SUPPPLEMENTAL MATERIAL

A streamlined hyperacute MRI protocol identifies tPA-eligible stroke patients when clinical impression is stroke mimic

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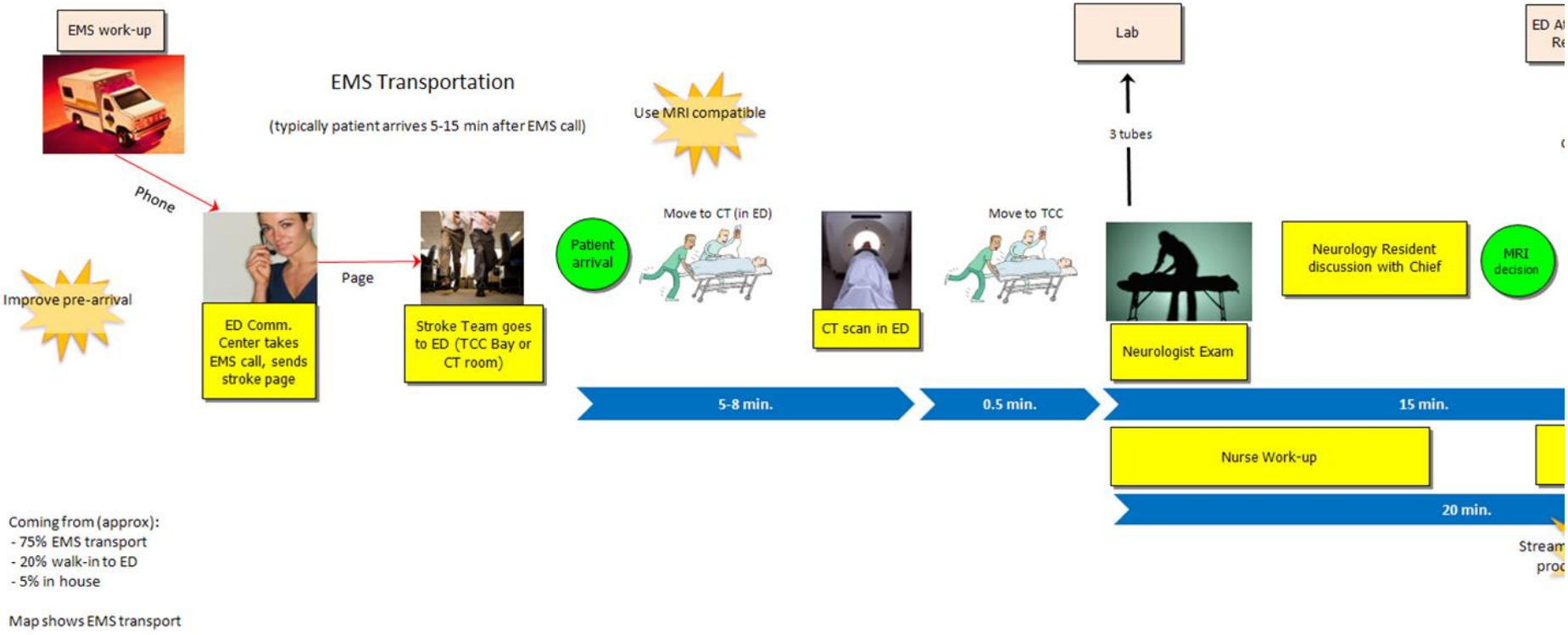
Supplemental Figure I

The end result of the two day Value Stream Analysis mapped a planned "future state" for the hyperacute MRI protocol beginning from patient arrival to IV tPA delivery in the MRI suite. Target metrics for door-to- MRI and door-to-needle times while using hyperacute MRI for clinical decision-making were included.

FutureState Value Stream Map - August 2013 -- Hyper Acute MRI (MRI needed for intervention decision)



