

Successful endovascular treatment of simultaneous acute ischaemic stroke and hyperacute ST-elevation myocardial infarction: the first case report of a single-operator cardio-cerebral intervention

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Background

The simultaneous management of cardio-cerebral infarctions is an extremely difficult task, as both organs need to receive reperfusion therapy in a limited time to avoid death or permanent disability. The following case is the first published endovascular treatment of synchronous heart and brain infarctions delivered by a single operator with excellent clinical outcome.

Case summary

A 67-year-old female patient was directly transported to the emergency room of a comprehensive stroke centre with acute onset global aphasia and right hemiplegia. The onset to admission time exceeded the 4.5-h time window of systemic thrombolysis. Head computed tomography (CT) excluded extensive early extensive brain damage, CT angiography documented left middle cerebral artery occlusion and mechanical thrombectomy was indicated. Extensive anterior ST elevation was detected on the transport monitor while waiting for in-hospital transfer. The two simultaneously evolving pathologies were handled in a single endovascular procedure that took less than 60 min by a dual-trained interventional cardiologist/neurointerventional surgeon. The patient recovered without any major cardiac or neurologic sequela.

Discussion

Interventional cardiologists, professionally trained through a neurointerventional fellowship programme to perform endovascular stroke interventions according to the latest multi-society position paper, could not only complement stroke teams lacking manpower, but their unique experience could also help the patients suffering from the most devastating forms of cardio-cerebral infarctions.

Keywords

acute ischaemic stroke • endovascular stroke treatment • primary percutaneous coronary intervention • cardio-cerebral infarction • case report

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Learning points

- Aphasic patients suffering from brain infarctions may be unable to express their pain even in case of concomitant ST-elevation myocardial infarction. This fact underlies the importance of routine 12-lead electrocardiogram recording during the admission of every stroke patient.
- The successful parallel management of acute cerebral and myocardial infarctions is depended on time and finding the optimal balance between thrombotic and haemorrhagic risk factors.
- Interventional cardiologists, who complete a formal neuro interventional training may contribute substantially to endovascular stroke teams by applying their unique expertise.

Guideline being discussed: Interdisciplinary management of acute ischaemic stroke: current evidence training requirements for endovascular stroke treatment: Position Paper from the ESC Council on Stroke and the European Association for Percutaneous Cardiovascular Interventions with the support of the European Board of Neurointervention.¹

Introduction

The successful parallel management of myocardial and cerebral infarctions is a challenging task. A series of difficult and timely decisions must be taken to avoid the potential devastating thrombotic and haemorrhagic complications related to the two simultaneously evolving pathologies. While the acute treatment algorithm of the two distinct diseases is well-guided by the evidence-based literature,^{2,3} no clear guidelines are available on the rare co-occurrence of the two emergencies. Due to the narrow therapeutic time window and life-threatening natural course of diseases, the mortality rate associated with the cardio-cerebral infarctions is extremely high according to the published case series.^{4,5} The successfully treated cases may represent a useful learning reference to guide the decision-making in these difficult scenarios. Interventional cardiologists completing the neuro-interventional training programme outlined in the latest multi-society consensus document¹ are ideally fit for performing such difficult interventions, as demonstrated by the outcome of the following clinical case.

Timeline

02 May 2021	9:00	Patient last seen well by family members.
	12:00	Patient found down, alert but unresponsive, unable to move the right side.
	13:40	Direct ambulance transfer to the comprehensive stroke centre.

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	13:50	On-call neurologist found global aphasia, left conjugate gaze deviation, right central facial palsy, and right hemiplegia [National Institute of Health Stroke Scale (NIHSS) 21].
	14:04	Cranial computed tomography (CT) documented left middle cerebral artery (MCA) occlusion, with no early ischaemic changes. Direct mechanical thrombectomy was indicated.
	14:13	ST elevation spotted on the transfer monitor, confirmed by 12-lead electrocardiogram.
	14:50	Coronary angiography found a pre-occlusive, thrombotic lesion of the proximal left anterior descending (LAD) coronary with slow flow.
	14:51	500 mg of IV ASPIRIN administered, stenting temporarily withheld.
	15:10	Aspiration thrombectomy of the MCA with complete flow restoration. 7500 IU Na-heparin administered.
	15:46	Coronary stenting of the left main-LAD continuum completed with excellent result.
	16:22	Control cranial CT ruled out procedural complication.
	16:25	600 mg of Clopidogrel administered orally.
03 May 2021	9:00	Control neurological examination detected clumsiness of the right hand with mild difficulty finding words (NIHSS 2 points). Early mobilization was started.
15 May 2021	9:30	Cardiac magnetic resonance imaging investigation showed preserved ejection fraction (EF 55%) with mild hypokinesia of the distal septal segments. No late enhancement noted.

