

# Time to CT scan for Poly-trauma Patients: King Saud University Medical City Experience

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## Abstract

**Background:** Total body CT scanning is the diagnostic method in polytrauma patients. The guideline suggested that rapid scanning will improve mortality rates in polytrauma patients. Our aim is to determine the time to do CT for severe polytrauma patients presenting to King Saud University Hospital Medical City (KSUMC) in Riyadh, Saudi Arabia. **Methods:** Retrospective study for 9 months, all dates were reviewed for all polytrauma patients who underwent pan CT scanning and managed in the Emergency Department at KSUMC. Trauma registry dates were collected for all eligible patients, including arrival time, pan CT scan order Time, pan CT scanning time, time until CT imaging completed, time until CT image reporting, final transfer to surgery wards or SICU, also the type and severity score of the injury, based on ISS. Subgroup analyses were performed to differentiate between the severities of any type of injury. Excluding criteria was: Pregnancy, Children less than 14 years old, trauma patients with isolated penetrating injury to one region (not including gunshot wounds), or patient underwent CPR, or need an immediate operation. **Results:** 114 eligible patients included in the study population. The mean age was 32. RTA was the most cause of injury with a range of GCS 3-15. The mean length of stay was 12 days. CT acquisition times were median 130 mins to completion. Time to completion was faster for multiple-body area injuries, intubated patients and those which caused by RTA. **Conclusion:** The 130 min to completion of trauma CT scans comparable with some international reports that were ranged from 93 to 102. Our results will serve a baseline to improve our center.

**Keywords:** CT scan; Trauma; Emergency Medicinetable

## Introduction

Management of patients with multiple injuries is challenging. It is challenging to get any clinical history from poly-trauma patients, and in most cases, the life-threatening injuries may not be apparent. <sup>[1]</sup> Total body Computed Tomography (CT) scanning is one of the most important diagnostic methods for poly-trauma patients due to its effectiveness in the detection of missed injuries, its high accuracy and its ability to rapidly diagnose patients. <sup>[2,3]</sup> The using of Total-body CT is increasing among physicians in the initial management of blunt trauma patients as recommended by Advanced Trauma Life Support (ATLS) guidelines. <sup>[4,5]</sup> Moreover, CT is the most comprehensive, non-invasive diagnostic modality in Multi-Trauma injuries. <sup>[6]</sup>

Applying pan CT in poly-trauma patients is recommended in early resuscitation phases as it was found in a large retrospective, multi-center study, that the mortality of poly-trauma patients who underwent early pan CT was reduced compared with what was expected due to their severe injuries. <sup>[7]</sup> Many centers recommend the Immediate CT scan as part of the primary survey in poly-trauma patients. <sup>[8,9]</sup> Some studies approved that the use of pan CT in multiple trauma patients increased the detection of intra-thoracic injuries. <sup>[5]</sup> Pan CT was taken 93 min to complete at an Australia trauma center, 102 min at a Hong Kong hospital, 105 min at USA center, 79 min at a center in Amsterdam. Many hospitals have assessed the median time to CT scan completion for poly-trauma patients and try to improve their services. <sup>[10-13]</sup>

According to the World Health Organization (WHO), Road traffic accidents were the 8<sup>th</sup> reason for death worldwide; almost 1.25 million people lose their lives due to Road Traffic Accidents. <sup>[14]</sup> 4.7% of mortalities in Saudi Arabia are caused by road traffic fatality. <sup>[15]</sup> The Ministry of Health (MOH) hospitals in Saudi Arabia report that 81% of deaths in the hospitals are due to Road Traffic Injuries (RTIs). <sup>[15]</sup> In this study, we aim to determine the time to CT scan completion in poly-trauma patients at our hospital and compare our results to the international reports.

## Material and Methods

For nine months period, all data were reviewed for all polytrauma patients assessed and managed According to the Emergency Management of Severe Trauma principles in Emergency Department resuscitation at King Saud University Medical City (KSUMC) in Riyadh, Saudi Arabia, and underwent pan CT scan. The project was approved by the institutional review board committee of the same institute as a retrospective cross-sectional study. Pan-CT scanning was done in an adjacent radiology Department located inside the Emergency Department. The

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consultant radiologist, registrar, and senior residents are present during working hours, radiology On-call (registrar, or senior resident) is on site outside these hours. A consultant radiologist on call is available outside working hours, but generally, the report confirms the next morning.

Excluded criteria were Pregnancy due to the expected delay in CT scan caused by the shared decision to expose her to radiation between the Emergency Department and Ob Gynae department. Children less than 14 years old, trauma patients with isolated penetrating injury to one region (not including gunshot wounds) since pan CT is not always indicated in these patients, patients who went into traumatic arrest and CPR was initiated or need immediate operational intervention. Trauma registry date was collected for all eligible patients. Including Arrival time, pan CT scan Order Time, pan CT scan time, time for CT imaging completion, time for CT image reporting, the initial patient transfer location, to surgery wards, Surgical Intensive Care Unit (SICU), High Dependency Unit (HDU) or discharge home from the Emergency Department. The number of body regions injuries. The body region categories were Head and neck, Face, Chest, Abdomen and pelvis, and Extremity. We do not include external injuries due to poor documentation.

