

# Chapter One Introduction

## 1.1 Introduction

Many different definitions for Turnaround time (TAT) are used, starting and end points for specific process, TAT in medical imaging can be defined as (time from physician request imaging exam until the time the physician views the results). TAT of medical imaging studies is a significant indicator of efficiency of a hospital. It is considered a critical element of quality because of the impact on clinical management of patients (Kuhn et al 2007)

Acute ischemic stroke is a serious medical emergency as urgent as heart attack or serious trauma and need to be diagnosed and treated as quickly as possible in order to minimize brain damage (Marler et al 2011).

Ischemic strokes can be treated with 'clot-busting' drugs (IV tPA) which should be administrated within 60 minutes or less (golden hour)(Figure 1.1) from arrival time of the patient to the hospital, and within 3 to 4.5 hour from onset of symptoms. The reason its "golden" is that stroke patients have a much greater chance of surviving and avoiding long-term brain damage if they arrive at the hospital and receive treatment within that first hour (Jeffrey et al 2010)

The time intervals for the golden hour according to UAE is the standard of American Stroke Association which are : Perform an initial evaluation within 15 minutes of arrival emergency department (referred to TAT 1 in this study), start to complete CT brain for stroke within 25 minutes or less from arrival (referred to TAT 2 in this study), Report CT within or less than 45 minutes from arrival (referred to TAT 3 in this study) and give drug IV tPA within or

less than 60 minutes from arrival time . The acceptable percentage in UAE is  $\geq$  80 % of stroke patients should be done within 60 minutes and it is approved key performance indicator (KPI) in stroke centers.

## **1.2 Problem Statement**

Many patients with ischemic stroke are not treated with (IV tPA) which should be administrated within 3- 4.5 hours from onset of signs and symptoms, because they arrive late to the hospital (pre hospital delay) or delay in TAT (in hospital delay). The typical stroke patient loses 1.9 million neurons each minute if stroke is untreated (Jeffrey L. Saver2006).

## **1.3 Research objectives**

### **1.3.1 General Objectives**

To evaluate TAT of brain stroke patients in CT department in UAE.

### **1.3.2 Specific Objectives**

Calculate the value of TAT 1, TAT 2 and TAT 3 for all stroke patients to find out the value of TAT 4 and find out the number of patients, median time and percentage for patients have been completed within recommended TAT and vice versa.

## **1.4 Significant of the study**

An evaluation of TAT in stroke patients has a very special significant because more time lost is more brain lost.

## **1.5 The Over view of the Study**

The study includes five chapters.

Chapter one is introduction includes introduction, problem statement, objectives, significant of study and overview of study.

Chapter two includes theoretical background and literature review of previous studies.

Chapter three is includes materials and methods of the study.

Chapter four includes the results of the study.

Chapter five includes discussion, conclusion and recommendations of the study.

# Chapter Two Literature Review

## 2.1 Theoretical Background

### 2.1.1 TAT in medical imaging

The measurement of TAT is the most commonly adopted performance metric to gauge the success of radiology service today. (Kuhn 2007).

Turnaround time in medical imaging can be defined as (time from physician request imaging exam until the time the physician views the results). End-to-end TAT (full cycle) in medical imaging involve many stages including :Time from physician request imaging exam till the time of starting the exam ( Stage 1 ) ,Time from starting the exam till completed it ( stage2) ,Time from complete the exam till a report done ( stage3), and time from order to report exam as (stage 4) TAT must be as fast as possible because extended TAT for imaging studies frustrates requesting physicians and patients and prolongs decisions regarding treatment plans especially if the exam is CT brain for stroke where time lost is brain lost. (Kuhn 2007).

### 2.1.2 TAT in Golden hour of brain stroke

“Door to needle” (DTN) is the time between the patient’s arrival at the hospital and IV administration of the clot-dissolving drug tissue-plasminogen activator (IV tPA). The drug widely is considered the best course of action in an ischemic stroke, when a clot cuts off blood flow to parts of the brain. (Gregg et al 2011)

Ideally, the drug should be delivered within 60 minutes of stroke onset, the so-called “golden hour.” (See figure 1.1). If (IV tPA) is given within three hours of

an ischemic stroke, one in three patients will benefit and within 4.5 hours, one in six patients will benefit. (Gregg et al 2011)

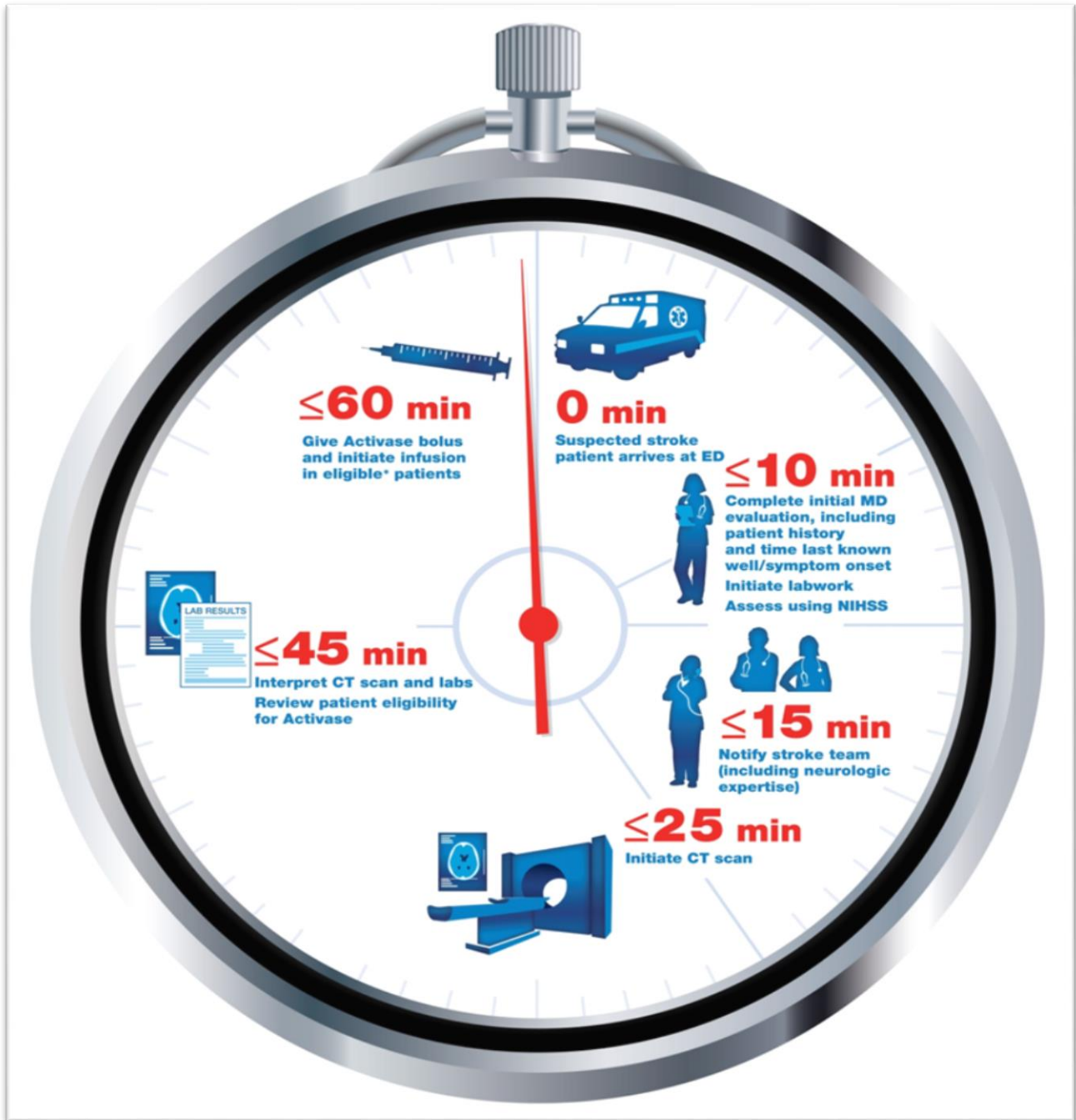


Figure 1.1: golden hour of stroke (Jeffrey L et al 2010)