Case presentation

A 67-year-old female patient with no previous history of chronic disease was found lying on the ground unresponsive, 3 h after being 'last seen well' by her family members. She got directly transported to the nearest comprehensive stroke centre with onsite endovascular treatment capability. The on-call neurologist documented global aphasia, left conjugate gaze deviation, right facial palsy, and right hemiplegia [National Institute of Health Stroke Scale (NIHSS) of 21]. Native computed tomography (CT) scan ruled out haemorrhage and showed no early ischaemic changes in the left hemisphere (*Figure 1A*). Artificial intelligence-based image analysis (Brainomix, Oxford, UK) measured an Alberta Stroke Program Early CT Score of 10/10, signifying no early ischaemic damage of the brain tissue.⁶ Computed tomography angiography analysis revealed the occlusion of the left middle cerebral artery (MCA) main segment (*Figure 1B*).

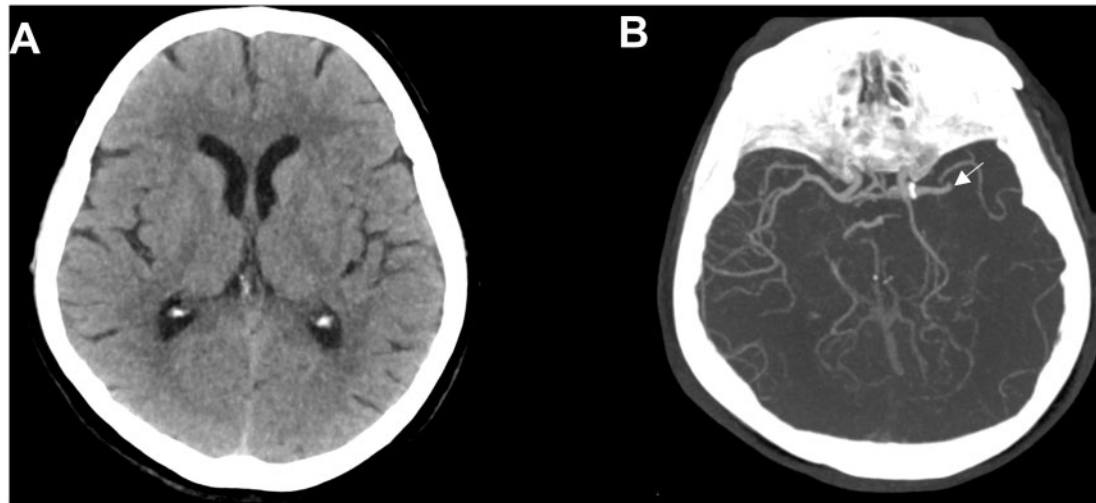


Figure 1 Cranial computed tomography imaging on admission. Native computed tomography scan showed no early ischaemic changes in the left hemisphere (A). Computed tomography angiography revealed an occlusion in the middle segment of the left middle cerebral artery main trunk (M1) (white arrow). (B).

