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Steven A Guidera
Doylestown Health

Sudhir Aggarwal
Doylestown Health

J Doyle Walton
Doylestown Health

David Boland
Doylestown Health

Roy Jackel
Doylestown Health

See next page for additional authors

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Authors

Steven A Guidera, Sudhir Aggarwal, J Doyle Walton, David Boland, Roy Jackel, Jeffrey D Gould, Brooke Kearins, Joseph McGarvey, Yan Qi, and Brian Furlong

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Mechanical Thrombectomy for Acute Ischemic Stroke in the Cardiac Catheterization Laboratory

Steven A. Guidera, MD,[a] Sudhir Aggarwal, MD, PhD,[b] J. Doyle Walton, MD,[a] David Boland, MD,[a] Roy Jackel, MD,[b] Jeffrey D. Gould, MD,[b] Brooke Kearins, CRNP,[b] Joseph McGarvey, Jr, MD,[a] Yan Qi, MD,[b] Brian Furlong, BA[c]

ABSTRACT

OBJECTIVES The aim of this study was to determine the feasibility of establishing a mechanical thrombectomy (MT) program for acute ischemic stroke in a community hospital using interventional cardiologists working closely with neurologists.

BACKGROUND American Heart Association/American Stroke Association 2018 guidelines give a Class I (Level of Evidence: A) recommendation for MT in eligible patients with large vessel occlusion stroke. Improvement in neurological outcomes with MT is highly time sensitive. Most hospitals do not have trained neurointerventionalists to perform MT, leading to treatment delays that reduce the benefit of reperfusion therapy.

METHODS An MT program based in the cardiac catheterization laboratory was developed using interventional cardiologists with ST-segment elevation myocardial infarction teams.

RESULTS Forty patients underwent attempted MT for acute ischemic stroke. An additional 5 patients who underwent angiography did not undergo attempted thrombectomy, because of absence of target thrombus (n = 4) or unsuitable anatomy (n = 1). Median National Institutes of Health Stroke Scale score prior to MT was 19 and at discharge was 7. TICI (Thrombolysis In Cerebral Infarction) grade 2b or 3 flow was restored in 80% of patients (32 of 40). At 90 days, 55% of patients (22 of 40) were functionally independent (modified Rankin score ≤2). In-hospital mortality was 13% (5 of 40). Symptomatic intracranial hemorrhage occurred in 15% of patients (6 of 40). Major vascular complications occurred in 5% of patients (2 of 40).

CONCLUSIONS MT can be successfully performed by interventional cardiologists with carotid stenting experience working closely with neurologists in hospitals lacking formally trained neurointerventionists. This model has the potential to increase access to timely care for patients with acute ischemic stroke. (J Am Coll Cardiol Intv 2020;13:884–91)
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Following several decades of clinical trials reporting conflicting results on the role of mechanical thrombectomy (MT) for acute ischemic stroke caused by large vessel occlusion (LVO) (1–5), a series of 5 randomized clinical trials published in 2015 validated the benefit of this treatment (6–10). A meta-analysis of these trials showed that the number of patients needed to treat to reduce disability by 1 modified Rankin score (mRS) level was only 2.6 (11). The impressive magnitude of this treatment effect is the impetus for structuring systems of care to provide this highly effective therapy to patients with acute ischemic stroke due to LVO (12).

The major limitation to providing MT to eligible patients who may benefit from this therapy is the limited number of medical centers currently offering this treatment. Fewer than 5% of U.S. hospitals are equipped to perform endovascular therapy for patients with acute stroke (13), resulting in

From the [a]Division of Cardiology, Doylestown Health, Doylestown Hospital, Doylestown, Pennsylvania; [b]Division of Neurology, Doylestown Health, Doylestown Hospital, Doylestown, Pennsylvania; and the [c]Department of Radiology, Lehigh Valley Hospital, Allentown, Pennsylvania. Mr. Furlong is a consultant for ConsignMed Consultants. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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time-consuming transfers of these patients to thrombectomy-capable institutions. The scarcity of formally trained neurointerventionalists is the primary reason why most U.S. hospitals cannot provide this vital service. The estimated number of neurointerventionalists in the United States in 2009 was 800, with an anticipated increase to 1,200 by 2019 (14). The delays caused by both hospital-to-hospital transfer protocols and emergency medical services diversion strategies results in loss of effectiveness of this highly time sensitive procedure. A critical need exists to increase the number of hospital teams that can provide timely and effective interventional treatment for patients with acute ischemic stroke due to LVO.