### **2.1.3 The Brain**

The brain is the most complex part of the human body. The brain is the seat of intelligence, interpreter of the senses, initiator of body movement, and controller of behavior. The brain is the source of all the qualities that define our humanity. The brain is the crown jewel of the human body (Augustus 2008).

#### **2.1.3.1 Anatomy of the Brain**

The brain is composed of three parts: cerebrum, cerebellum, and brainstem. The cerebrum is made up of the left and right cerebral hemispheres, separated by the falx cerebri. Each hemisphere has five lobes: the frontal lobe in the front, the temporal and parietal lobes on the sides, the occipital lobe in the back, and the insular lobe located between the temporal lobe and the frontal lobe. The cerebral cortex is the outer layer of the cerebrum. The surface of the cerebral cortex has folds, grooves, and clefts. The folds are called gyri, the grooves are sulci, and the clefts are called fissures. These features increase the surface area of the brain while still allowing it to fit into its bony vault. The cerebral hemispheres are connected by the corpus callosum, a band of nerve fibers that allows each side to communicate with the other. The cingulate gyrus is located superior to the corpus callosum. It helps coordinate emotions. The hippocampus and the amygdala are located in the temporal lobe and are important for memory. The cerebellum is the portion of the brain lying beneath the tentorium cerebelli in the posterior part of the cranium. It's made up of two hemispheres connected by the narrow wormlike part of the cerebellum called the vermis. The cerebellum controls balance, coordinates movement, and maintains muscle tone. The brainstem includes three parts: the midbrain is the most superior part, the pons is in the middle, and the medulla oblongata (medulla) is the most inferior portion and connects to the spinal cord.

The brainstem controls your levels of alertness, arousal, respiratory rate, blood pressure, digestion, heart rate, and other autonomic functions (Augustus 2008).

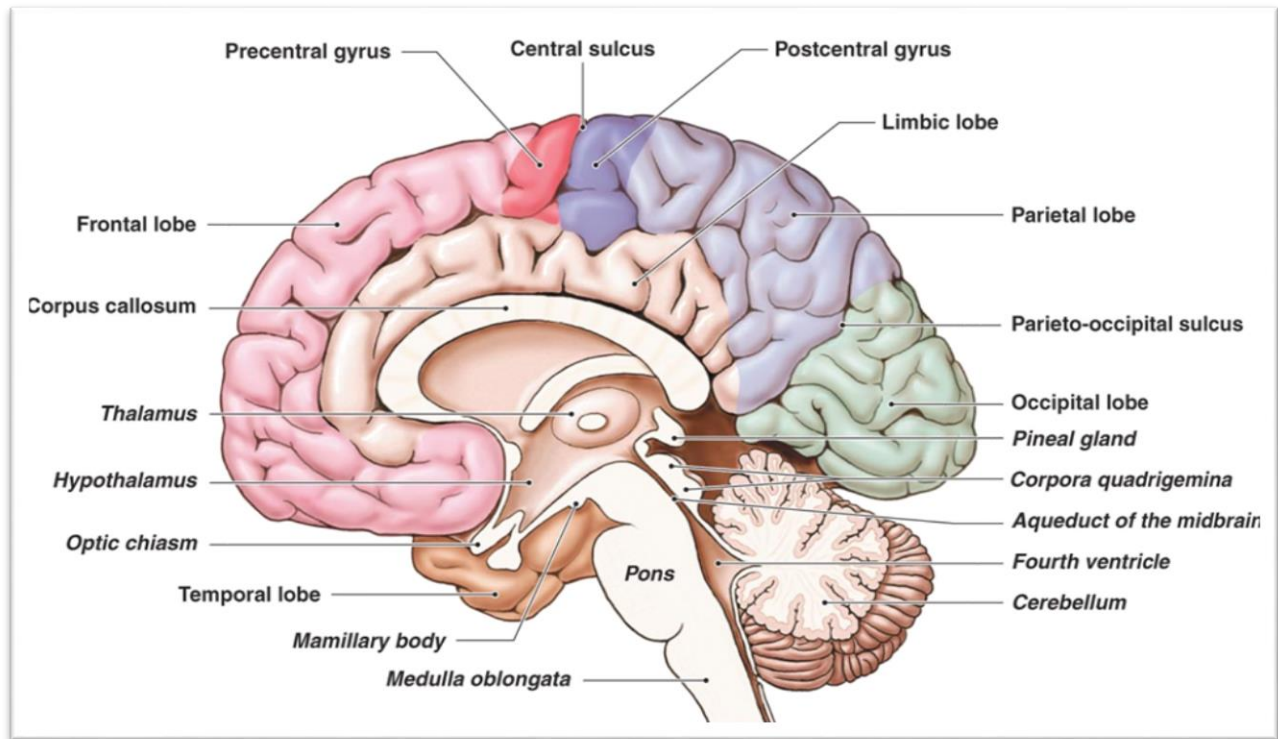


Figure 1.2: Anatomy of the brain (Augustus 2008)

### 2.1.3.2 Physiology of the Brain

The cerebrum is the largest part of the brain and is composed of right and left hemispheres. It performs higher functions like interpreting touch, vision and hearing, as well as speech, reasoning, emotions, learning, and fine control of movement. The cerebellum is located under the cerebrum. Its function is to coordinate muscle movements, maintain posture, and balance. The brainstem

includes the midbrain, pons, and medulla. It acts as a relay center connecting the cerebrum and cerebellum to the spinal cord. It performs many automatic functions such as breathing, heart rate, body temperature, wake and sleep cycles, digestion, sneezing, coughing, vomiting, and swallowing. Ten of the twelve cranial nerves originate in the brainstem (Augustus 2008).

### **2.1.3.3 Pathology of the Brain**

Neurological disorders are diseases of the central and peripheral nervous system. In other words, the brain, spinal cord, cranial nerves, peripheral nerves, nerve roots, autonomic nervous system, neuromuscular junction, and muscles. These disorders include epilepsy, Alzheimer disease and other dementias, cerebrovascular diseases including stroke, migraine and other headache disorders, multiple sclerosis, Parkinson's disease, neuroinfections, brain tumours, traumatic disorders of the nervous system such as brain trauma, and neurological disorders as a result of malnutrition (Augustus 2008).

### **2.1.4 Brain Stroke**

Strokes occur due to problems with the blood supply to the brain either the blood supply is blocked (Ischemic) or a blood vessel within the brain ruptures (Hemorrhagic). A stroke is a medical emergency, and treatment must be as quickly as possible (Saver et al 2010).

