, the pain felt widespread, the patient complained of not being able to eat and drink, nausea and vomiting, left leg pain when lifted. Physical examination revealed vulnus excoriation. The diagnosis of mild head injury accompanied by multiple trauma can be established by history taking, physical examination, neurological examination, and supporting examinations such as laboratory, X-ray, and abdominal ultrasonography.

**Discussion** : Non-helmeted riders experience more severe head and facial injuries than helmeted riders. Riders who did not wear helmets had poorer mental status than those who did, and their mean GCS scores were usually lower than those who wore helmets. This suggests that there is a relationship between head protection, or helmets, and the severity of motorcyclists' injuries, and that when motorcyclists do not wear helmets, injuries and the risk of injury are greater.

**Conclusion** : The patient suffered a mild head injury with multiple organ trauma after physical and supporting examinations. The patient's head injury can be minimized because the patient was still wearing a helmet at the time of the accident.

**Keyword** : helmet, injury, trauma



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## 1. Introduction

Head injury literally means injury to the head. This definition is actually not simple as head injury can mean injury to the scalp, skull bones, brain tissue, or all of them. According to Jennet and Teasdale, the term "Cranio-cerebral Injury" is more appropriate because the field of neuroscience focuses on injuries to the brain tissue, brain membranes, and blood vessels.[1] Head injury according to the American Brain Injury Association, is a type of injury to the head caused by an external physical attack or impact, which can reduce or alter consciousness, which can impair cognitive abilities and physical function.[2]

A leading cause of death and disability, head injury is also a health and social problem in many countries around the world. Non-degenerative and non-congenital diseases caused by mechanical masses outside the body are called head injuries.[3]

This disease disrupts cognitive, psychosocial functions and can occur permanently or temporarily, and can cause decreased consciousness. Traumatic brain injury cases are found at different levels of emergency.[4] Head injuries have an incidence of between 75 and 200 cases per 100,000 people. They occur at all ages, but are most common in males aged 15 to 24 years. Head injury or other injuries involving head injury account for 50% of injury deaths, and injury is the leading cause of death in patients under 45 years of age.[5] The World Health Organization (WHO) report states that severe head injuries from traffic accidents cause approximately 1.2 million deaths annually.[6]

The Indonesian Central Bureau of Statistics explained that the number of accidents in Indonesia in 2022 was more than 139,258, about 28,131 citizens died as a result of traffic accidents. In addition to fatalities, more than 13,364 people were seriously injured and 160,449 people suffered minor injuries due to traffic accidents throughout 2022.[7] Traffic accidents are one of the main causes of head injuries. In Indonesia, epidemiological data on head injury is not yet available, but according to Teuku Aditya Kemal, the prevalence of head injury after traffic accidents sampled from MEURAXA Banda Aceh Hospital was 173 people with a diagnosis of head injury after traffic accidents, with 149 men and 24 women.[8]

Head injuries were classified using Glasgow Coma Scale (GCS) values into three categories. A Glasgow Coma Scale (GCS) score of 14-15 is considered a mild head injury, a Glasgow Coma Scale (GCS) score of 9-13 is considered a moderate head injury, and a Glasgow Coma Scale (GCS) score equal to or less than 8 is considered a severe head injury.[9] Moderate head injury may result in decreased consciousness for several hours. Abnormal neurologic signs are often accompanied by edema and cerebral contusion. In addition, fatigue and confusion occur which may last for several weeks. Impaired behavior and cognitive function may last several months or even become permanent.[10]

Non-helmeted riders experience more severe head and facial injuries than helmeted riders.[11] Riders who do not wear helmets have poorer mental status than those who do, and their mean GCS scores are usually lower than those who wear helmets.[12] This suggests that there is a relationship between head protection, or helmets, and the severity of motorcyclists' injuries, and that when motorcyclists do not wear helmets, injuries and the risk of injury are greater.[13]

Patients with head injuries have a high risk of organ trauma.[14] Organ trauma can occur along with head injury, especially in cases of accidents involving hard impact.[15] Mild head injury with multiple traumas can occur due to several factors such as trauma mechanisms and different degrees of severity in each area.[16] In traffic accidents or falls from a height, the impact energy usually does not hit only one area of the body. The head may be lightly impacted, but other parts of the body may also be injured [17]. Not all parts of the body receive the same severity of impact. The head can have a mild injury (GCS 13-15), without severe cerebral hemorrhage, while other parts of the body can have more severe injuries.[18]