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Over the past 3 decades, the development of ST-segment elevation myocardial infarction (STEMI) programs has dramatically improved the outcomes of patients with acute myocardial infarction. STEMI teams of physicians, nurses, and technical staff members provide efficient, lifesaving emergent coronary revascularization. The brain is extremely sensitive to the effects of ischemia, and the potential benefit of revascularization is progressively diminished by delays in treatment. The widespread availability of STEMI teams could provide the framework to facilitate timely access to acute stroke intervention.

METHODS

In 2015, we developed a program in our community hospital to provide this therapy. There are no active staff neurosurgeons and no formally trained neurointerventionalists on staff at Doylestown Hospital. A collaborative working group with representatives from neurology, interventional cardiology, emergency medicine, radiology, anesthesia, hospitalists, nursing, and hospital administration was formed to develop an MT program based in the cardiac catheterization laboratory. Two of the interventional cardiologists (S.A.G., J.M.) had extensive experience with carotid artery stenting and were granted privileges to perform MT. We identified a core team of catheterization laboratory nurses and technicians who would be involved in each procedure. The interventional cardiologists and catheterization laboratory staff members spent several days observing the daily operation of an interventional neurovascular laboratory at a large urban center experienced in stroke intervention. We arranged industry support, which funded a neuroradiology technician with extensive experience in acute stroke procedures who was on call as an adviser for MT procedures. This adviser (B.F.) provided valuable insights to a team at the steep end of a learning curve. During each case, a neurologist remained present for the duration of the MT procedure and provided advice regarding neuroanatomy and pharmacological treatment of medical conditions (e.g., hypertension) in the catheterization laboratory.

Statistical analysis was performed using medians because of the small sample size. All patients undergoing MT were included, and no patients were lost to follow-up.

PATIENT SELECTION PROTOCOL. Pre-hospital and hospital stroke alerts were used to identify patients with acute stroke symptoms who might be eligible for MT. The final decision to refer a patient for MT was made by the attending neurologist after obtaining the clinical history, performing a neurological examination with National Institutes of Health Stroke Scale (NIHSS) assessment, and reviewing the noncontrast computed tomographic (CT) and CT angiographic (CTA) studies. Patients with acute ischemic stroke presenting within 6 h of last known time well with identifiable anterior circulation LVO (involving the internal carotid artery [ICA] or M1 or M2 segments of the middle cerebral artery [MCA]) constituted the majority of patients referred for MT. Once data emerged showing a role for MT in select patients presenting 6 to 24 h following symptom onset, patients were eligible for MT if CT perfusion imaging showed a large penumbra with small core, along with other inclusion and exclusion criteria as specified in the DAWN (Clinical Mismatch in the Triage of Wake Up and Late Presenting Strokes Undergoing Neurointervention With Trevo) and DEFUSE-3 (Endovascular Therapy Following Imaging Evaluation for Ischemic Stroke 3) trials (15,16).

We excluded patients with NIHSS scores <6 (unless aphasia was a major symptom, because aphasia is such a devastating neurological deficit and the NIHSS is motorically biased) or NIHSS scores >28 and/or Alberta Stroke Program Early CT Score on noncontrast CT imaging of <6. A noncontrast head CT examination was performed as rapidly as possible after presentation with stroke symptoms. Once intracranial hemorrhage was excluded and criteria for intravenous thrombolysis were met, intravenous alteplase was administered. CTA imaging was performed on patients with suspected LVO, typically those with high NIHSS scores, aphasia irrespective of NIHSS