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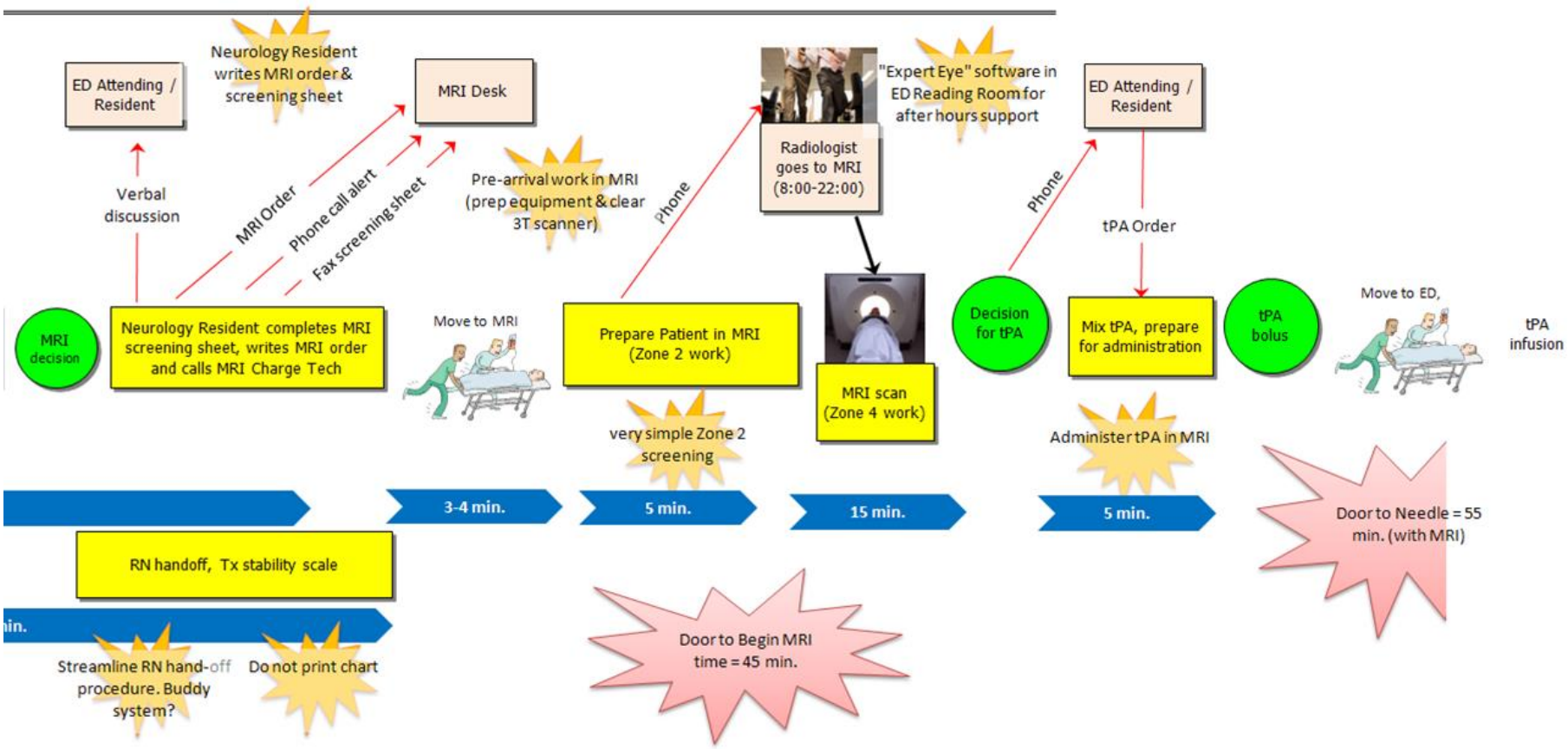


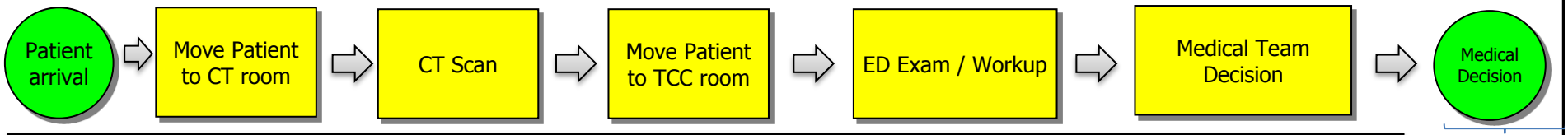
Supplemental Figure II

After the two day VSA, several small group meetings were held in the form of rapid improvement events (RIE) over several weeks to implement solutions. The standard work for each role (RN, neurology, emergency medicine and radiology MDs, and MR technician) within each of the four phases was defined in detail: (1) Code Stroke in ED – this phase included the time from patient arrival until the decision to go to hMRI was made; (2) hMRI Process in ED – this phase included all standard work for patient and staff preparation for hMRI and transport to hMRI, (3) hMRI Process in MRI – this phase included safe patient transfer into the scanner room, scan completion, and radiology image review, and (4) tPA Delivery in MRI – this phase included repeat neurological evaluation and blood pressure to ensure patient remained an IV tPA candidate, preparation and delivery of tPA in the MRI suite. The standard work for each role (RN, neurology, emergency medicine and radiology MDs, and MR technician) within each of the four phases was defined in detail.

