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Utilizing Lean Management Techniques to Improve Head CT Scan Turnaround Time of Ischemic Stroke Patients in the Emergency Department of Dr. Mohammad Hoesin Hospital, Palembang

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Abstract

Stroke is the most common neurological problem encountered in an emergency department. The management of acute stroke in an emergency department in South Sumatra has not been the most important standard of examination in the diagnosis of stroke, especially ischemic stroke. Thrombolytic therapy was performed on patients within 3 hours after onset. The process of CT Scan of head at the arrival department of Emergency Department Mohammad Hoesin Hospital Palembang takes 4 hours from arrival to examination[1], while according to the guideline, it should take no more than 25 minutes [2]. The application of lean method is expected to improve the service quality for ischemic stroke patients in emergency departments. This study used an operational study method with lean management approach in accordance with the head CT scan evaluation of ischemic stroke patients in emergency departments. The evaluation started from the triage until the head CT scan examination. This study was conducted at the Mohammad Hoesin Hospital Palembang emergency department from November until December 2016. Primary data were collected from direct observation as well as interviews with informants, while secondary data were obtained with document search, patient service flow charts and other related data in emergency departments. Current value stream map showed that the CT scan turnaround time was 175.41 minutes, in 87.8% were waste activities (non-value-added), 6.9% were value-added activities and 5.26% were NVA but necessary. After utilizing lean management techniques, simulated value stream map showed significant decrease in lead time to 30.09 minutes, followed by increased in value-added activities and percentage of non-value-added activities. The results of this study are in accordance with what was disclosed by McManus [3] and Eitel [4] that the lean principle on increasing the percentage of value-added activities and reducing waste, thus providing considerable success in improving the quality of emergency room services. Lean management technique successfully improves the head CT scan turnaround time of ischemic stroke patients in the emergency department.

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Keywords: lean management, value streaming map, value-added, non-value-added

1. Introduction

Stroke is a neurological case most encountered in the emergency room. Of all strokes, ischemic strokes occur 87% and bleeding strokes 13% [5]. Until the end of 2015, the management of acute stroke in most hospital emergency rooms in the South Sumatra region had not been optimal, especially the management of acute ischemic stroke which required prompt and accurate management within 3 hours after the onset of the incident.

Since the enactment of the National Health Insurance (JKN) in 2014, patient visits at Dr. Moh. Hoesin Palembang Government General Hospital increases significantly which causes overcrowded in the Emergency Department (ED). This overcrowded condition causes the length of stay in the ED to be longer and the waiting time for support- ing investigations is longer, so that the diagnosis and management, especially stroke patients, are delayed. Currently, the average of waiting time for the head CT scan services for ischemic stroke patients at the Dr. Moh. Hoesin Palembang Government General Hospital is 4 hours. This length of time is still below standard [1]. Time standard for the implementation of the head CT scan services start from patients' arrival until they got all services is 25 minutes and for interpreting the results of the Head CT Scan are 45 minutes [2]. It needs a lean management for improving the quality of ischemic stroke services at Dr. Moh. Hoesin Palembang Government General Hospital by reducing the waiting time in the process of carrying out the head CT scan.

2. Methods

This research uses operational research method with lean management approach to the process flow of the head CT scan for ischemic stroke patients in the Emergency Department (ED) starting from triage until the patient got all the services. This study recorded the length of time from each stage that takes place. It was conducted at the Emergency Department (ED) in Dr. Moh. Hoesin Palembang Government General Hos- pital starts from November 2016 until December 2016. Primary data was obtained from direct observation on the flow of the head CT scan for ischemic stroke patients with the lean method approach at the Emergency Room (RD) and Radiology Installation of Dr. Moh. Hoesin Palembang Government General Hospital as well as structured interviews and Focus Group Discussions/FGD with informants. The flow of service processes for ischemic stroke patients in the emergency department and all related units will be observed directly to calculate the time used in each stage of the process, from triage

to the head CT scan. Secondary data was obtained by searching documents, the service flow of ED patients, and other related data in the Emergency Department (ED) of Dr. Moh. Hoesin Palembang Government General Hospital.

The observation population was ischemic stroke patients who came to Dr. Moh. Hoesin Palembang. The sample observed in this study were patients with suspected ischemic stroke who followed the flow of the head CT in the ED. The inclusion criteria of patients observed were patients with suspicion of ischemic stroke who came alone or through the referral from another hospital to the ED who followed each stage of the flow process of the head CT scan in the ED. Exclusion criteria were patients with suspicion of unstable ischemic stroke which requires initial cardiac pulmonary resuscitation before attending each stage of the process of carrying out the head CT scan in the ED.