ABBREVIATIONS AND ACRONYMS

CT = computed tomographic

CTA = computed tomographic angiographic

ED = emergency department

ICA = internal carotid artery

LVO = large vessel occlusion

MCA = middle cerebral artery

mRS = modified Rankin score

MT = mechanical thrombectomy

NIHSS = National Institutes of Health Stroke Scale

sICH = symptomatic intracranial hemorrhage

STEMI = ST-segment elevation myocardial infarction

score, or hyperdense MCA sign on noncontrast CT imaging. If the CTA examination confirmed evidence of ICA or MCA (M1 or M2) occlusion, the catheterization laboratory stroke team was activated by group paging. To date, we have chosen not to treat LVO strokes involving the posterior circulation with MT; these patients are transferred to a comprehensive stroke center. We made the decision not to treat patients with posterior LVO occlusion stroke because they are at higher risk for complications requiring urgent neurosurgical intervention compared with those with anterior LVO stroke. Doylestown Hospital does not have on-site neurosurgery capability. For each patient brought to the catheterization laboratory, anesthesia was contacted and placed on standby unless immediate assistance was required. We routinely attempted to perform MT using conscious sedation but occasionally intubated for airway protection or for management of patients unable to cooperate, typically because of profound aphasia.

MT STRATEGY. Initially, all cases were performed using a stent retriever-first strategy (Solitaire, Medtronic, Minneapolis, Minnesota). As data emerged showing the beneficial role for suction thrombectomy using the Penumbra (Alameda, California) system (17), we acquired this technology, and the interventionalist (with the input of the neurologist) chose either a stent retriever-first strategy or the direct aspiration first-pass technique. In general, suction thrombectomy with the Penumbra system was chosen as the initial strategy only for more proximal occlusions (ICA, proximal M1) because this technique requires accessing the clot not only with a microcatheter but also with the larger support catheter.

MT PROCEDURE. A femoral approach was used first line (although a radial artery approach was used if carotid access could not be obtained from the femoral artery). Coronary catheters (IMA, JR4) or specialty catheters (e.g., Berenstein, Vitek, Simmons, Headhunter) were used to access the ipsilateral common carotid artery. Imaging of the common and proximal ICA was accomplished to exclude high-grade disease and thrombus in these segments. The catheter was advanced over a 0.035- or 0.038-inch Glidewire into the ICA to allow digital subtraction imaging of the cerebral vessels. Once a target occlusion in either the ICA or MCA (M1 or M2) distribution was identified, a Shuttle sheath (Cook 6 F, 7 F, or 8 F) or a Neuron MAX guide (Penumbra) was advanced to the petrous segment of the ICA. At this point, the combination of a support catheter (either Medtronic Arc or Penumbra ACE68) over a microcatheter (either Medtronic Marksman or Penumbra Velocity) over a 0.014-inch guidewire (Abbott BMW, Whisper) was advanced as a unit into the distal ICA. Each catheter of the triaxial system (guide, support catheter, and microcatheter) was attached to its own pre-mixed heparinized flush solution (2,000 U heparin in 1000 ml normal saline) to prevent thrombus formation. For patients who received intravenous alteplase, we did not routinely give adjuvant unfractionated heparin outside of what was given through the continuous flush system. For patients who were ineligible for intravenous thrombolysis, we typically gave a bolus of unfractionated heparin in the range of 40 U/kg and measured activated clotting time levels during the procedure, with a goal of 225 to 300 s. The thrombus was crossed with the guidewire and microcatheter. The wire was removed, and gentle contrast injection was made through the microcatheter to ensure that the entirety of the thrombus had been crossed. If we had chosen a stent retriever-first strategy, a stent retriever was advanced to the distal end of the microcatheter, followed by withdrawal of the microcatheter to deploy the stent retriever within the thrombus, where it dwelled for 4 min prior to removal. If we had opted for first-line suction thrombectomy, the suction catheter (e.g., Penumbra ACE68) was advanced into the face of the clot, and the microcatheter and wire were removed before initiating suction. Following each MT attempt, angiography was performed to assess the result, and additional attempts were made as needed with the initial treatment strategy or the alternative strategy was implemented.

In the case of severe proximal ICA stenosis, this was treated with balloon angioplasty and/or stenting using distal embolic filter protection if needed to facilitate passage of a large sheath (6- to 8-F shuttle) or Neuron MAX guide into the ICA to allow MT of the distal occlusion. If the sheath could be advanced without first treating the proximal ICA stenosis, stenting of the proximal ICA with distal embolic filter protection was deferred until the distal MT was completed. In the case of thrombotic occlusion of the proximal ICA at the time of initial angiography, this was treated with suction thrombectomy and/or stenting to restore flow and allow assessment of the intracranial vasculature. ICA stenting was always performed with distal embolic filter protection, as our catheterization laboratory does not stock a proximal protection system.