Prompt and appropriate treatment is required to prevent complications of head injury.[19] One possible consequence is increased intracranial pressure in the brain, which if not treated promptly can be fatal to the patient's organ systems as a whole.[20] Children can also experience a long-term complication known as a progressing fracture, which occurs when a poorly treated fracture continues to progress and causes an abnormal head shape at a later age.[21]

## 2. Case Presentation

A 22-year-old male patient came to the emergency department of Yogyakarta City Hospital on May 2, 2025, delivered by ambulance with decreased consciousness after a traffic accident since 30 minutes SMRS, when the patient was riding a motorcycle in the red light area of giwangan terminal, the patient hit a bus that ran through the red light while wearing a helmet that was not removed. The patient fainted for 30 minutes from the beginning of the incident until arriving at the emergency department of Yogyakarta City Hospital. When the patient regained consciousness, he complained of severe lower abdominal pain. When questioned, the patient could not remember the full chronology of the traffic accident. The patient only remembered that he hit a bus and was unconscious for 30 minutes. When in the ward, the patient complained of lower abdominal pain, the pain felt widespread, the patient complained of being unable to eat and drink, nausea and vomiting, left leg pain when lifted. History of previous illness was denied. Medical history was denied. Smoking history was denied. History of narcotic and addictive substance use was denied.

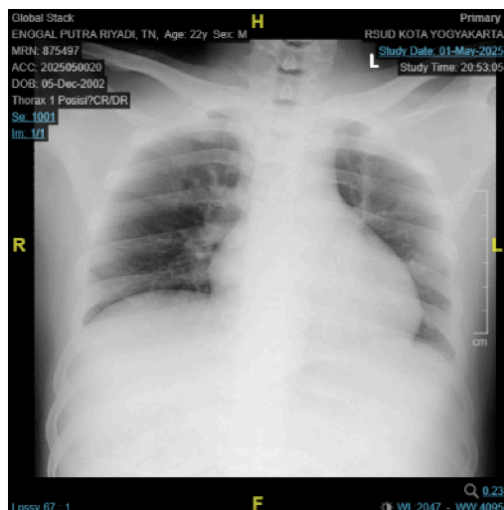


Figure 1. Thoracic x-ray, within normal limits.

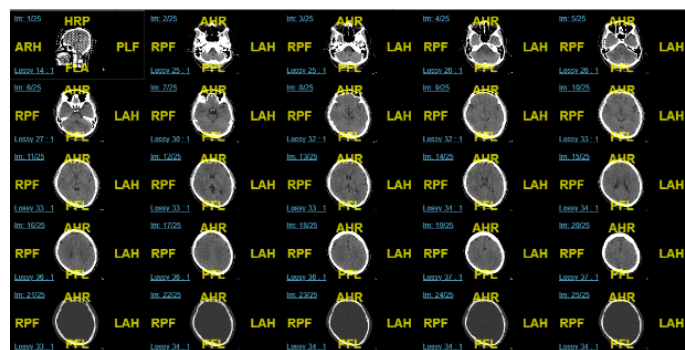


Figure 2. CT-Scan of the Head, within normal limits.

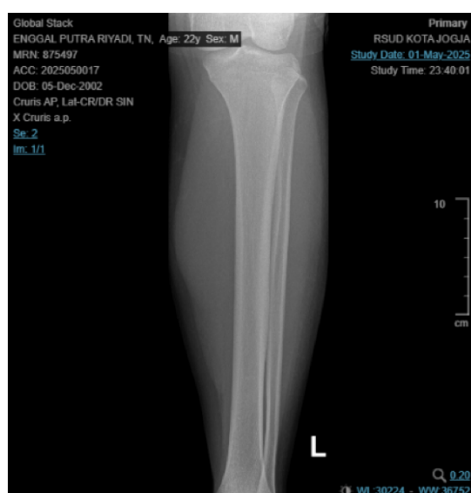
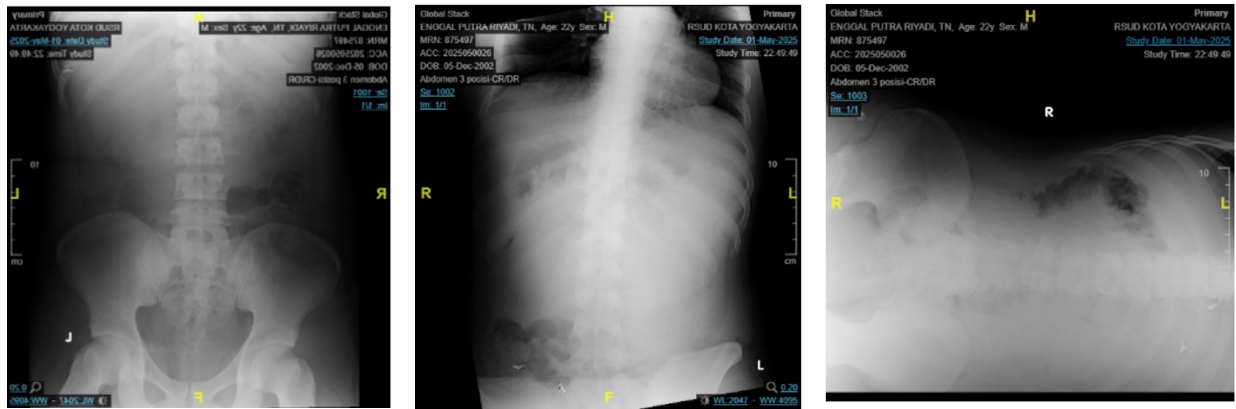