The number of processes observed was 22 patients. The number of samples observed for 2 weeks of simulation was 11 patients. Informants were selected by means of purposive sampling which was determined by researchers through several considerations. There were 9 informants, namely registration staff, triage nurses, P2 nurses, triage doctors, neurology residents, transporters, radiographers, top managers of the ER, top managers of the Department of Neurology, and top managers of Radiology Installation. Data collection methods were carried out by observation, Focus Group Discussion (FGD), in-depth interviews, and document review. Data collection instruments are observation guidelines, guidelines for FGD, guidelines for interviews, and other tools such as watches or stop watch. Data validation is done by data source triangulation techniques and methodology triangulation.

Data were analyzed through several stages using the principle of the lean method, which is done by making a groove from each stage of the process of the head CT scan for ischemic stroke patients in the Emergency Department (ED). The analysis includes time spent at each stage, identification of value and waste, formulation of the Value Stream Map/VSM (the current state in the hospital), determining of a root of the problem with the 5 whys method, proposed improvements for waste elimination, as well as making VSM simulations. Informants in the study will be given an explanation in advance about the purpose of the study and they are asked to sign the informed consent form provided.

3. Results

Based on a document search, the service flow observed was in accordance with the service flow that had been going on in the Emergency Department (ED). Flow chart

can be seen in Figure 1. The lead time for the entire process of the head CT scan for ischemic stroke patients in the Emergency Department (ED) was 175.41 minutes (SD = 135.97).
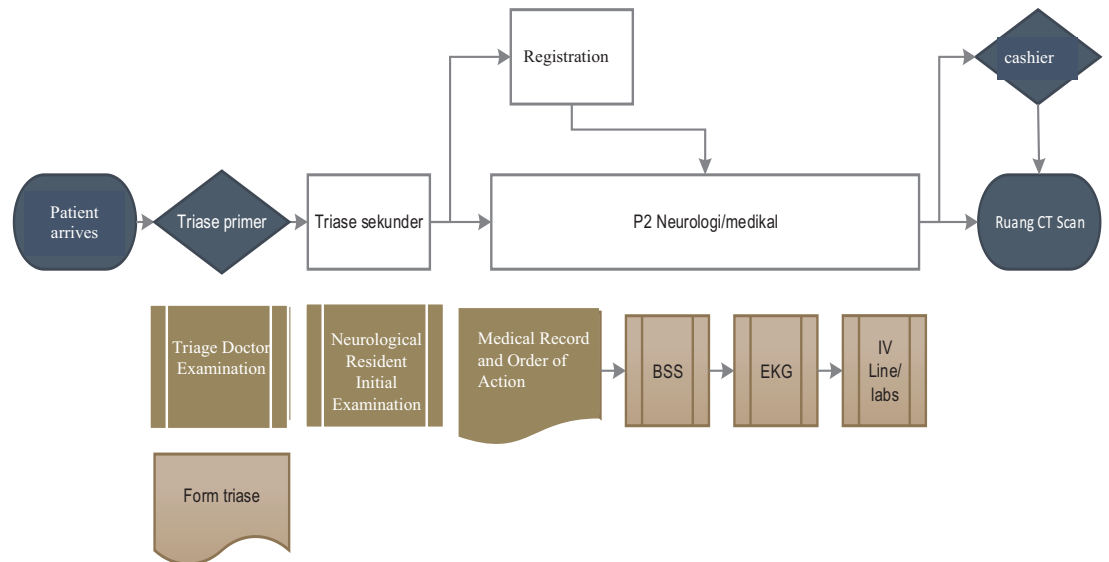

Figure 1: Flow chart for the implementation of the Head CT Scan for ischemic stroke patients before lean analysis.

After identifying the value, obtained 3 wastes in the head CT scan process for ischemic stroke patients in the Emergency Department (ED), namely transportation, waiting and overproduction. Waste transportation takes 6.77 minutes for activities belonging to NVA/waste. For waste on the service waiting time, it takes the longest time with 163.8 minutes, while the total waste overproduction is 23 minutes. From the total observations, it can be concluded that 87.8% of the time spent on the entire process of implementing the head CT scan for ischemic stroke patients in the RSMH Emergency Department (ED) is waste (NVA). While the value-added activity is only 6.9% and the NVA but necessary is 5.26%.