Poly-trauma patients were defined as the Injury Severity Score is greater than 15. Time to CT imaging completed was defined as the time from patient arrival to recording the final CT image. Time to CT image reporting was defined as the time from patient arrival to CT report in the system.

### Results

One hundred seventeen eligible patients included in the study population. [Table 1] shows the demographic data. In our hospital and depending on the patient’s situation, 45(39%) patients were

discharged from the Emergency 31(27%) transferred to hospital wards, 11(9%) needed Surgical Intensive Care Unit, and 30(26%) needed high dependency unit admission. Most of the patients were discharged without mortality 102(87%), 3(3%) patients died during the 30 days, 1(.9%) died during the 1<sup>st</sup> 24 hours, and 11(9%) were transferred to other hospitals due to the need of extended long-term care.

The median time for CT image completion was 127 mins, the median time for CT image reporting was 268 mins, with maximum time 652 mins for pan CT completed and 1284 mins for pan CT reported. [Table 2] showed the number of body regions injuries for our patients, and their relationship with time for CT imaging completed, and time for CT image reporting.

[Table 3], we assess the relationship between the meantime for CT image completed and mean time for CT image reporting

**Table 1: Demographic data**

		n(%)
Age	22 years old or less	32 (27%)
	23-28 years old	28 (24%)
	28-39 years old	28 (24%)
	40 years old or more	29 (25%)
Gender	Male	101 (84%)
	Female	16 (14%)
Cause of injury	RTA	93 (80%)
	hit his head	3 (3%)
	fall down	19 (16%)
	inhalation	2 (2%)
Need to intubate		31
Positive FAST		3
GCS	15-13	69
	12-5	22
	4-3	11

**Table 2: Relationship of body regions with time for CT imaging completed and time for CT image reporting**

Number of body regions injuries	N	Mean		Std. Deviation		p-value	
		Time from presentation to pan CT completed	Time from presentation to pan CT reported	Time from presentation to pan CT completed	Time from presentation to pan CT reported	Time from presentation to pan CT completed	Time from presentation to pan CT reported
Zero	26	171	415	78	278	0.352	0.664
One	33	154	342	90	264		
Two	32	173	398	122	289		
Three or more	26	135	364	71	329		
Total	117	159	378	94	287		

**Table 3: Determination of Meantime for CT image completed and mean time for CT image reporting with different injury causes**

		Time from presentation to pan CT completed			Time from presentation to pan CT reported		
		Mean	Median	p-value	Mean	Median	p-value
GCS	13-15	153	130	0.012	445	310	0.049
	5-12	105	96		313	203	
	3-4	132	96		226	195	
need for intubation	Yes	116	98	0.001	270	203	0.006
	No	174	151		417	313	
FAST finding	Negative	149	113	0.314	370	265	0.334
	Positive	139	58		189	185	
	Not done	221	211		564	564	
need for blood transfusion	Yes	136	109	0.302	269	228	0.371
	No	161	130		391	287	

with different injury causes, mortality status, the first area to transfers patients from ED, FAST finding, need for intubation, need for blood transfusion and GCS upon arriving.

We found weak positive between GCS and each of time from presentation to pan CT complete and time from presentation to pan CT reported ( $r=0.227$ ,  $P=0.022$  and  $r=0.241$ ,  $P=0.014$  respectively). That is meaning if GCS increase the time will increase and vice versa. In addition, we found weak positive age and time from presentation to pan CT complete ( $r=0.218$ ,  $P=0.018$ ). There is no relationship between age and each of GCS and time from presentation to pan CT reported since P-value more than 0.05.

## Discussion

In our institution, the median time for CT image completion was 127 mins and the median time for CT image reporting was 268 mins. Time to completion was faster for multiple-body area injuries, intubated patients, with positive FAST finding and those who need for blood transfusion. In addition, there is a positive correlation between GCS and each of time from presentation to pan CT complete and time from presentation to pan CT reported, so as GCS increase the time will increase and vice versa.

In comparison to other international studies, for example in Australian experience the time to Pan CT completion was 97 mins which was not comparable with our time which 127 mins, however both agree on some similarities like; intubated patients and patients need for blood transfusion were faster in CT image completion than other.<sup>[10]</sup> A Centre in the USA, the median time to Pan CT completion was 105 min for completed imaging.<sup>[13]</sup>

Comparing our result to Hong Kong hospital, the Hong Kong hospital was reported that the time to complete imaging was reported 197 before installing an ED scanner, and 102 after installing an ED scanner.<sup>[11]</sup> Nevertheless, our study report 127 mins in ED with ED scanner.

## Conclusion

After reviewing our study results and aiming to improve our center, we recommend facilitating and improving CT timings. Limitations of our study include the small number of cases, due to it not being a level one trauma center. Also, the retrospective design there is a lack of availability of complete demographic data, and missing information in physical examination which play a role in assessing the factors that may affect the time for pan CT completion. We didn't report the CT time between first and final imaging, and transport time which can make different in some cases. In addition, the most clinically urgent patients have been prioritized for early imaging, but this does not reflect the real outcome in some cases.

We believe this study will help us identify our weakness and recommend corrective steps to improve our services and patient care.

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