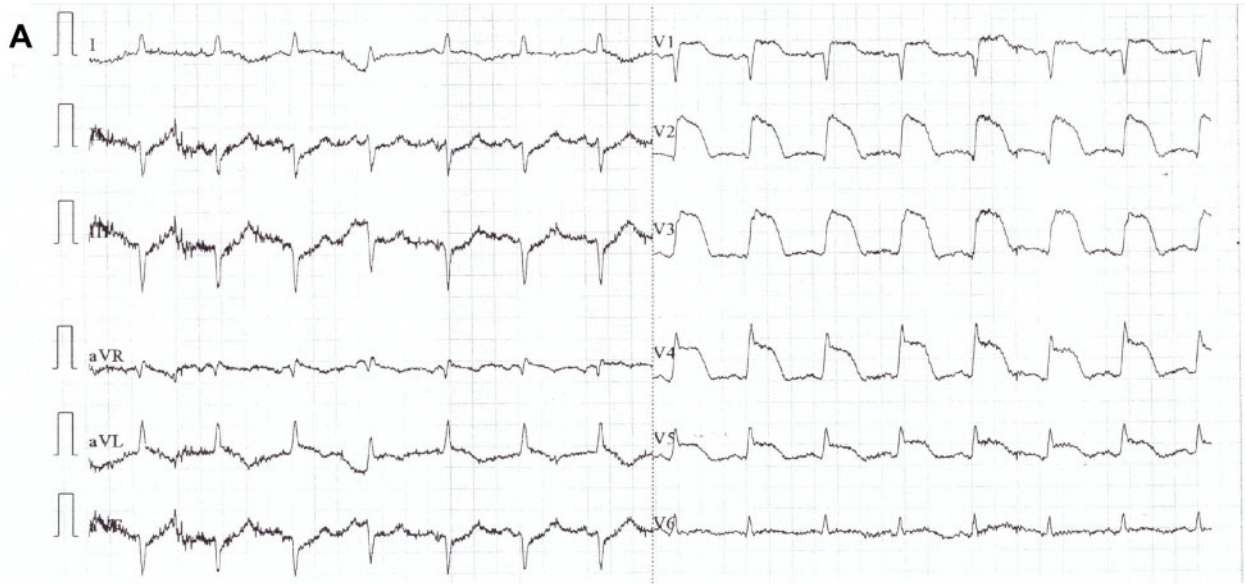


Figure 2 Electrocardiogram following the computed tomography scan. A 12-lead electrocardiogram was confirmed extensive anterior ST elevation, which was previously spotted on the transport monitor screen. The aphasic patient did not signal any pain.

As the exact onset of symptoms was unknown, the neurologist decided to withhold IV thrombolysis and send the patient directly to mechanical thrombectomy.

The ER staff spotted a large ST elevation on the monitor of the patient waiting for transfer to the angiography suite. While the patient could not signal chest pain, being completely mute due to aphasia, a 12-lead electrocardiogram (ECG) confirmed the extensive anterior ST-elevation myocardial infarction (STEMI) pattern (Figure 2A).

The neurointerventional service that day was provided by an accredited interventional cardiologist with completed neurointerventional fellowship training, thus a consensual decision was taken by the cardiology and neurology teams to request the execution of the necessary endovascular interventions within a single procedure.

The patient was transferred to the catheterization laboratory with anaesthesia backup. The right femoral artery was cannulated with an oversized, 9-Fr sheath to allow continuous invasive blood pressure