From the current VSM data shown in Figure 2, can be seen the amount of time spent on value-added activities is 12.18 minutes, non-value-added but necessary is 9.23 minutes and recorded the time spent for waiting the services is 154 minutes. The longest waiting time is in the process of preparing a CT head scan (102.77 minutes), which includes waiting for the porter to transfer internally and waiting for the radiographer before a CT scan.

Root analysis of the problem in this study was carried out through a Focus Group Discussion (FGD) process. FGD was conducted on informants who were directly involved in the stage of the head CT process in the ED, namely triage doctors, triage nurses, administrative officers, P2 nurses, neurology residents, porters, and radiographers. In
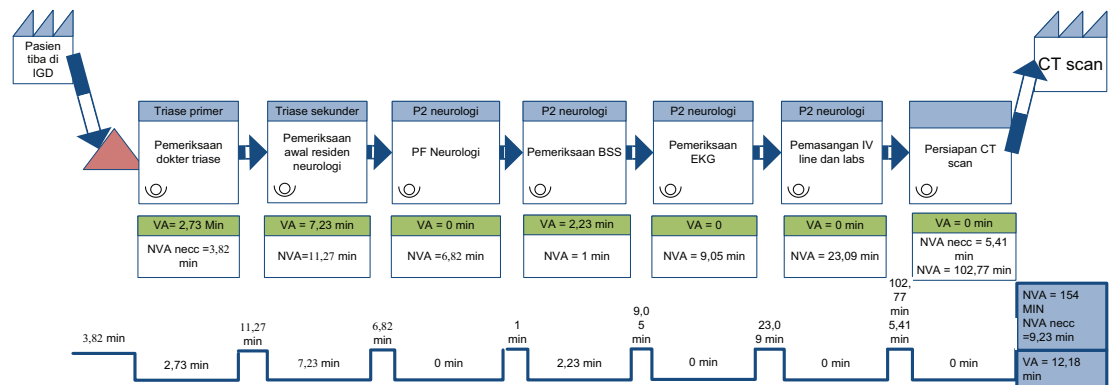
Figure 2: Current value streaming map.

detail, the root of the problem can be seen in Figure 3. After finding the root of the problem from the FGD implementation, then improvements are made using several lean methods. The lean tools used in this study include standardized work, visual management, and ideal Value Streaming Map. In Table 1, it can be seen several suggestions for improving the process of implementing CT scans of a head of ischemic stroke patients in the ED.
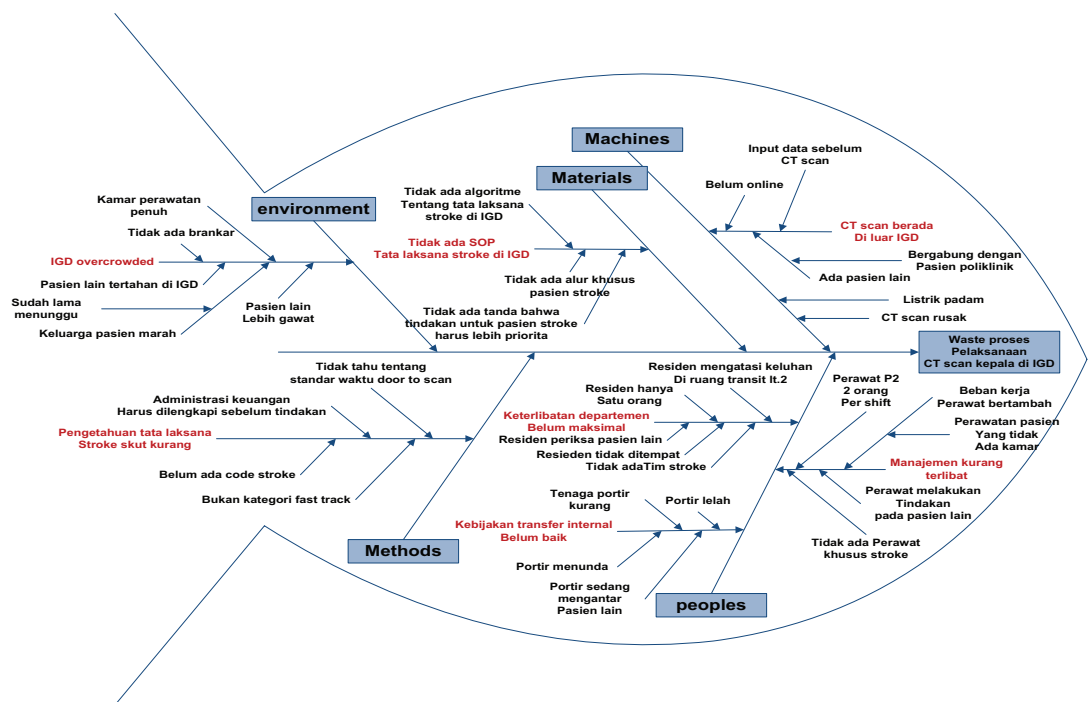