Following the completion of the MT procedure, the femoral artery sheath was either removed immediately using an AngioSeal closure device (Terumo Medical, Tokyo, Japan), or the sheath was secured in place for manual hemostasis once the lytic state passed and activated clotting time was <180 s. All

patients were admitted to the intensive care unit under the care of the hospitalist service with protocol-driven consultations to the intensivist service and continued follow-up by neurology. Cardiology was consulted only if there was a cardiac issue (e.g., atrial fibrillation). Periodic NIHSS assessments were performed per protocol upon arrival in the intensive care unit. Brain magnetic resonance imaging was typically performed on the day following MT. In the event of a significant change in neurological status such as a change in NIHSS score of ≥4 or symptoms suggesting increased intracranial pressure (e.g., headache, declining level of consciousness, new focal neurological deficits), urgent noncontrast head CT imaging was performed. Any significant intracranial hemorrhage prompted transfer to a medical facility with neurosurgical capability in case surgical decompression became warranted.

RESULTS

Between October 2015 and January 2019, 45 patients were brought to the catheterization laboratory with acute ischemic stroke and CTA evidence of LVO. Of these, MT was attempted in 40. Four patients (all with M2 occlusion by CTA) did not have visible thrombus and were presumed to have successfully reperfused following alteplase administration. These patients had uniformly excellent outcomes. One patient had unfavorable anatomy (type III arch with severe innominate and proximal common carotid tortuosity) that did not allow access to the carotid artery.

The median age of patients undergoing MT was 75 years. The median time from symptom onset to emergency department (ED) arrival was 66 min. Fifty-three percent of patients presenting through the ED arrived outside of normal catheterization laboratory working hours. The median time from ED arrival to catheterization laboratory arrival was 65 min, and the time from catheterization laboratory arrival to first pass with a thrombectomy device was 43 min (12 min from catheterization laboratory arrival to groin puncture and 31 min from groin puncture to thrombectomy).

A stent retriever–first strategy was used in 80% of patients. A suction thrombectomy–first strategy (Penumbra or Riptide system) was used in 20% of patients. We used a stent retriever–first strategy for the initial 16 patients treated because of the use of this technology in the pivotal trials and then acquired the Penumbra system to allow suction thrombectomy. Subsequently, the option for either strategy first has been left to the operator. The mean number of thrombectomy passes with the first device chosen was 2.1. A second device was used in 20% of cases, typically after failure to achieve an acceptable result with 2 or 3 passes with the initial strategy. Thirteen percent of patients (5 of 40) underwent concomitant cervical carotid stent placement.

TABLE 1 Patient Demographics (N = 40)

Sex (male/female)	52%/48%
Age (yrs)	74 (51–94)
History of TIA/CVA	23%
History of or current AF	52%
Hypertension	85%
On oral anticoagulation	25%
Location	
ICA terminus	13%
M1	53%
M2	32%
CCA	2%

Values are median (range) or %.
AF = atrial fibrillation; CCA = common carotid artery; CVA = cerebrovascular accident; ICA = internal carotid artery; TIA = transient ischemic attack.

Improved perfusion was accomplished in 90% of patients in whom MT was attempted. Eighty percent of patients achieved TICI (Thrombolysis in Cerebral Infarction) grade 2b or 3 perfusion. Median NIHSS score before the procedure was 19 and at hospital discharge was 7. Mean mRS at 90 days was 2.75, and 55% of patients achieved functional independence (mRS 0 to 2) at 90-day follow-up. In-hospital mortality was 13%, and mortality at 30 days was 15%. Symptomatic intracranial hemorrhage (sICH) occurred in 15% of patients, none of whom underwent neurosurgical intervention. Major vascular complications occurred in 5% of patients (2 of 40) (groin bleed requiring 4 U packed red blood cell transfusion with pseudoaneurysm requiring surgical closure in one patient and femoral pseudoaneurysm treated with thrombin injection in another patient).