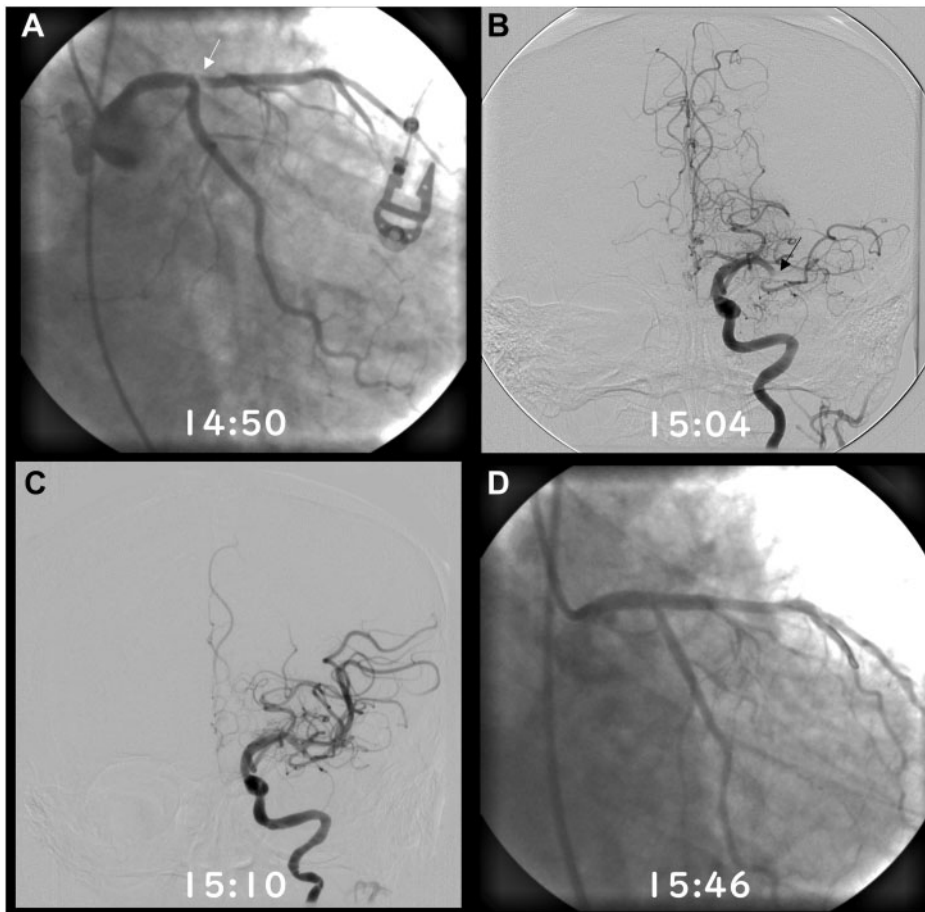


Figure 3 Treatment sequence of simultaneous anterior ST-elevation myocardial infarction and left middle cerebral artery occlusion. Coronarography confirmed a thrombotic lesion on the left anterior descending artery origin (white arrow) with persistent slow flow. (A) Angiography confirmed left middle cerebral artery occlusion (black arrow) (B). Aspiration thrombectomy resulted in complete cerebral reperfusion without complication (C). Left main–left anterior descending artery stenting achieved excellent result (D).

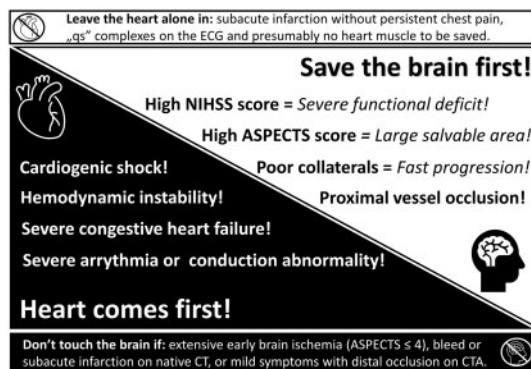


Figure 4 Decision-making in simultaneous cardio-cerebral infarction. Any form of haemodynamic instability favours prioritizing the cardiac revascularization, while poor collateral status and severe neurologic deficits call for immediate cerebral flow restoration in stable patients.

monitoring. As a first step, a coronarography was performed to rule out a suspected Takotsubo syndrome caused by a potential stroke-induced spasm. While no sign of coronary spasm was seen, a sub-occlusive thrombotic lesion was documented at the origin of the left anterior descending (LAD) artery (Figure 3A). Taken the slow but persistent coronary flow, the patient's stable haemodynamic condition, and the haemorrhagic risk associated with a stroke intervention under dual antiplatelet therapy into account, coronary stenting was temporarily withheld, and 500 mg of IV aspirin was administered only (Figure 4).

To save time, the fastest cerebral recanalization technique, aspiration thrombectomy was performed in the left MCA using a dedicated 6-Fr aspiration catheter (Sofia Plus, Microvention Terumo Inc., Aliso Viejo, CA, USA). Complete flow restoration was achieved with a single pass, and the patient's right hemiplegia promptly improved.