Figure 3: Ishikawa diagram (*Fishbone*).

After the analysis, there were 4 things that could be done immediately in a short time to improve the flow of the head CT scan process for ischemic stroke patients in the ED, that is (1) create new pathways (Figures 4 and 5); (2) addition of neurological residents who served in the emergency department; (3) coordinating with radiology

TABLE 1: Summary of proposals for improving quality of the Head CT Scan process for ischemic stroke patients in the Emergency Department (ED).

A Root of the Problem	Proposed Improvements
There is no Standard Operating Procedure/SOP specifically for stroke management in the ED	•Standard Operating Procedure/SOP making to regulate the management of acute stroke in the emergency room •Protocols making for managing acute stroke in the emergency room •The formation of a stroke code •The improvement of the services pathway for ischemic stroke patients in the ED
The involvement and policies of the neurology department have not been maximized	•Addition of the number of residents serving in the emergency department
Internal transfer policy is not good enough	•Improving the scope of internal transfer policy, which includes entering stroke cases as fast track categories
The involvement of management in regulating nurse duties with increasing workloads is still lacking	•The formation of a special stroke management team involving neurologists, neurology residents, and nurses proficient in strokes
Knowledge of management of acute stroke is lacking	•Training and education of stroke patients specifically for emergency care staff
CT scan is at the radiology installation	•Procurement of CT scan equipment in the emergency •room Provides fast track marks for stroke patients
The ED is overcrowded	•Improved tiered referral system for emergency cases

installations to prioritize stroke patients to do the head CT scan; and (4) dissemination of new pathways and giving brief information about stroke management to the ED's health staff and all neurological residents.
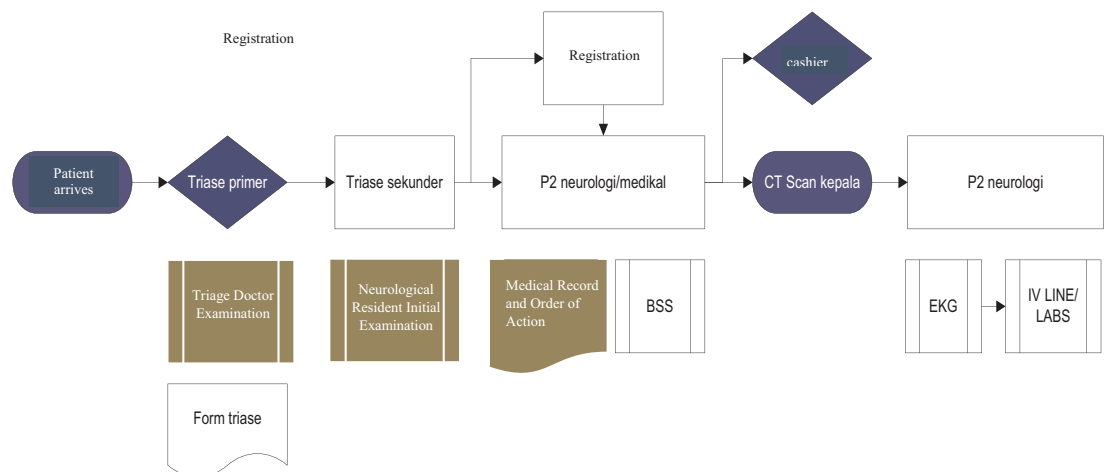

Figure 4: Simulation flow chart for the Head CT Scan for ischemic stroke patients after lean analysis.