#### **2.1.4.1 Types of Stroke**

There are three main kinds of stroke; first type is Ischemic strokes happens when blood vessels are blocked by a clot or become too narrow for blood to get through to the brain, the reduced blood flow causes brain cells in the area to die from lack of oxygen, It accounts for more than 80% of all stroke cases, second



type is Hemorrhagic strokes it occurs when a weakened blood vessel ruptures, third type is Transient ischemic attacks (TIAs) also referred to as mini-strokes are caused by a temporary clot (Schwamm et al 2005).

#### **2.1.4.2 Signs and Symptoms of Stroke**

Strokes occur quickly, and as such their symptoms often appear suddenly without warning like sudden numbness, confusion, trouble seeing and severe headache. The acronym FAST is a way to remember the signs of stroke, and can help toward identifying the onset of stroke in someone, F for Face drooping Arm weakness Speech difficulty Time to look for help (Schwamm et al 2005).

#### **2.1.4.3 Diagnose of Stroke**

There are several different types of diagnostic tests that can use in order to diagnose stroke including clinical examinations, lab test and imaging studies Clinical examinations: checking patient's symptoms, medical history, check blood pressure, listen to the carotid arteries in the neck and examine the blood vessels at the back of the eyes. Lab test is complete blood count (CBC) is a routine test to determine the number of red blood cells, white blood cells, and platelets in the body. Imaging modalities includes CT, MRI, carotid ultrasound and cerebral angiogram (Schwamm et al 2005).

#### **2.1.4.4 Treatment of Stroke**

As the two main different kinds of stroke, ischemic and hemorrhagic, are caused by different factors, both require different forms of treatment. Ischemic strokes are caused by arteries being blocked or narrowed and so treatment focuses on restoring an adequate flow of blood to the brain. Treatment can begin with drugs to break down clots and prevent further ones from forming. Aspirin can be

given; injection of a tissue plasminogen activator .tPA is very effective at dissolving clots (see figure 1.3) but needs to be injected within (3-4.5) hours of stroke symptoms manifesting themselves (Keith 2001).

Hemorrhagic strokes are caused by bleeding into the brain and so treatment focuses on controlling the bleeding and reducing the pressure on the brain that it is causing. Treatment can begin with drugs being given to reduce the pressure in the brain, overall blood pressure, prevent seizures and prevent sudden constrictions of blood vessels (Keith 2001).

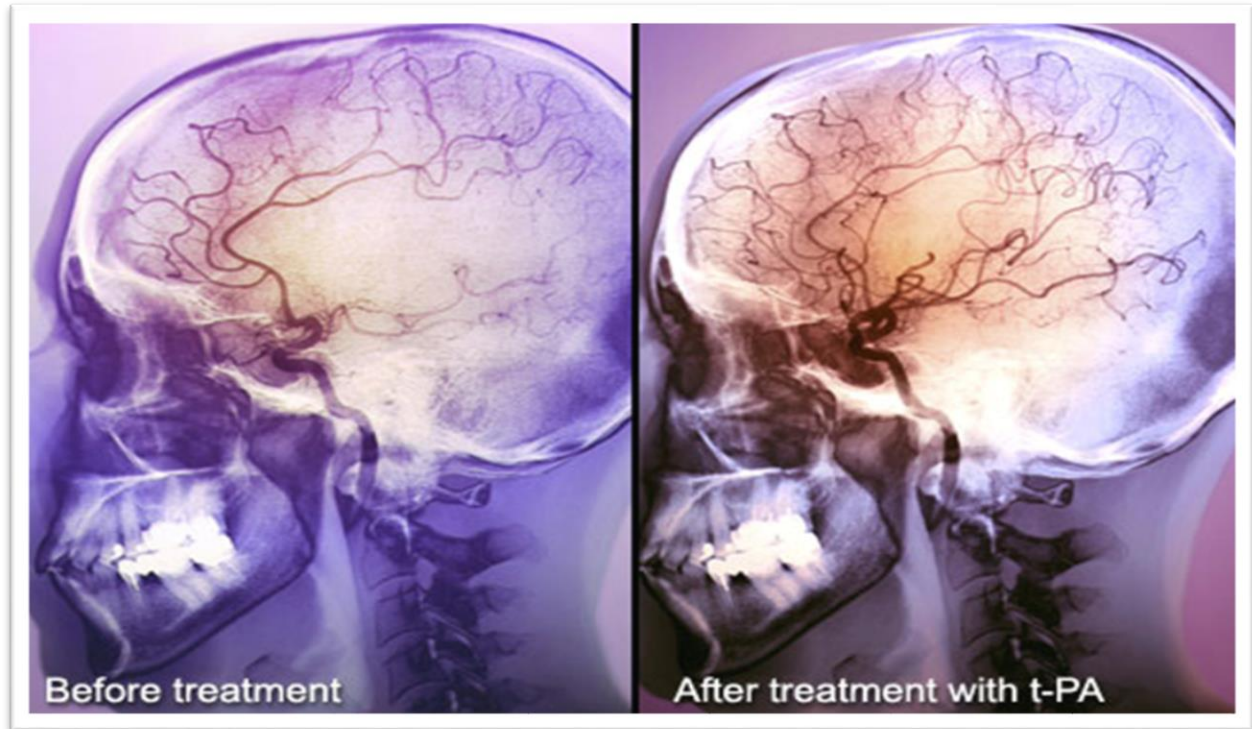


Figure 1.3: Digital subtraction angiogram of head before & after treatment of stroke with IV tPA (Saver et al 2010)

#### **2.1.4.5 Complications of Stroke**

Stroke leave complications vary according to their strength and size, may lead to a significant hemiplegia (paralysis) in half the body and sometimes disorders in swallowing, breathing, and in the circulatory system, and may cause death in the first few hours or after several hours if not treated. (Fonarow et al 2007).

#### **2.1.4.6 Stroke Risk Factors**

There are two types of risk factors controllable and uncontrollable, controllable factors are High blood pressure, atherosclerosis, heart disease, smoking, high cholesterol, diabetes, obesity and excessive alcohol intake. Uncontrollable factors are age, gender, race, family history, and artery abnormalities (Schwamm et al 2005).

### 2.1.5.1 Computerized Tomography CT

Since its introduction in the 1970s, CT has become an important tool in medical imaging to supplement X-rays and medical ultrasonography. A CT scan makes use of computer-processed combinations of many X-ray images taken from different angles to produce cross-sectional (tomographic) images (virtual 'slices') of specific areas of a scanned object, allowing the user to see inside the object without cutting. Digital geometry processing is used to generate a three-dimensional image of the inside of the object from a large series of two-dimensional radiographic images taken around a single axis of rotation. Medical imaging is the most common application of X-ray CT. Its cross-sectional images are used for diagnostic and therapeutic purposes in various medical disciplines (Srinivasan et al 2006).