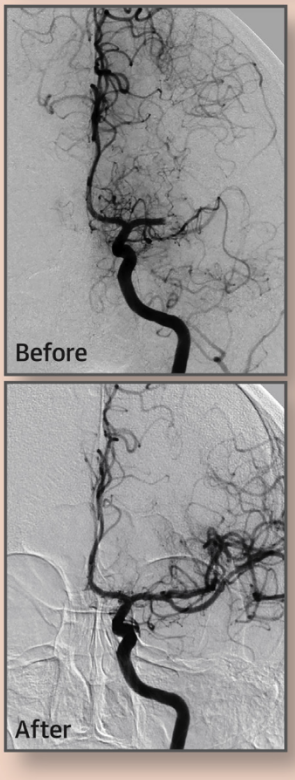
Pertinent demographic data for the 40 patients who underwent MT are shown in **Table 1**, and a comparison of demographic, procedural, and outcome data achieved at Doylestown versus what was reported in several pivotal multicenter trials is shown in the **Central Illustration**.

DISCUSSION

MT for acute ischemic stroke due to LVO (ICA or M1 and M2 segments of MCA) has been shown to significantly improve neurological outcomes in eligible patients. Intravenous alteplase alone is successful in

CENTRAL ILLUSTRATION **Mechanical Thrombectomy in the Cardiac Catheterization Laboratory**

Comparison of Doylestown Hospital Outcomes With Pivotal Trials



	Doylestown	MR CLEAN	SWIFTPRIME	ESCAPE	REVASCAT	EXTEND 1A
Number pts	40	233	98	165	103	35
Age (median)	75	66	65	71	66	69
NIHSS pre (median)	19	17	17	16	17	17
IV alteplase	65%	87%	100%	73%	68%	100%
Stroke onset to groin puncture	182 min	260 min	224 min	185 min	269 min	210 min
Groin puncture to reperfusion	31 min	not available	28 min	33 min	86 min	43 min
TICI IIb/III flow	80%	59%	88%	72%	66%	86%
NIHSS post (median)	7 (discharge)	8 (discharge)	8 (27 hr)	6 (24 hr)	2 (90 day)	5 (24 hr)
90-day functional independence (mRS 0-2)	55%	33%	60%	53%	44%	71%
Death	15% (30 day)	19% (30 day)	9% (90 day)	10.4% (90 day)	18% (90 day)	9% (30 day)
Symptomatic ICH	15%	7.7%	0	3.6%	4.9%	0
Vascular access site complication	5%	not available	not available	7.2%	11.7%	3%

Guidera, S.A. et al. J Am Coll Cardiol Intv. 2020;13(7):884–91.

ICH = intracranial hemorrhage; IV = intravenous; mRS = modified Rankin score; NIHSS = National Institutes of Health Stroke Scale score; TICI = Thrombolysis In Cerebral Infarction.

promptly restoring flow in only 10% to 20% of patients with LVO strokes (18,19). The benefits of MT are highly time dependent, with the best chance of improving neurological outcomes mandating immediate transfer to the endovascular suite once LVO is documented.

In our consecutive series of 40 patients who underwent MT, we report a median time from ED arrival to catheterization laboratory arrival of 65 min, which is both a testament to a coordinated institutional strategy for rapidly evaluating patients with acute ischemic stroke and a target for continued process improvement in our program. In our series, the median time from groin puncture to first pass with thrombectomy device was 31 min, which is comparable with the time of 28 min reported in SWIFT-PRIME (Solitaire™ With the Intention for Thrombectomy as Primary Endovascular Treatment) (which required participating institutions to have performed at least 40 MT procedures annually to be involved in the trial) (9). On the basis of these and other metrics, we are confident that interventional cardiologists with experience in performing carotid intervention working with cardiac catheterization laboratory STEMI teams can perform MT in a time frame consistent with established programs staffed by formally trained neurointerventionalists.

Efficacy outcomes achieved by our program compare favorably with those reported in the MR CLEAN (Multicenter Randomized Clinical Trial of Endovascular Treatment for Acute Ischemic Stroke in the Netherlands) trial, which was the first and largest of the seminal trials changing the paradigm of acute stroke therapy (6). Our patients were older (median age 75 years vs. 66 years in MR CLEAN), with higher initial NIHSS scores (19 vs. 17 in MR CLEAN). Despite an older patient population with more severe neurological deficits, our patients achieved a mean 90-day mRS of 2.75, compared with 3.5 in MR CLEAN. Fifty-five percent of our patients achieved functional independence (mRS 0 to 2) compared with 33% of MR CLEAN patients. Thirty-day all-cause mortality was 15% in our series, which is similar to the 19% 30-day mortality rate in MR CLEAN. We achieved these outcomes during the steepest part of a learning curve.

