Code Stroke LVO: Multidisciplinary Quality Improvement Project to Decrease Door to Treatment Times for Stroke Patients

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Background

Treating patients with an acute ischemic stroke (AIS) caused by a large vessel occlusion (LVO) is time sensitive. Approximately 2 million neurons die every minute during cerebral ischemia (Saver, 2006). Recent research demonstrates eligible AIS patients with a LVO have more favorable outcomes when emergency mechanical thrombectomy (MT) is successful and reperfusion is achieved within 120 minutes (min) of arrival (Powers et al., 2018).

Multiple specialties and departments are involved in the acute work-up, diagnosis and treatment of AIS patients at Mayo Clinic Hospital in Phoenix, Arizona. The workflow was multifaceted, not streamlined, and required multiple phone calls to notify key stakeholders and arrange the necessary resources/staff resulting in delayed emergency intervention.

Statistical analysis elucidated from the time of neurosurgery notification (NN) to case start time (CST) was the highest variation and one of the largest root causes to overall time variations. Average NN to CST for all cases was 61.1 min resulting in average door to puncture (DTP) times of 125 min and door to reperfusion (DTRp) average of 162.6 min, 42.6 min longer than the national goal set forth by the American Stroke Association (ASA). This delay translates to an average of more than 120 million neurons lost.

*DTP and DTRp averages are for ED arrivals only

Objective

To create a one-step, advance notification system called, "Code Stroke LVO" to notify on-call staff responding to MT cases through a collaborative, multidisciplinary team approach. Code Stroke LVOs would be activated via an existing group paging system designed to streamline communication. Standardized multidisciplinary roles would be instituted to improve workflow inefficiencies and align with the organization's strategic plan to transform its current practice. The established goals were to reduce NN to CST to ≤ 45 min resulting in DTP times of ≤ 90 min to achieve DTRp ≤ 120 min.

Planning and Research

In 2019, a multidisciplinary work group was assembled with broad representation from every stakeholder group including: Vascular Neurosurgery, Neurointerventional Radiology (Neuro IR), Vascular Neurology, Anesthesiology, Emergency Department (ED), House Supervisors (HS), Nursing Administration (NA), Nursing, and Critical Care Department (ICU). A multidisciplinary plan was instituted to streamline the MT workflow for all key stakeholders and improve communication to all responding staff with the ultimate goal of decreasing DTP times to ≤ 90 min to achieve early reperfusion.
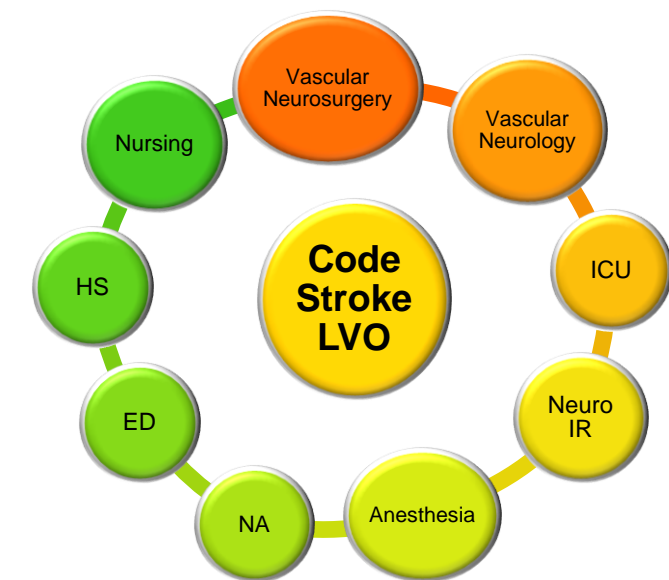
A project timeline was established with milestones focused in three categories: 1) planning, 2) education and training, and 3) implementation.

Planning activities included research of current ASA clinical practice guidelines, surveying key stakeholders, multidisciplinary simulations, and securing HS group agreement to activate the system. Key stakeholders also provided input on who receives a Code Stroke LVO page from their respective groups and what critical information would be included in the page.

Staff education and training focused on standardization of each specialty's respective workflow and role during a Code Stroke LVO. Specialty specific educational materials were created focusing on key information: who activates the system, what triggers system activation, information that will be communicated, and actions to take when a Code Stroke LVO page is received. System training materials were created specifically for the HS group detailing how to update, validate and activate the system, and how to send out cancelation notifications.

Implementation

Implementation required scheduled testing of the system to validate its functionality. Test pages were sent on specified days and times to on-call staff with instructions to notify a designated person that the page was received. During test paging, hospital and surgical operations continued as normal to best simulate a real activation. On-call staff who received the page were required to respond promptly which meant brief diversion from daily activities (inpatient rounding, outpatient clinic, surgery, etc.).

Test paging exercises revealed an opportunity to improve broader notification of a Code Stroke LVO activation to the anesthesia department. Anesthesiology leadership instituted two "anesthesia stroke pagers," one for the OR front desk and one for the CRNA facilitator. The anesthesia stroke pagers would be used during normal business hours to ensure prompt anesthesia notification and coverage.