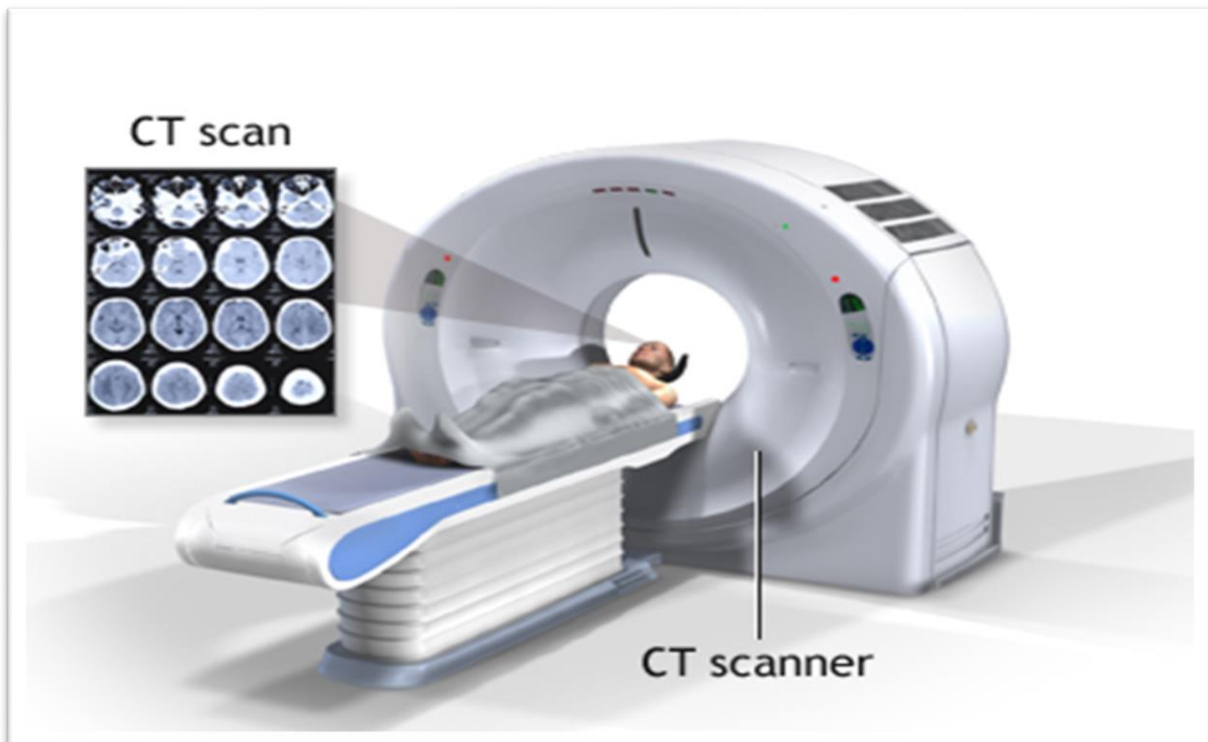


Figure 1.4: CT scanner (Srinivasan et al 2006)

### **2.1.5.2 CT Brain Stroke Protocol**

Non-contrast CT of the brain remains the mainstay of imaging in the setting on an acute stroke. It is fast, inexpensive and readily available. Its main limitation however is the limited sensitivity in the acute setting. Detection depends on the territory, the experience of the interpreting radiologist and of course the time of the scan from onset of symptoms. (Srinivasan et al 2006)

The goals of CT in the acute setting are to exclude intracranial hemorrhage, which would preclude thrombolysis; look for any "early" features of infarction and exclude other intracranial pathologies that may mimic a stroke, such as tumor (Srinivasan et al 2006).

CT angiography and CT perfusion also can help diagnose and evaluate blood vessel disease or related conditions, such as aneurysms or blockages, they requires more time than non-contrast CT brain (Srinivasan et al 2006) .

## **2.2 Literature Review of Pervious Studies**

Many studies were done to measure and evaluate and TAT of stroke patients.

(Cumbler et al. 2012) assess TAT of the first 25 minutes of golden hour for stroke patients to reduce time for strokes occurring in patients already hospitalized, and they found median inpatient stroke alert-to- complete CT time was 69.0 minutes, with 19% meeting the goal of 25 minutes from alert to CT time.

(Gregg. et al 2011) was performed a study of full 60 minutes of golden hour to improve outcomes for ischemic stroke patients by helping hospitals achieve door-to-needle (DTN) times of 60 minutes or less. Study conducted in 98

hospitals, 6867 acute patients, 118 IV TPA. Treatment within target 60 minutes was 14.4%.

(Jeffrey et al. 2010) was performed a study TAT of full 60 minutes of golden hour for stroke patients. During the 4.75 years study period, among (253,148) stroke patients at 905 hospital Emergency Departments. A door-to-needle TAT of  $\leq 60$  minutes was achieved in 18.3% of golden hour patients.

(Janine et al 2010) were studied TAT of 10 minutes of golden hour from complete to start CT brain for stroke patients , A nine months of data, noted that the median CT brain stroke TAT for patients was 21.88 minutes with patients receiving IV tPA within 60 minutes of arrival.

(Atte et al 2004) were performed study of TAT for full 60 minutes of golden hour, Door-To-Needle (DNT) study; they found median TAT was reduced from median 105 minutes in 1998, to 60 minutes in 2003.

(Young et al 2009) had done a prospective multicenter study for pre hospital delay not in hospital delay, the study conducted at 14 tertiary hospitals in Korea from March 2009 to July 2009 aimed to investigate the factors associated with pre hospital delay after acute ischemic stroke. There result among 500 stroke patients under study the median time interval was 474 minutes pre hospital delay.

## **Chapter Three Material and Methods**

### **3.1 Materials**

#### **3.1.1 Patients**

The study population consists of all the patients admitted in emergency department with suspected stroke and send to medical imaging department for CT brain for stroke during duration of study from January to May of the year of 2015.

#### **3.1.2 Sample Size**

The total number of patients admitted in ED and send to medical imaging department for CT brain for stroke was 105 patients as sample size during duration of study.

#### **3.1.3 Research Place**

The Study was conducted in Al Raha hospital (UAE). It was chosen as the most appropriate place to conduct this type of study because there is an emergency department in the hospital with a capacity of 30 beds, the hospital contains a 64 slices CT machine, also supports a comprehensive electronic filmless paperless hospital information system (HIS) to manage patient files, Medical imaging department depend on paperless Radiology Information System (RIS) and filmless Picture Archiving and Communication System (PACS).

## **3.2 Methods**

### **3.2.1 Data collection**

Data were collected from electronic patient file of hospital information system (HIS) through data collection sheet (see appendix 1) which included patient number, month, examination, reason for examination , arrival date/ time of patient to ED, start date/time of start CT , complete date/time of CT and report CT date/time.

### **3.2.2 Data Analysis**

Median of each TAT calculated by equation:

$$\text{Sum of TAT minutes} / \text{total number of patients}$$

Percentage of each TAT calculated by equation:

$$\text{Number of each TAT patients} / \text{total number of patients} \times 100$$

Data of each TAT categorized into TAT-A for patients performed within recommended TAT and TAT-B for patients their TAT exceeds recommended TAT (appendix 2).