After an invasion for 1 week, re-observation of the head CT scan process was carried out, starting with the patient arriving at the ED until the patient had all the services.
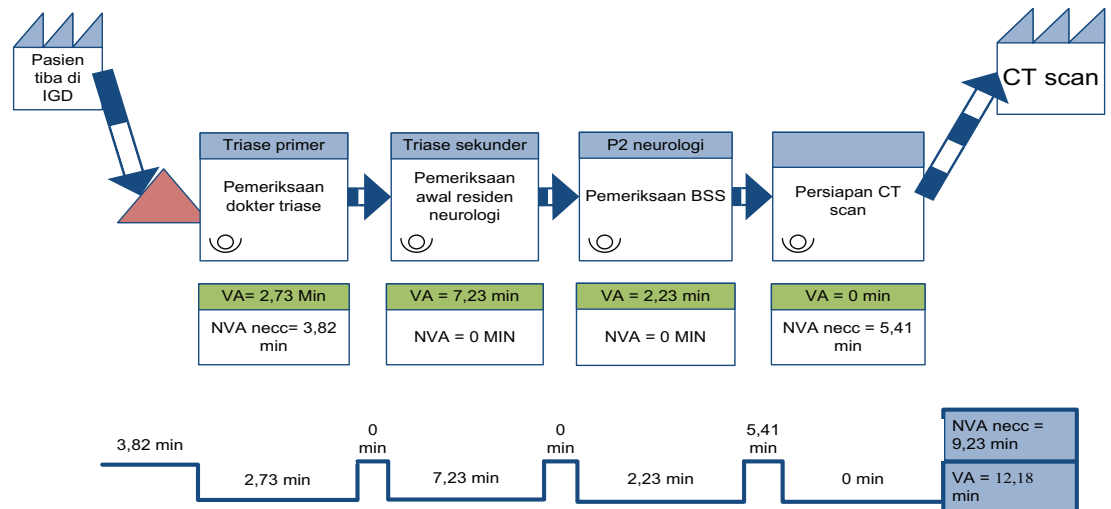
Figure 5: Ideal value streaming map.

From the simulation, it is known that the percentage of value-added times from the whole process increased from 6.9% to 19.3% after lean management, while the percentage of NVA/waste decreased from 87.8% to 61.97%. Based on simulated VSM (Figure 6), from the total activities, the time spent on VA activities was 5.81 minutes down from the previous 12.18 minutes. The NVA but necessary activities also decreased from 9.23 minutes to 5.63 minutes. NVA activities are still found in VSM stimulated but then decreased significantly from 154 minutes to 18.64 minutes. The total lead time of the head CT scan process for ischemic stroke patients in the ED after lean analysis decreased from 175.41 minutes to only 30.09 minutes, even though it had not reached the standard time set which was 25 minutes.
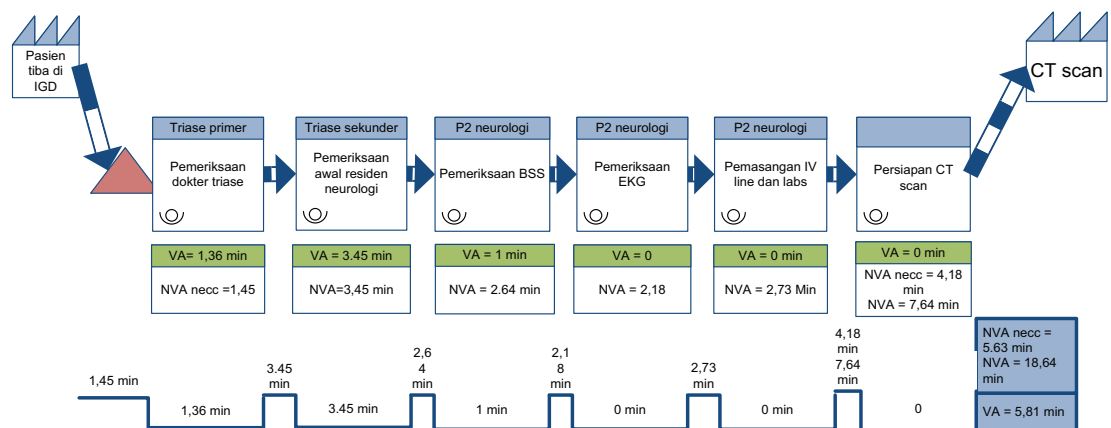

Figure 6: Simulated VSM.