Figure 3. X-ray of anterior cruris sinistra, within normal limits



Figure 4. X-ray of Lateral Cruris Sinistra, within normal limits



**Figure 5.** 3-position abdominal X-ray, showing air in the projection of cavum pelvis regio rectum.

**Table 1.** Laboratory results of whole blood, leukocyte and coagulation counts

Types of Examinations	Results	Description	Reference Value	Unit
Eritrosit	3.82	Low	4.50-5.90	10e6/ul
Hemoglobin	11.2	Low	12,3 - 17,5	g/dl
Hematokrit	31.1	Low	40.0-52.0	%
Mean Corpuscular Volume	81.7	Normal	80-96	fl
Mean Corpuscular Hemoglobin	28.2	Normal	28.0-33.0	pg
Mean Corpuscular Hemoglobin Concentration	34.5	Normal	33-36	gr/dl
RDW-CV	13.4	Normal	11-16	%
RDW-SD	39.1	Normal	35-56	fL
Leukosit	9.8	Normal	4.4-11.3	10e3/ul
Neutrofil%	84.2	High	50-70	%
Lymfosit%	9.8	Low	25-60	%
Monosit%	5.6	Normal	2-8	%
Eosinofil%	0.3	Low	2.0-4.0	%
Basofil%	0.1	Normal	0-1	%
IMG%	0.4	Normal	0	%
Neutrofil#	8.24	High	2-7	ribu/ul
Lymfosit#	0.96	Normal	0.8-4	ribu/ul
Monosit#	0.55	Normal	0.12-1.2	ribu/ul
Eosinofil#	0.03	Normal	0.02-0.50	ribu/ul
Basofil#	0.01	Normal	0-1	ribu/ul
PT	18.5	High	11,3 - 14,6	Detik
INR	1,44	High	0,8 - 1,2	-
Control Normal PT	15,5	Normal	11,3 - 16,2	Detik
APTT	31,7	Normal	26,8 - 36,3	Detik
Control Normal APTT	34,9	Normal	26,9 - 38,7	Detik

Physical examination found that the patient's general condition appeared moderately ill, with full composmentis consciousness with Glasgow Coma Scale E4V5M6 on Head to Toe examination obtained tenderness on palpation of the abdomen with VAS 8. Nutritional status is overweight. Blood pressure 119/65 mmHg, pulse 54x/min, respiratory frequency 20x/min, body temperature 36.7°C, and oxygen saturation 96%. On physical examination, there was vulnus excoriation regio facialis sinistra measuring 0.5x4 cm and metacarpal sinistra measuring 0.5 cm x 1 cm. On neurological examination of nerves I-XII there was no abnormality, pathological reflexes were absent, excitatory brain membranes also found no abnormalities.

The supporting examinations performed were laboratory examinations (Table 1), thoracic x-rays (Figure 1), cruris x-rays (Figures 3 and 4), 3-position abdominal x-rays (Figure 5), computed tomography scan of the head (Figure 2) and abdominal ultrasonography (Figure 6). Complete blood laboratory examination, leukocyte count and coagulation were performed. Complete blood laboratory results showed a decrease in erythrocytes, hemoglobin, and hematocrit. The leukocyte count showed an increase in absolute neutrophils and percentage of neutrophils, and an increase in coagulation Prothrombin Time (PT) and International Normalized Ratio (INR).