Hyperacute MRI Protocol

ML-TP-0001 **Team Process:** Code Stroke Process in Emergency Department

Document Owners & Approvers: ED Manager & Neurology Resident Program Director



Neurology Resident (Stroke)	• Begin Exam • History/NIHSS	• Observe live CT image	• Place patient on stretcher, move to TCC room	• Complete exam, History/NIHSS	• Discuss treatment plan with ED Attending (call Stroke Fellow / attending as as needed)	1) No Stroke, Hand-off to ED Physician 2) Administer Alteplase in ED 3) Hyper Acute MRI, follow doc #: ***ML-TP-0002***
ED Nurse	• Move patient to CT room • Put Pt in HMED & order CT	• Move patient to CT table • Protocol all stroke orders & HPI	• Place patient on stretcher, move to TCC room	• Draw labs • Place Bilateral IVs • Watch Physical Exam		
ED PCT				1) Place in **MRI gown** *before* RN places IV 2) Take Vitals 3) Point-of-Care Creatinine 4) Point-of-Care INR 5) Point-of-Care Glucose 6) Perform ECG		
CT Technologist		• Move pat. to table • Run CT scan	• Place patient on stretcher	• Process Image		
ED Physician	• Go to CT •Perform Physical Exam	• Order CTA and extra labs (as needed)			• Discuss treatment plan with Neurology Resident • Make treatment decision	
	1 min.	**5-8 min.**	**1 min.**	**5-10 min.**	**2-10 min.**	

Note: This work is time sensitive and should be performed as quickly and safely as possible. The times above are expected flow times.

Hyperacute MRI Protocol

ML-TP-0002 **Team Process:** Hyper Acute MRI Process in Emergency Department

Document Owners & Approvers: ED Manager, MRI Supervisor & Neurology Resident Program Director

Decision for MRI → Prepare for MRI: Nurse Handoff, MRI order & screening sheet, travel logistics, etc. → Move patient to 5th floor MRI → Arrive in MRI

Neurology Resident (Stroke)	1) Request orders from ED MD (MRI, BP meds, bed placement) 2) Tell Nurse to prepare for MRI 3) Complete MRI Screening Sheet, write Creatinine & patient weight on Screening Sheet before faxing * 4) Fax Screening sheet to MRI (keep copy) 5) Call MRI Charge Tech 362-1676 (give ETA if possible) 6) Ensure patient is in MRI gown (laces only, no metal snaps)	• Get 2 Patient Belonging Bags (for MD/RN items) • Transport patient to MRI • Place metal items in bag while on elevator Go to process: ***ML-TP-0003***

**NOTE: If patient (or family) cannot answer MRI screening questions, obtain a "shunt series" plain film X-ray in the ED prior to sending the patient to MRI. Call the Advanced Imaging Fellow to notify as soon as X-ray is complete. You may transport patient to MRI while AI Fellow determines if patient is MRI eligible based on X-ray.*

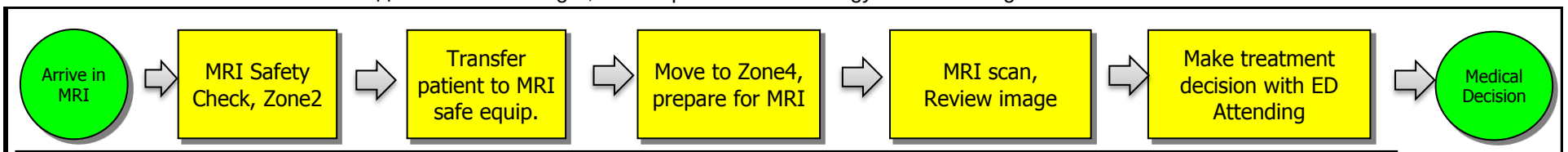
ED Nurse	1) Call Charge, Sign-out patients to assigned ED nurse *Note: do **not** print charts, HMED is available in MRI* 2) Hook up Transport Monitor 3) Obtain ED Med Bag from Pyxis	• Transport patient to MRI - Notify Comm Center on way out • Place metallic items in bag while on elevator
ED Physician	• Enter order for MRI • Enter open order for BP meds • Enter order for bed placement (don't "up arrow")	
MRI Charge Tech	1) Receive call from Neurology Resident 2) Review order and screening sheet, Calculate GFR from Creatinine on screening sheet 3) Call Advanced Imaging Radiologist to notify Hyper Acute process underway *(if day (8AM-10PM) call once you receive the hyper acute screening sheet so fellow can come to scanner; if night, call when MRI begins so fellow can read from ClinDesk)* 4) Remove patient from 3T scanner (if needed), notify Tech of hyper-acute patient on the way 5) Prepare Invivo monitor, MRI stretcher and ready Zone 2	
Advanced Imaging Radiologist	• Receive call from MRI Charge Tech • Go to MRI to for "live" read and assist treatment decision (If night, read image on ClinDesk and discuss over phone with Neurology Resident)	