## Chapter Four Results

### 4.1 Result of TAT 1

Table 4.1: Result of TAT 1 A & B by number of patients, sum time, median & %

Result of TAT 1	TAT 1 from arrival to start CT		
	TAT 1-A > 15 min	TAT 1-B ≤ 15 min	TAT 1
No. of patients	95	10	105
Sum time (min)	3146	90	3236
Median time (min)	33.11	9.00	30.81
%	90.47%	9.53%	100%

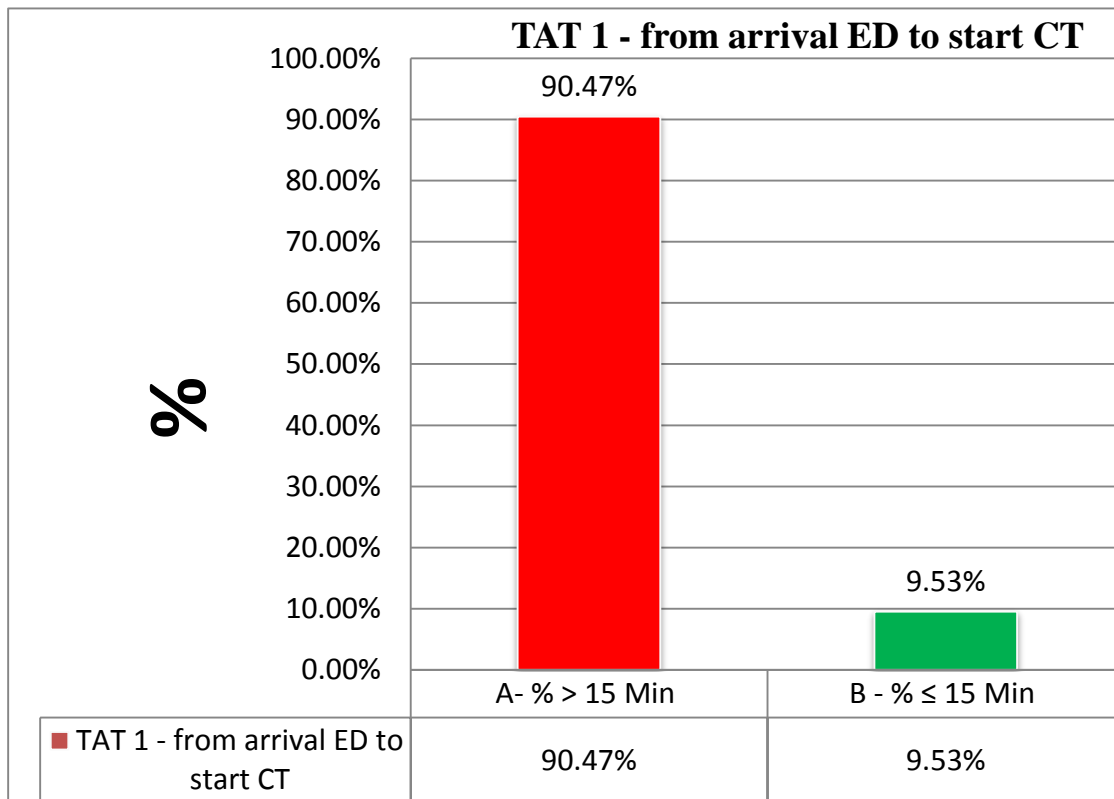


Figure 4.1: Relation between TAT 1 and %

## 4.2 Result of TAT 2

Table 4.2: Result of TAT 2 A & B by number of patients, sum time, median & %

Result of TAT 2	TAT 2 :from start to complete CT		
	TAT 2-A > 10 min	TAT 2-B≤10 min	TAT 2
No of patients	21	84	105
sum time (min)	331	605	936
Median time ( min)	15.76	7.20	8.91
%	20.00%	80.00%	100%

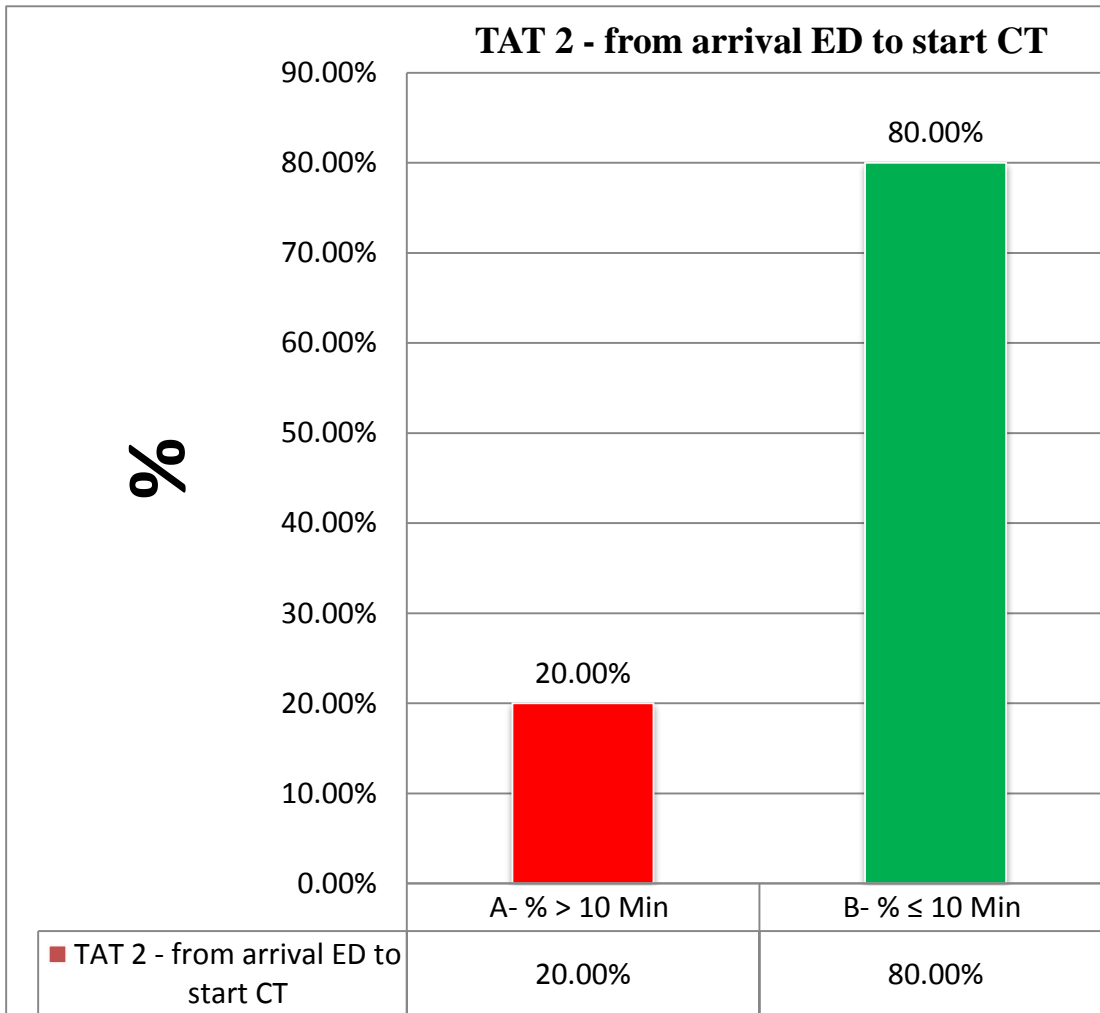


Figure 4.2: Relation between TAT 2 and %

### 4.3 Result of TAT 3

Table 4.3: Result of TAT 3 A & B by number of patients, sum time, median & %

Result of TAT 3	TAT 3-From complete CT to report CT		
	Time 3-A > 20 min	TAT 3- B ≤ 20 min	TAT 3
No of patients	14	91	105
sum time (min)	487	702	1189
Median time ( min)	34.78	7.71	11.32
%	13.33%	86.67%	100%