4. Discussion

This study produced information about the process of carrying out the head CT scan at the R. ER. Mohammad Hoesin Palembang Government General Hospital. which lasted for 175.41 minutes (SD = 135.97). This time is considered far from the standard set, which is 25 minutes [2]. After doing a lean analysis by identifying the value and waste, obtained 3 wastes in this process, namely transportation, waiting and overproduction. From the results of the observation, 87.8% of the time spent on the entire process of the head CT scan for ischemic stroke patients in the RSMH emergency department is waste (NVA). From current VSM, it can be seen that the amount of time spent on value-added activities is 12.18 minutes, non-value-added but necessary is 9.23 minutes and recorded the time spent for waiting for the services is 154 minutes. According to this calculation, ideally, this process takes place in only 21.41 minutes for waiting for the services. To overcome the problem, researchers conducted a root analysis of the problem with the 5whys method. Based on the lean approach, the principle of '5 whys' is the best in the process of finding the root cause of a problem [6] because the word 'why' itself will be better used than the word 'who' who seems to blame. With the word 'why' too, what really be the root of a problem will be obtained.

The causes of problems obtained through Focus Group Discussion (FGD) were analyzed by researchers and categorized by categories of methods, machine, manpower, material, measurement, and environment. The root of the problem causes waste in the process of carrying out the head CT scan in the Emergency Departments (ED) was presented using the Ishikawa Diagram, commonly known as the 'Fishbone Diagram'. Ishikawa's Diagram has been known as a way to conclude several causes related to a specific effect [7]. Then, problems found from the FGD are corrected using several lean methods. The lean tools used in this study include standardized work, visual management, and ideal Value Streaming Map.

Suggestions regarding Standard Operating Procedure (SOP) making, protocols, stroke code, improvement of stroke management process flow and improvement of other policies proposed by top manager departments and top managers of emergency departments are one form of standardized work based on lean concepts. By conducting this standardized, officers will work together continuously to carry out activities to conform to the standards, so that it will reduce the variety of activities and time variations found in the previous flow. Fast track marking for stroke patients at the time of the emergency room and in the head CT scan is one of the ways to overcome internal waiting time transfers in the emergency room, as well as queuing in the

head CT scan in the morning. By giving a sign, both porters and radiographers will quickly recognize which patients will be prioritized for transfer or action. In the lean principle, this is known as visual management, which is a visual method for creating waste, problems and other abnormal conditions that are clearly visible to workers and leaders [6].

After an invasion for 1 week by creating a new pathways for the head CT scan of ischemic stroke patients in the ED, adding the number of neurology residents on duty at the ED, then coordinating with the radiology installation to prioritize stroke patients to do the head CT scan and dissemination of new pathways to emergency departments health officer and all neurology residents as well as giving brief information about stroke management, re-observation of the head CT scan process were made, starting from the patient arriving at the ED until the patient patients get all services. In observation, it was seen that not all patients observed followed the new path. This is likely due to a very short time of intervention, so that staff has not adapted or fully understood the new pathways that have been made, but from observations, it can be seen that the waiting time of each stage of the process has decreased. Thus, it can be concluded that the staff has understood their respective responsibilities, even though they are not yet familiar with the pathways that have been set.

This study shows the successful implementation of lean management in improving the quality of one service in the emergency room. The application of lean management in this study resulted from a decrease in lead time in the implementing of the head CT scan process for ischemic stroke patients in the ED. This is in accordance with what is mentioned by Eitel et al. [4] that there are various specific methods that can be used to improve the quality of services in the emergency room, one of lean method for quality improvement was reported to provide considerable success in improving the quality of services in the emergency room [4].

5. Conclusion

In the current value stream map, 87.8% of the head CT scan process in emergency departments/IGD is non-value add/waste. Only 6.9% of the time spent on value-added and 5.26% of the time spent on non-value-added but still necessary. After the improvement with the lean method, in the simulated Value Stream Map, it was found that there was a decrease in the lead time of the head CT scan process of ischemic stroke patients in the ED from 175.41 minutes to only 30.09 minutes, an

increase in value percentage added activities and decreased non-value-added activities. The policy of Standard Operating Procedure (SOP) making for the management of acute ischemic stroke patients in the ED, the formation of code strokes and stroke teams, fast-track policy, increased knowledge of ED officers, procurement of CT Scan equipment and improvement of Emergency Medical System need to be considered to improve the service of ischemic stroke patients in Dr. Moh. Hoesin Palembang.

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