As no sign of complication was detected on control angiography (Figure 3B and C), the operator decided to continue with the coronary revascularization after the administration of 7500 IU Na-heparin. Two 14" guidewires were advanced into the LAD and circumflex

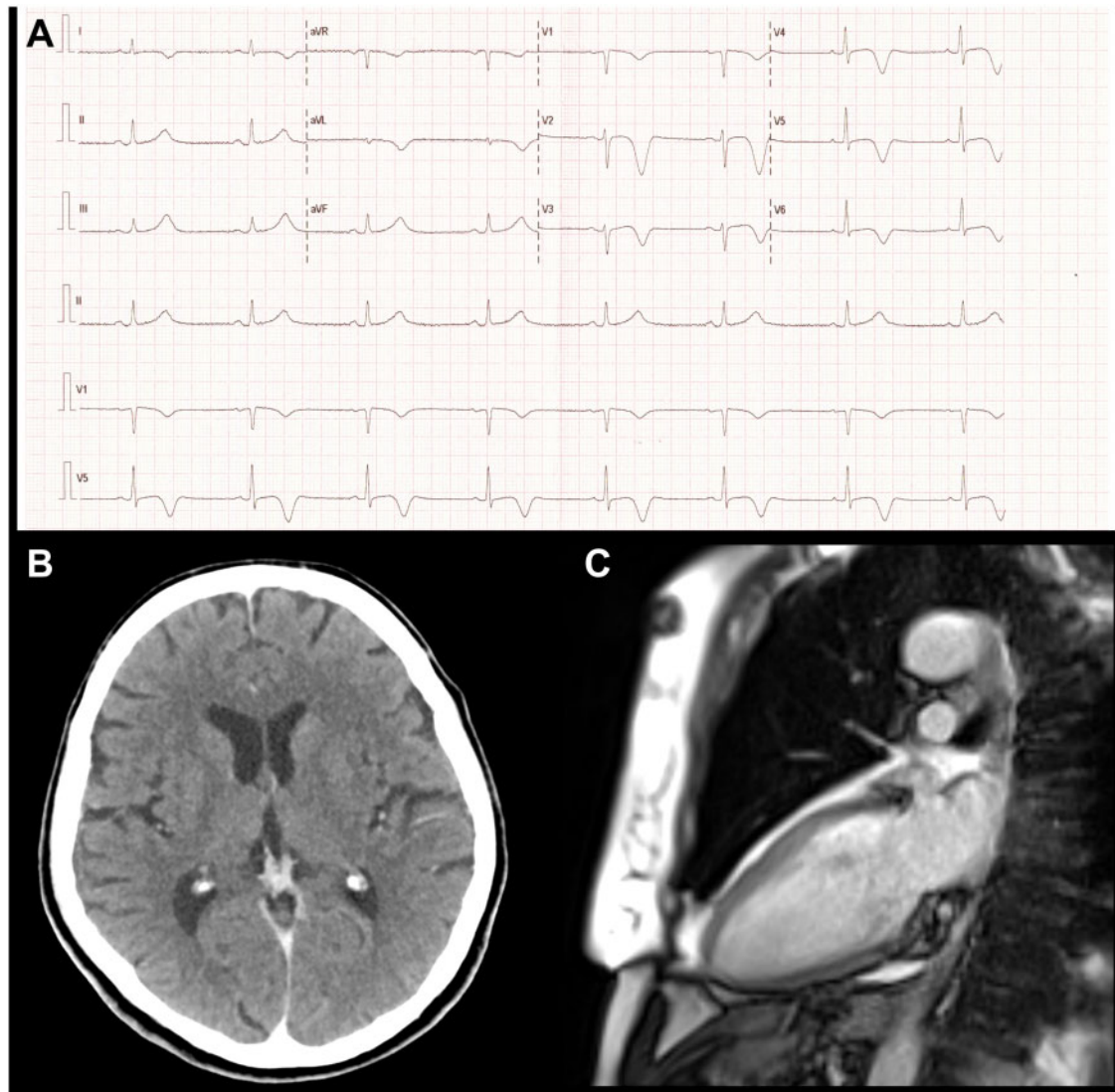


Figure 5 Control studies. Post-intervention electrocardiogram showed ST-segment resolution with anterior T inversion (A), cranial computed tomography scan showed no new ischaemic lesion or bleed (B), cardiac magnetic resonance imaging performed on the 12th day documented preserved ejection fraction without late enhancement in the myocardium (C).