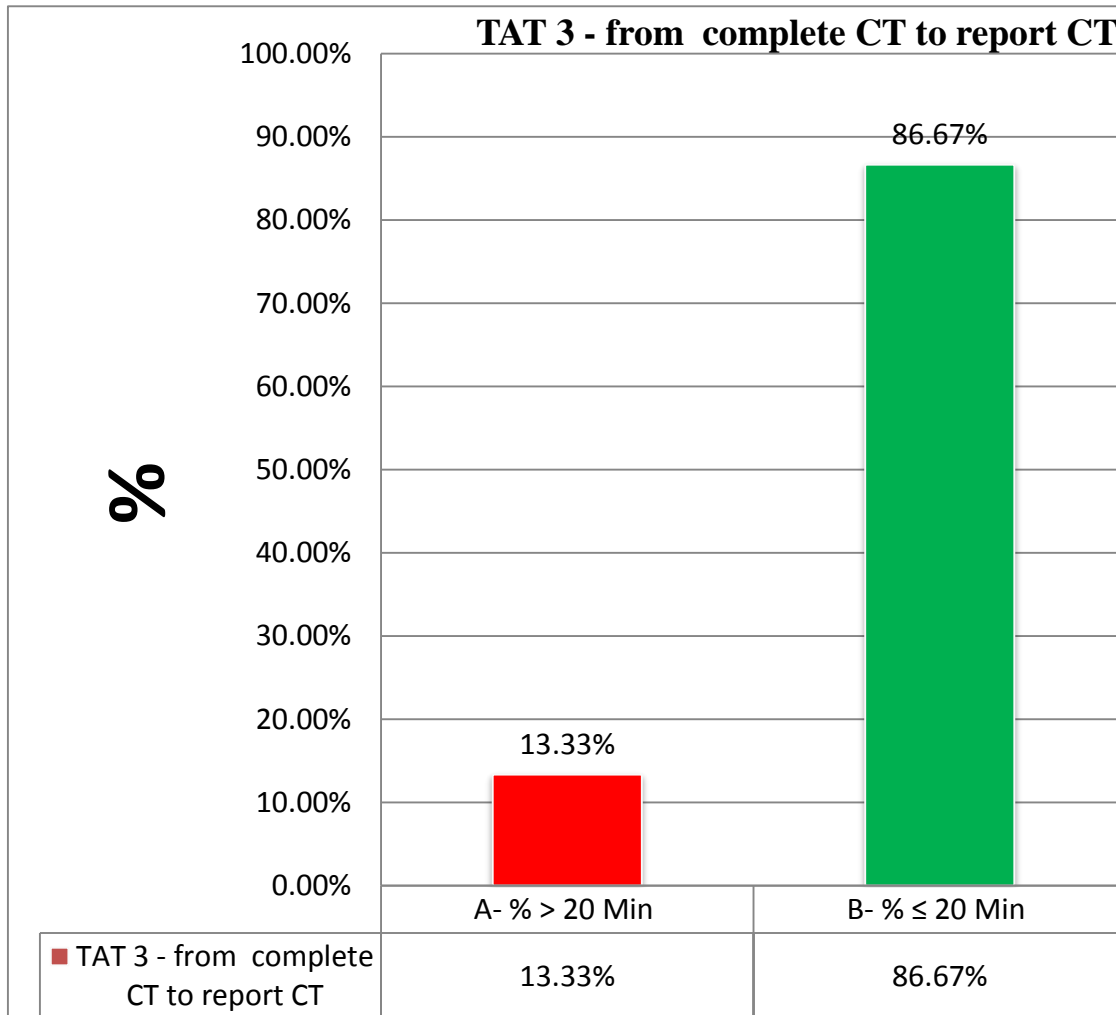


Figure 4.3: Relation between TAT 3 and %

#### 4.4 Result of TAT 4

Table 4.4: Result of TAT 4 A & B by number of patients, sum time, median & %

Result of TAT 4	TAT 4 from arrival to report CT		
	TAT 4 -A> 45 min	TAT 4 -B≤ 45 min	TAT 4
No of patients	52	53	105
sum time (min)	3158	2203	5361
Median time ( min)	60.73	41.56	51.05
%	49.52%	50.48%	100%