Safety outcomes were not as favorable in our series as those reported in the MR CLEAN trial (6). The incidence of sICH was 15% in our series, compared with 8% in MR CLEAN. In other contemporary trials, the reported sICH rates were 3.6% in ESCAPE (Endovascular Treatment for Small Core and Proximal Occlusion Ischemic Stroke) (7), 0% in EXTEND-IA (Extending the Time for Thrombolysis in Emergency Neurological Deficits–Intra-Arterial) (8), 0% in SWIFT-PRIME (9), and 4.9% in REVASCAT (Endovascular Revascularization With Solitaire Device Versus Best Medical Therapy in Anterior Circulation Stroke Within 8 Hours) (10). Our higher rate of sICH may be due to several factors. Our patients were older than those in any of these 5 published trials. Age has been shown to be a risk for hemorrhagic transformation following intravenous thrombolytic therapy for stroke (20). History of atrial fibrillation has also been demonstrated to increase the risk for hemorrhagic transformation following intravenous tissue plasminogen activator for stroke (20). Our patients had a higher incidence of atrial fibrillation (52%) than in any of the 5 major trials, which reported atrial fibrillation in 28% to 37% of treated patients (6–10). SWIFT-PRIME, ESCAPE, and EXTEND-IA all had protocol-driven perfusion imaging and excluded patients with large core infarcts, while REVASCAT required perfusion imaging for some patients at higher risk for developing hemorrhagic transformation (mandated for patients presenting 4.5 h or later from symptom onset) and also had other exclusion criteria (e.g., Alberta Stroke Program Early CT Score <9 for patients 80 years of age and older) (7–9). The additional neuroimaging exclusion criteria as well as the exclusion of high-risk patients on the basis of age and time of presentation would be expected to reduce the incidence of sICH in each of these trials. Another factor that could have contributed to our higher sICH rate is that we performed MT in a higher percentage of patients with more distal (M2 rather than ICA or M1) occlusions than any of the reported trials; our series had MT for M2 occlusion in 32% of patients, compared with 8% in MR CLEAN (6), 14% in SWIFT-PRIME (9), 7% in EXTEND-IA (8), 10% in REVASCAT (10), and 12% in ESCAPE (7). Treating smaller more distal intracranial vessels likely increases the risk for perforation and hemorrhage.

Our rate of vascular access-site complications (5%) should be considered acceptable for an elderly population, most of whom had 8-F femoral access and two-thirds of whom received intravenous thrombolytic therapy.

WHO SHOULD PERFORM MT FOR STROKE?

Competency to perform MT is best achieved with formal fellowship training in interventional neuroradiology (also known as endovascular surgical neuroradiology). In the United States, there are 3 groups of physicians who collectively perform >95% of MT procedures for acute ischemic stroke: radiologists, neurosurgeons, and neurologists (21). The prerequisite requirements to obtain a training position are different for each of these specialties; at a minimum, the fellowship will add 2 to 3 years to a radiology residency, 1 to 2 years to a neurosurgery residency, and almost 3 years to a neurology residency. There are fewer than 50 certified interventional neuroradiology fellowship training programs in the United States, and these programs graduate approximately 100 physicians annually. These highly trained specialists perform multiple neurovascular interventional procedures and are based in large, mostly urban comprehensive stroke centers that offer a full range of endovascular and neurosurgical therapies, to which acute stroke intervention is a minor contributor. The vast majority of community hospitals will not have formally trained neurointerventionalists on staff for the foreseeable future (if ever). In 2016, only 4% of U.S. hospitals offered stroke intervention services, and the average annual number of MT procedures was 38 per hospital (13). Assuming 3 or 4 physicians in a call rotation, this means that the average number of stroke interventions per physician was approximately 10 to 13 annually. If acute stroke intervention is to be made available to patients outside of large predominantly urban medical centers, community-based physicians with endovascular

skills who are experienced in performing cervical carotid interventions (interventional cardiologists, interventional radiologists, endovascular surgeons) will need to participate in the interventional care of these critically ill patients.