(CX) coronaries, pre-dilatation of the lesion was performed, and an everolimus-eluting stent (Resolute Integrity, Medtronic Inc., Dublin, Ireland) was implanted in the left main (LM)-LAD continuum. The LM portion of the stent was post-dilated by a non-compliant balloon at 20 ATM (Figure 3D). Although the origin of the CX was covered with struts, the flow was patent, and no further post-dilatation was performed to avoid the need for bifurcation stenting. The puncture site was closed by a closure device. As soon as the post-operative control CT ruled out any complication (Figure 5B), the patient was loaded with 600 mg of clopidogrel. Control ECG in the cardiac care unit showed complete ST resolution (Figure 5A).

Neurological examination on the following day revealed only mild clumsiness of the right hand with a very mild word-finding difficulty (NIHSS 2 points). Laboratory analysis documented a peak high-sensitivity troponin T level of 595 pg/mL. Cardiac magnetic resonance

imaging performed on the 12th day following the interventions showed preserved ejection fraction (EF 55%) with only mild septal hypokinesia. Surprisingly, no late enhancement and no cardiac source of emboli were documented (Figure 5C). Prolonged rhythm monitoring using 72-h Holter ECG did not detect atrial fibrillation. Patient was scheduled for haematology examination as the next step of her work up. She remained independent upon her discharge to rehabilitation (modified Rankin Scale: 1).

Discussion

The simultaneous occurrence of cardio-cerebral infarction is a rare clinical entity with a prevalence rate of about 0.25% among the patients admitted for acute myocardial or cerebral infarctions, based

on the largest institutional series.⁵ The optimal clinical management of these patients is poorly defined, and the overall mortality was found to be larger than 45% at 30 days applying medical therapy or consecutive endovascular interventions provided by separate teams, even though various sequences of the reperfusion therapy (brain–heart vs. heart–brain) were used in these cases.⁵ The rapid revascularization of the infarcted territories in the two organs is elementary to avoid death and permanent disability (Figure 4). The optimal timing of the various components of the anti-thrombotic therapy is also critical, as the obligatory use of antiplatelet medications and anticoagulants in STEMI management can significantly increase the risk for haemorrhagic complications in ischaemic stroke, especially if the blood–brain barrier is compromised by prolonged cerebral ischaemia or by an otherwise minor vascular injury associated with the mechanical recanalization.⁷

Interventional cardiologist formally trained to perform endovascular treatment (EVT) in stroke according to the position paper of European Society of Cardiology Council on Stroke⁴ are theoretically ideally placed to handle cardio-cerebral infarctions. Based on the results of early feasibility studies, properly trained interventional cardiologists working as part of a multidisciplinary stroke team demonstrated similar patient outcomes in the endovascular management of ischaemic stroke as neurointerventional specialists with neurosurgical or radiological training background,^{8,9} while the above presented case suggest, that in cardio-cerebral infarction the dual-trained cardiologists may even outperform other specialists of the field. The rapid execution of simple interventional solutions and the careful stepwise administration of the various components of anti-thrombotic therapy have all largely contributed to the final good outcome of our case. We do acknowledge, however, that the successful management of such a complex clinical situation is dependent on multiple factors, including many that are not controllable by the care providers.

In conclusion, the adequate treatment of cardio-cerebral infarctions requires the rapid but careful evaluation of multiple disease aspects, and even if the interventions are performed by a single operator, the ultimate good outcome can only be reached through multidisciplinary cooperation and the functional integration of the acute care networks.

Lead author biography



Dr Sándor Nardai, PhD, is a Hungarian board-certified cardiologist, neurologist, and neurointerventional specialist. He completed his cardiology residency training at the Heart and Vascular Center of Semmelweis University between 2008 and 2014. In 2014–2015, he spent 1 year as a visiting fellow at the Luxembourg Heart Center (INCCI). From June 2015, he completed a

neurology and neurointerventional fellowship at the National Institute of Clinical Neuroscience in Budapest. In 2018, he was the first cardiologist to acquire the Diploma of the European Society of Minimal Invasive Neurological Therapy (ECMINT), and the first cardiologist to get a state accredited license to practice neurointervention in Hungary.

Supplementary material

Supplementary material is available at *European Heart Journal - Case Reports* online.

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Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as [Supplementary data](#).

Consent: The authors confirm that written consent for submission and publication of this case report including images and associated text has been obtained from the patient in line with COPE guidance.

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