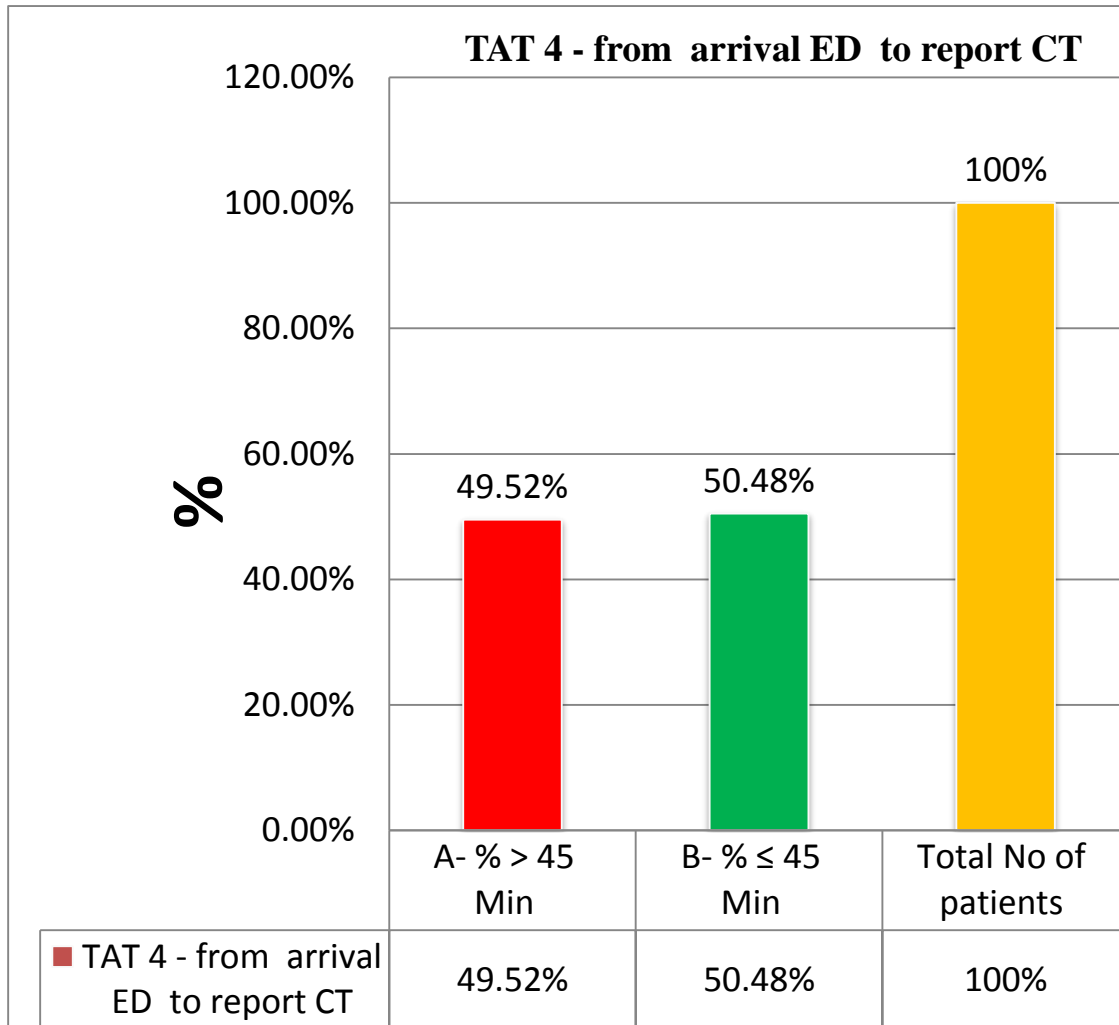


Figure 4.4: Relation between TAT 4 and %

## 4.5 Total Result of TAT

Table 4.5: Total Result of TATs A & B by number of patients

Result of TAT	TAT 1: from arrival to start CT			TAT 2: from start to complete CT			TAT 3: From complete report CT			TAT 4: from arrival to report CT		
	TA T 1 A	TAT 1 B	TA T 1	TAT 2 A	TAT 2 B	TA T 2	TAT 3 A	TAT 3 B	TA T 3	TAT 4 A	TAT 4 B	TA T 4
No. of patients	95	10	105	21	84	105	14	91	105	52	53	105

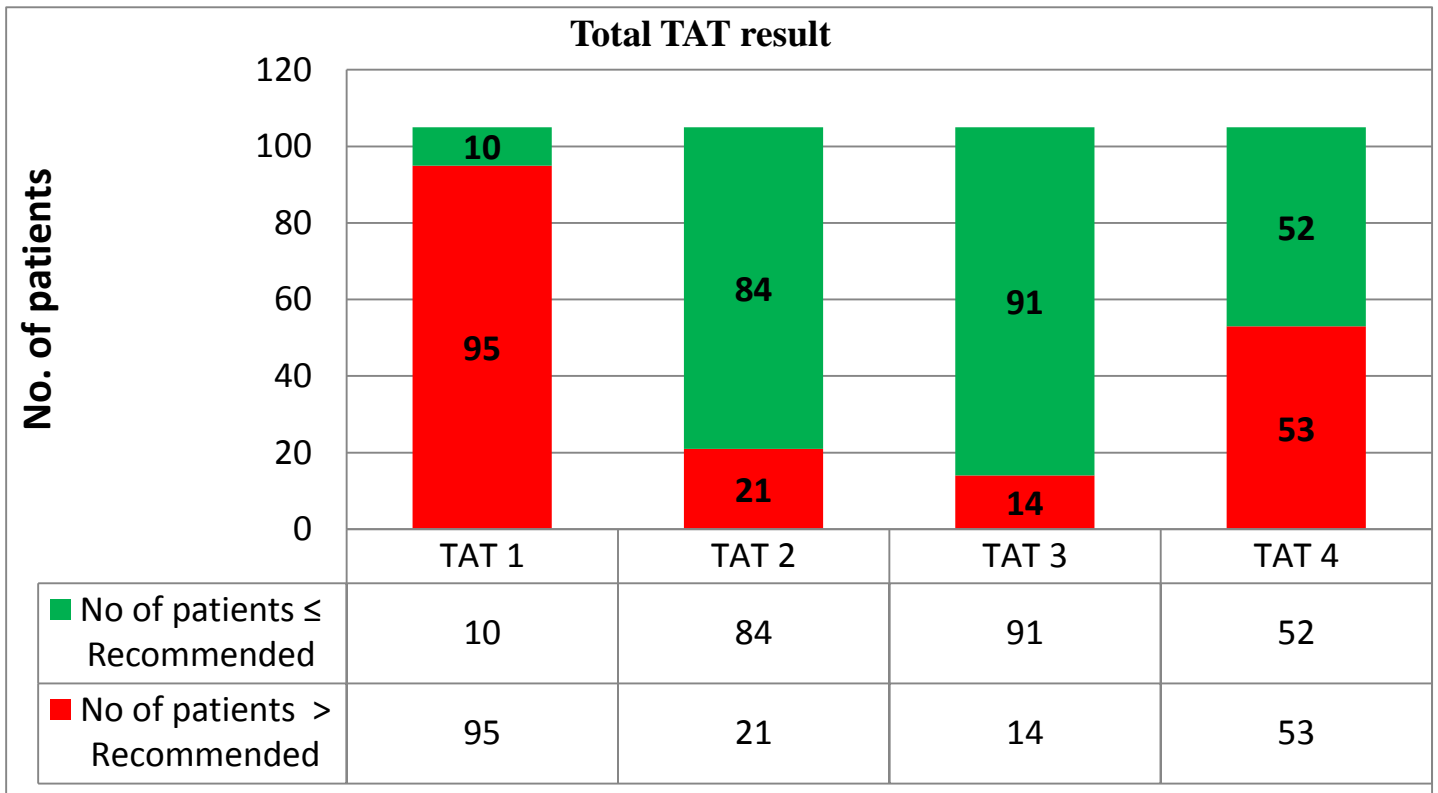


Figure 4.3: Relation between TATs and number of patients

## **Chapter Five Discussion, conclusion and recommendations**

### **5.1 Discussion**

(Table 4.1) and (Figure 4.1) The sum total of TAT 1 was 3236 minutes with median of 30.81 minutes. The result of TAT 1 –A was 95 patients which equivalent 90.47 % of total numbers of patients with median of 33.11 minutes, with sum total 3156 minutes. The result of TAT 1-B was 10 patients which equivalent 8.53 % of total numbers of patients with median 9 minutes, with sum total 90 minutes.

The sum total of TAT 2 was 936 minutes with median of 8.91 minutes. The result of TAT 2 –A was 21 patients which equivalent 20 % of total numbers of patients with median of 15.76 minutes, with sum total 3131 minutes. The result of TAT 2-B was 84 patients which equivalent 80 % of total numbers of patients with median 7.20 minutes, with sum total 605 minutes.

(Table 4.3) and (Figure 4.3) The sum total of TAT 3 was 1189 minutes with median of 11.32 minutes. The result of TAT 3 –A was 14 patients which equivalent 13.33 % of total numbers of patients with median of 34.78 minutes, with sum total 478 minutes. The result of TAT 3-B was 91 patients which equivalent 86.67 % of total numbers of patients with median 7.71 minutes, with sum total 702 minutes.

(Table 4.4) and (Figure 4.4) The sum total of TAT 4 was 5361 minutes with median of 51.05 minutes. The result of TAT 4 –A was 52 patients which equivalent 46.52 % of total numbers of patients with median of 60.73 minutes, with sum total 3158 minutes. The result of TAT 4-B was 53 patients which equivalent 53.48 % of total numbers of patients with median 41.56 minutes, with sum total 2203 minutes.

(Table 4.5) and (Figure 4.5) Results revealed the efficiency and lack of in TATs process, the percentage of standalone performances from highest to lowest was

(86.67 % in TAT 3), (80 % TAT 2) and (9.53% in TAT 1).The number of patients performed with recommended TAT were 10,84,91 and 53 patients for TAT 1,2,3 and 4.