6-15 min. **3-4 min.**

Hyperacute MRI Protocol

ML-TP-0003 **Team Process:** Hyper Acute MRI Process in MRI Department

Document Owners & Approvers: ED Manager, MRI Supervisor & Neurology Resident Program Director



MRI Charge Tech	• Facilitate MRI Safety Screening	• Transfer to MRI stretcher • Place MRI ECG, verify ED patches are MRI compatible, if so, do not remove • Attach MRI Pulse-Ox	• Move to Zone 4 • Assist MRI setup • Monitor ED IV pump in Zone 3 if needed	• If night hours, call AI Fellow on control room speaker phone		1) No tPA, No IR 2) Administer tPA in MRI, process #: ***ML-TP-0004*** 3) Prepare for IR
MRI Technologist	• Prepare MRI room and coil		• Setup MRI	• Run MRI	• Push images to ClinDesk **asap**	
ED Nurse	• Place bag with metal objects in locker • Place phone in "Zone 3 basket"	• Transfer to MRI stretcher • Remove ED monitor & Pulse Ox • Unscrew BP cuff and attach to MRI monitor	• Move patient to Zone 4	• HMED / Document • Administer Meds as ordered • Monitor Patient	• Listen to physician treatment plan	
Neurology Resident (Stroke)	• Place bag with metal objects in locker; place White Coat on coat hook • Place phone in "Zone 3 basket"	• Transfer to MRI stretcher	• Move patient to Zone 4 (MRI room)	• Review images with Radiologist in person from 7AM-10PM M-F, 8AM-12PM S-S (after hours, radiologist will review at home: 508-3767)	• Discuss plan, include Stroke Attending/Fellow as needed •Call ED Attending (758-6903) on speaker phone, with ED nurse listening • Lead **Safety Time-out** with group if decision made for tPA	
Advanced Imaging Radiologist				• Review image	• Discuss plan • Assist with treatment recommendation	
	5 min.		**3-4 min.**	**5-7 min.**	**3 min.**	

Note: if Hyper Acute MRI process occurs at night and another tPA Page occurs, the On-Call Chief Resident will call the On-Call Stroke Neurology Resident to go to MRI. The On-Call Stroke Resident will cover the Hyper-Acute MRI patient so the Night Float Resident can respond to the other Stroke Page. The On-Call Stroke Resident will assume care for the patient and makes the treatment recommendation to ED Attending. After the MRI is complete, the On-Call Stroke Resident will inform the Night Float Resident about the results if Night Float will continue to follow the patient.

Hyperacute MRI Protocol

ML-TP-0004 **Team Process:** Alteplase Administration Process in MRI Department

Document Owners & Approvers: ED Manager, MRI Supervisor & Neurology Resident Program Director

Neurology Resident (Stroke)	•Receive verbal order for tPA from ED Attending on phone	•Assist ED Nurse with tPA "double-check" •Inform family and Chief of treatment plan as needed	•Recheck NIHSS to ensure patient has not improved •Observe bolus push	•Escort patient back to ED	• Hand-off to ED team as needed
ED Nurse	•Receive verbal order for tPA from ED Attending on phone	•Obtain tPA from MRI Pyxis •Get printout from front desk, mix tPA in Zone 2 •Obtain "tPA double check " from Neurology Resident	•Check vitals •Administer tPA Bolus, infusion to start after return to ED	• Escort patient back to ED	• Complete tPA infusion in ED
MRI Charge Tech	•Remove patient from MRI table •Move patient to Zone 2	•Detach Invivo monitor, attach ED monitor			
MRI Technologist	•Remove patient from MRI table	•Move patient to Zone 2	•Prepare MRI for next patient		
ED Attending	•Give verbal order for tPA on phone	•Enter order for tPA (alteplase)	•Finalize bed placement request		
	2 min.	**5 min.**	**4 min.**	**3-4 min.**	**3 min.**