The lack of on-site neurosurgery should not be considered a contraindication to performing timely MT. The timing of neurosurgical intervention (decompressive craniectomy) following ischemic stroke is >24 h after hospitalization in more than 75% of the cases when it is performed (22). Transfer protocols from community hospitals to comprehensive stroke centers are already in place for medically treated patients with stroke who demonstrate hemorrhagic transformation and the need for neurosurgical evaluation. Although we have a low threshold for transferring patients to a comprehensive stroke center for neurological deterioration following MT, none of the patients in our series underwent neurosurgical decompression following transfer to a tertiary care center.

The benefits of endovascular treatment for acute ischemic stroke are highly time sensitive: each 1-h delay to reperfusion is associated with more disability and less chance of achieving functional independence (23). Patients with acute stroke evaluated and deemed appropriate for MT often become ineligible if transferred to other institutions because of infarct demarcation (24). The impetus for developing a stroke intervention program in our cardiac catheterization laboratory came from the realization that our community was not receiving access to optimal therapy for LVO stroke. Our analysis of patients transferred from our institution to a major urban neurointerventional program approximately 45 miles away showed that very few transferred patients underwent MT. Most commonly, repeat imaging at the accepting institution showed little penumbra to justify proceeding with thrombectomy.

Our early experience with MT performed by interventional cardiologists with carotid stenting experience working collaboratively with neurologists suggests an alternative model that we believe will improve clinical outcomes by delivering more timely interventional care for patients with stroke with LVO. Our series and others (25–27) demonstrate that MT can be effectively performed by interventional cardiologists with carotid stenting experience despite a lack of formal neurointerventional training. Wider implementation of this model to STEMI-capable hospitals would dramatically increase the number of patients who could benefit from the proven life-changing benefits of timely MT. Training pathways will need to be developed to allow interventional cardiologists who do not have cervical carotid stenting experience to become proficient in acute stroke intervention. In our program, 2 experienced interventionalists (D.B., J.D.W.) have assisted on the majority of MT procedures and have acquired the skills to competently perform these cases independently.

The current care pathway enabling intervention for LVO stroke requires emergency medical services diversion strategies or hospital to hospital transfer of critically ill patients to large comprehensive stroke centers, which results in loss of precious time and death of precious neurons. We believe that an alternative model that facilitates rapid reperfusion of the infarcting brain locally has the potential to yield superior outcomes. This hypothesis should be tested with a trial comparing outcomes with a “drip and ship” strategy versus a strategy of MT using STEMI teams at the hospital of presentation. A hybrid approach involving local MT followed by transfer to a comprehensive stroke center for ongoing medical treatment is also a care pathway worth investigating. We believe that the optimal and most logical strategy is to perform MT at the hospital of presentation, with subsequent transfer to a comprehensive stroke center when necessary to manage post-procedural complications.

STUDY LIMITATIONS. The major limitations of this study include that it is a real-world retrospective registry with a relatively small sample size. Additionally, cerebral flow rates were not evaluated by a core lab. Adverse clinical events and functional status evaluations were not adjudicated by a central study committee.

CONCLUSIONS

Mechanical thrombectomy for large vessel occlusion stroke can be performed effectively and safely in the cardiac catheterization laboratory by interventional cardiologists working closely with neurologists. This model may greatly increase access to timely stroke care leading to improved functional outcomes.

ADDRESS FOR CORRESPONDENCE: Dr. Steven A. Guidera, Doylestown Hospital, 315 West State Street, Doylestown, Pennsylvania 18901. E-mail: guidera5@verizon.net.

PERSPECTIVES

WHAT IS KNOWN? MT is a time-sensitive procedure that improves outcomes for patient with acute ischemic stroke due to LVO. There is a severe shortage of formally trained neurointerventionalists who perform this procedure.

WHAT IS NEW? We have demonstrated that excellent clinical outcomes can be obtained by interventional cardiologists without formal neurointerventional training performing MT.

WHAT IS NEXT? Additional clinical research is needed to compare outcomes between the current model of transfer of patients requiring MT to large comprehensive stroke centers and a model of using interventional cardiologists to treat these patients more rapidly at community hospitals.

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