In TAT 1 there were 13 patients (12.38%) of total patients there TAT exceed 45 minutes where it became impossible there TAT 4 to be  $\leq$  45 minutes.

Although the different between final result of TAT 4-A and TAT 4 –B only one patient which equivalent (0.96 %) of total number of patients , the different between A and B categories are varies in other TATs , it has reached 85 patients (80.94%) in TAT 1, 63 Patients (60%) in TAT 2 and 77 patients (73.34 %) in TAT 3, this explains the standalone performances in each stage TAT separately , where the best TAT was in TAT 3 ( %), second in TAT 2(%) and third in TAT 1(%).

(Cumbler et al. 2012) assess TAT of the first 25 minutes of golden hour of stroke patients to reduce time for strokes occurring in patients already hospitalized, and they found median inpatient stroke alert-to- complete CT time was 69.0 minutes, with 19% meeting the goal of 25 minutes from alert to CT time.

Cumbler et al were studied the first 25 minutes while this study studied the first 45 minutes from the full 60 minutes of golden hour, their study had done on patients already hospitalized (inpatients) while this study done for emergency patients. Their study goal to reduce median TAT alert to CT from 69.0 minutes to 25 minutes as a target goal while this study goal to evaluate TAT from arrival time to report CT time. But if we compare the target goal of Cumbler et al 19 % with the result of this study from arrival to CT (see appendix 6), we find our percentage from arrival to complete CT is only 8.57 % the different in percentage between two studies can be explained by the long TAT 1 of this study where a 95 patients (90.47 %) of total patients taken more than TAT recommended. Another factor may

explained the deferent is Cumbler et al studied the TAT in inpatients where the status of patients well known and clinical data were available unlike this study where are studied emergency patients whose need more time to examined and take clinical data of patients.

(Gregg. et al 2011) was performed a study of full 60 minutes of golden hour of stroke patients to improve outcomes for ischemic stroke patients by helping hospitals achieve door-to-needle (DTN) times of 60 minutes or less. Study conducted in 98 hospitals, 6867 acute patients, 118 IV TPA. Treatment within target 60 minutes was 14.4%.

Gregg et al study focused on the full 60 minutes while this study focused on first 45 minutes of golden hour. Their study conducted in 98 hospitals and 6867 patients while this study had conducted in one hospital and 105 patients, but if we compare result of goal achieved (14.4%) by Gregg et al with result of this study (50.48%) of patients done  $\leq 45$  minutes we find the different of (36.08%) between two results, taking into account all different factors between two studies mentioned previously.

(Jeffrey et al. 2010) was performed a study the TAT of full 60 minutes of golden hour of stroke patients during t 4.75 years study period, among (253,148) stroke patients at 905 hospital emergency departments. A door-to-needle TAT of  $\leq 60$  minutes was achieved in 18.3% of golden hour patients.

Jeffery et al focused also in full 60 minutes while this study focused on first 45 minutes of golden hour. The duration of Jeffery et al Study also much longer it was 4.75 years (57 months) while the duration of this study was (only 5 months). The Sample size of Jeffery et al study also much larger it was 253,148 stroke patients while it was 105 patients of this study. The study of Jeffery et al conducted in 905 hospital emergency departments whiles this study done in only one hospital



emergency department. But if we compare the result achieved by Jeffrey et al which is 18.3% with result achieved by this study a arrival to report CT time  $\leq 45$  minutes was 50.48%, we find 32.18 % different between results ,taking into account all different factors mentioned previously.

(Janine et al 2010) were studied TAT of 10 minutes of golden hour of stroke patients from complete to start CT, A nine months of data, noted that the median TAT CT brain stroke for patients was 21.88 minutes with patients receiving IV tPA within 60 minutes of arrival.

Janine et al study focused only in the time of CT brain for stroke patients (TAT 2) in this study, and had calculated the value of median time of scan, while this study focused on TAT from arrival time to report CT including the scan time. The study duration of Janine et al was 9 months while this study duration was five months, but in order to make a fair and free of bias compression between two studies, we will take a median of TAT of first five months from Janine et al study which is (14.4 minutes- figure 4.1) and compare it with the median TAT 2 of five months of this study which is (8.91 minutes) see (table4.2), we find a 5.49 minutes between Janine et al study and this study.

(Atte et al 2004) were performed TAT of full 60 minutes of golden hour of stroke patients from Door-To-Needle (DTN) study; they found median TAT was reduced from median 105 minutes in 1998, to 60 minutes in 2003, As mentioned previously this study focused first 45 minutes of golden hour of stroke (Door-to-report CT), while (Atte et al 2003) focused on Door-To-Needle (DTN) full 60 minutes golden hour. Also (Atte et al .2003) had conducted two studies and compared the tow results, while this study were conducted once a time, but if we compare the latest result by Atte et al in 2003 which it was 60 minutes for median door to needle with

given result given by this study (from arrival to report CT is 51.05 minutes) we find 8.95 minutes different between result of two studies, taking into account all the different factors between two studies mentioned previously.

(Young et al 2009) had done a prospective multicenter study of pre hospital delay( not in hospital delay ). The study conducted at 14 tertiary hospitals in Korea from March 2009 to July 2009 aimed to investigate the factors associated with pre hospital delay after acute ischemic stroke. There result among 500 stroke patients under study the median time interval was 474 minutes pre hospital delay.

Although Young et al study related to pre hospital delay and our study related to in-hospital delay, but I mentioned there study to draw attention to pre hospital delay because sometime even if TAT was perfect, patient may be not be eligible to IV tPA therapy if patient arrived after 4.5 hours from onset of symptoms because IV tPA supposed to be administrate within 3- 4.5 hours from onset of stroke symptoms for better outcomes.

## 5.2 Conclusion

This study shows that only (53.48%) stroke patients achieved within recommended TAT, although the results are somewhat unsatisfactory (standard in UAE  $\geq 80\%$ ) but this can lead to establish and apply best practice strategies and stroke protocols to improve TAT of stroke patients, study also highlights the importance of time where more time lost is more brain lost.

The also study reveals the efficiency and lack of in TATs process as best performance was for TAT 3( 86.67%) ,second was TAT 2(80%) and last was TAT1 (9.53%), and this providing opportunities to know which TAT need more efforts to be improved.

### **5.3 Recommendation of the study**

In order to improve TAT of brain stroke patient the researcher strongly recommends to:

- 1- All patients with suspected stroke in UAE should be triaged with the same priority as patients with acute myocardial infarction or serious trauma, regardless of the severity of the deficits.
- 2- Create efficient pathways and processes to rapidly identify and evaluate potential stroke patients.
- 3- Organize stroke protocol for the emergency evaluation of patients with suspected stroke.
- 4- Establish of lectures and seminars on TAT for stroke patients for hospital staff to increase knowledge about the subject.
- 5- Issuing bulletins from the hospital management to the public include easy and simple information about the golden hour of stroke and TAT in order to increase awareness for the public.
- 6- Consider TAT for stroke patient as one of medical imaging department KPI to measure performance.

#### **Suggestions**

- Expanding the duration of future studies to at least 6 months or one year for better assessment of TAT process.
- Includes the last 15 minutes of golden hour.
- Include other criteria than time like age, gender, stroke type and pre hospital delay.
- Include inpatients and outpatients.