Prompt electronic feedback would also be sent to staff involved in each case, departmental leaders, and administrators to promote transparency, acknowledge achieved goals, and identify opportunities to improve the new workflow.
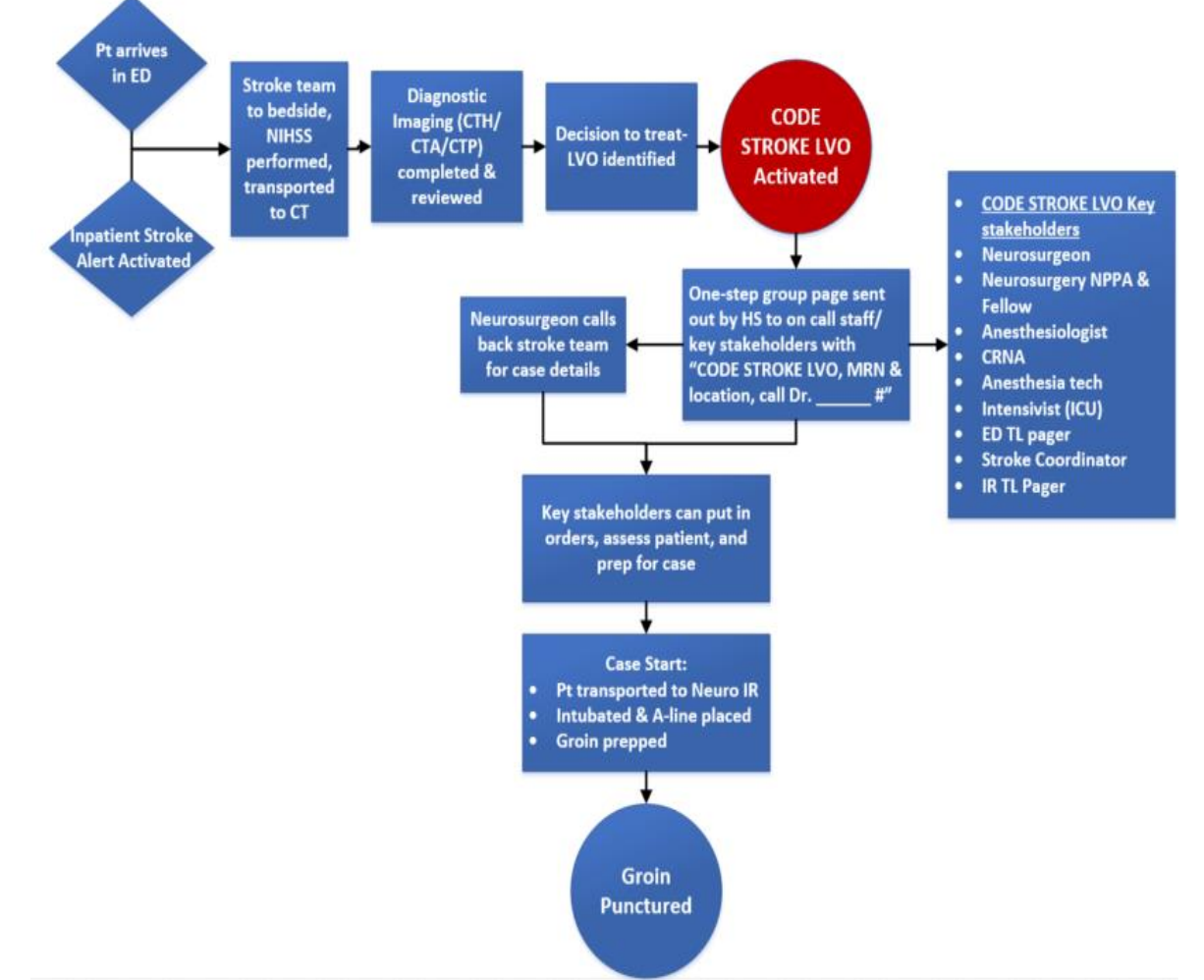
Results

Code Stroke LVO went live Sep 3, 2019 with the first activation/case occurring on Sep 6, 2019. The first Code Stroke LVO case demonstrated a drastic reduction in the NN to CST of 25 min (36 min reduction) resulting in a DTP of 82 min (42.8 min reduction) and DTRp of 105 min (57.6 min reduction).

There have been 14 activations since the system went live. The average NN to CST time is 28.8 min (32.3 min reduction: all cases, n=14; p<.0001) resulting in an average DTP time of 82.5 min (42.6 min reduction: ED cases only, n=11; p<.0001), and average DTRp of 135.2 min (27.6 min reduction, n=9).

Phase	NN to CST	DTP	DTRp
Baseline (1/1/208 – 9/2/2019)	61.1 min	125.1 min	162.6 min
Goal for Improve Phase	≤45 min	≤90 min	≤120 min
Improve (9/3/19 – 12/3/19)	28.8 min p<.0001	82.5 min p<.0001	135.2 min p<.0492
Improve Phase Average Time Reduction	32.3 min	42.6 min	27.6 min

The group paging system was cost neutral because of existing licensing agreements.

Conclusion: These outcomes suggest instituting an early notification system, along with standardized multidisciplinary roles and workflows, can transform different specialty practices, improve system inefficiencies resulting in more timely treatment with the goal of early reperfusion for AIS patients requiring emergency MT.

References

Power et al. (2018). 2018 Guidelines for Management of Acute Ischemic Stroke. *Stroke, 49*, e49-e99

Saver, J.L. (2006). Time is brain—quantified. *Stroke, 37*, p. 263–266.

Acknowledgements

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