Abdominal ultrasonography examination resulted in normal hepatic size and echostructure, smooth surface, acute lobe angle. No mass/nodule was seen. Intrahepatic Bile Duct or intrahepatic bile duct is not dilated. ascites appears. paraaortic lymphonodi not prominent. enlarged lien, normal echostructure and no mass / nodule appears. hilus lienalis not prominent. Longitudinal anechoic lesion in the distal pars of the lymphaden. 4 cm. anechoic vesica fellea, smooth wall, no mass, stone sludge. The pancreas is not enlarged, normal echostructure, no mass, ductus pancreaticus is not dilated. Normal size ren dextra, slightly elevated echostructure, firm cortex-medulla border, non dilated pancreatic/cystic duct, no mass or stone. Normal size ren sinistra, slightly elevated echostructure, firm cortex-medulla border, non dilated pelvico calyx system. Hypoechoic lesion in the inferior pole in triangular shape. vesica urinaria anechoic, no thickened wall, no stone. hyperechoic lesion in amorphous lobulated shape. The prostate appears normal in size and echostructure, no mass or calcification. There are anechoic areas in the hepatorenal space and splenorenal space. Ultrasonography impression showed splenomegaly with laceration with subcapsular hematome showed renal sinistra hematome with differential diagnosis of laceration with urinary extravasation showed free fluid intra-abdominal no abnormalities in hepar, vesica felea, pancreas, ren dextra and prostate.

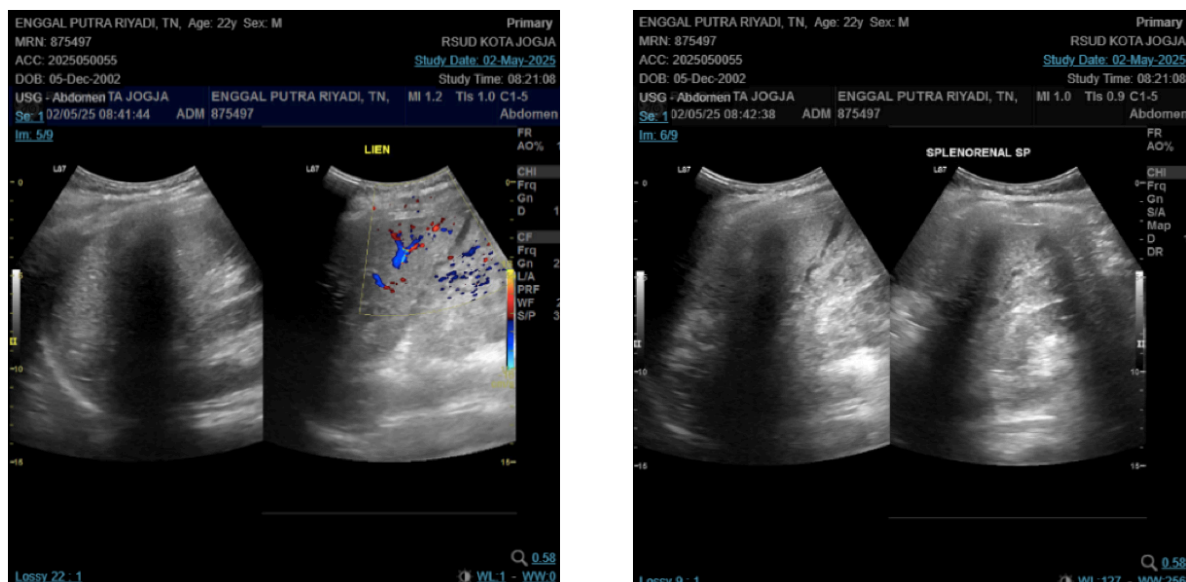


Figure 6. Abdominal ultrasound of Lien, splenomegaly with laceration with subcapsular hematome leading to renal sinistra hematome.

### **3. Discussion**

Anamnesis obtained the patient's main complaint, namely lower abdominal pain which was very painful after a traffic accident since 30 minutes before admission to the hospital, when the patient was riding a motorcycle in the red light area of the giwangan terminal, the patient hit a bus that ran through the red light while wearing a helmet not detached with a history of unconsciousness for 30 minutes. When the patient regained consciousness, he could not remember the full chronology of the traffic accident.

Head injuries are classified based on the Glasgow coma scale (GCS) into mild head injury (GCS 14-15), moderate head injury (GCS 9-13), and severe head injury (GCS 3-8). The Glasgow coma scale (GCS) score is based on three components of the patient's state: eye opening response (E), motor response (M) and verbal response (V). Once combined, the maximum GCS score is 15 and the minimum score is 3.[22] The patient showed a GCS score of 15 (E4V5M6) with spontaneous eye opening so that the value of E is 4, able to communicate verbally well the value of V is 5, and can follow the command to raise both hands and feet the value of M is 6, therefore the Glasgow Coma Scale score is E4M6V5 or GCS 15, without signs of neurological deficits, so the patient's head injury is classified as mild head injury.

Supportive examination showed a decrease in hemoglobin value and an increase in Prothombin Time and International Normalized ratio. Low hemoglobin indicates anemia, which is caused by blood loss (acute or chronic) impaired red blood cell production (e.g. bone marrow disorders), or nutritional deficiencies such as iron, folate, and vitamin B12.[23] Meanwhile, an increase in the Prothombin Time and International Normalized ratio values means that the blood clotting time is longer than normal. Low hemoglobin values along with increased prothombin time and international normalized ratio indicate anemia which is most likely caused by bleeding due to blood clotting disorders. A decrease in erythrocyte count and hematocrit indicates a reduced number of red blood cells and reduced blood capacity to transport oxygen.[24] An increase in the absolute number of neutrophils and percentage of neutrophils is the body's response to certain conditions, such as acute bacterial infection or acute inflammation.[25]

X-ray examination of the anterior lateral cruris sinistra, head, pulmonary and abdominal 3 positions were within normal limits. Thus, there were no obvious signs of trauma or disease in the left cruris bone, head, lung, and abdomen. X-ray examination cannot assess soft tissue and is not sensitive to detect bleeding such as laceration or hematoma in these organs. So an abdominal ultrasound is required for further examination.

Abdominal ultrasound examination obtained results and impressions of splenomegaly accompanied by laceration with subcapsular hematome leading to a picture of renal sinistra hematome with differential diagnosis of laceration with urinary extravasation appearing intra-abdominal free fluid. Interpretation of ultrasound results on the splen there is an enlarged spleen, there is a tear or wound in the lipa tissue so that there is a buildup of blood under the spleen capsule due to the tear, this finding indicates a serious spleen injury, which can occur due to blunt trauma to the abdomen. The sinistra renal picture shows renal tissue hemorrhage, possibly a tear in the kidney resulting in urine leaking out of the urinary system due to renal injury.

The patient was diagnosed with mild head injury with multiple trauma because he had a GCS score of 15 (E4V5M6) without neurological deficits and a normal CT-Scan and there were 2 organ trauma, namely tears in the spleen and kidney tissue. The first treatment for head injury patients in traffic accidents is ABC, which means airway, breathing, and circulation.[26] Airway and respiratory disorders that can cause obstruction to the respiratory system must be considered, such as pneumothorax, a retracted tongue to the back, and foreign objects that block the airway. Traffic accidents cause head impacts resulting in increased intracranial pressure to reduce intracranial



pressure, mannitol can be given at a dose of 0.25 to 1 gram/kg BW daily.[27]

Antrain administration functions as an analgesic in complaints of abdominal pain, effective for managing moderate to severe pain.[28] Intravenous infusion of asering and oxygen 3 liters per minute serves to prevent dehydration and increase oxygen levels in the blood. Intravenous ceftriaxon as an antibiotic to treat various serious bacterial infections in the body.[29] Intravenous citicolin serves to help restore and maintain the function and structure of neuronal membranes after brain damage after head trauma, the function of intravenous omeprazole 1x1 ampoule is to reduce gastric acid production by inhibiting proton pumps (proton pum inhibitors) in gastric parietal cells.[30] The injection of kalnex (tranexamic acid) is to prevent and stop bleeding.[31]

#### **4. Conclusion**

A 22-year-old man came to the emergency department of Yogyakarta city hospital with a chief complaint of upper abdominal pain after a traffic accident since 30 minutes before admission. The patient was given a primary survey to find and correct any life-threatening problems. After the patient's condition was stabilized, an additional survey was performed by performing a physical examination from head to toe. The patient had mild head injury with multiple organ trauma after physical and supporting examination. The injury to the patient's head could be minimized because the patient was still wearing a helmet at the time of the accident. The management was performed cito laparatomy surgery to evacuate bleeding and non-surgical management such as oxygenation, bed rest with head elevation of 30 degrees, wound care, and treatment of antibiotics, fluids, antiemetics, and analgesic drugs. Treatment was provided in the cempaka ward of Yogyakarta City Hospital for one week to monitor the patient's condition and provide education to the family to get the best care. This case was handled successfully and without obstacles.

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None.

#### **Conflict of Interest**

The authors declare no conflicts of interest in preparing this article

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