Algorithm for Evaluating Patients with Ischemic Stroke for Purposes of Optimizing Prevention of Recurrent Stroke

CONSIDERATIONS FOR CLINICAL PRACTICE:
• For TTE, consider a bubble study using Valsalva maneuver. Rule out: PFO, etc.
• Cardiac rhythm monitoring choice will depend on status of patient (inpatient or outpatient).
• Initial evaluation should occur in hospital.
• When considering monitoring and based on the clinical situation and patient preference, reasonable options are to start with long-term monitoring (insertable cardiac monitor) first or with shorter duration monitoring (14 days to 30 days) and then moving to long-term monitoring if needed.
• When contemplating testing for hypercoaguable states, consider this for younger patients (under age 50).

CT or MRI (Class 1)
- Shows ischemic stroke†
  - YES
    - ECG and basic laboratory tests* (Class 1)
    - Echocardiography to evaluate for cardiac source of embolus (SOE) (Class 2a)
  - NO
    - CT or MRI shows ischemic stroke mimic
      - YES
      - Manage accordingly
      - NO
      - Consider delayed reimaging with CT or MRI if not done initially (Class 2a)

Anterior circulation infarct
- YES
  - Non-invasive intracranial arterial imaging (Class 2a)
  - Non-invasive intracranial and extracranial imaging of vertebrobasilar arterial system (Class 2a)
- NO
  - TEE, Cardiac CT, or Cardiac MRI (Class 2b)
  - Evaluate for other rare causes of stroke

Based on age, medical comorbidities, imaging, and clinical syndrome, consider:
- Long-term cardiac rhythm monitoring (Class 2a)
- Test for genetic stroke syndrome (Class 2a)
- Test for infectious vasculitis (Class 2a)
- TEE, Cardiac CT, or Cardiac MRI (Class 2b)
- Evaluate for other rare causes of stroke

Abbreviations: CT, computed tomography; CTA, computed tomography angiogram; ECG, electrocardiogram; MRA, magnetic resonance angiography; MRI, magnetic resonance imaging; SOE, source of embolism; TEE, transesophageal echo; TIA, transient ischemic attack; and US, ultrasound

## Diagnostic Evaluation and Therapeutic Implications in Ischemic Stroke:

<table>
<thead>
<tr>
<th><strong>Diagnostic Test</strong></th>
<th><strong>Therapeutic Implications</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cardiac Causes</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Paroxysmal Occult AF</strong></td>
<td>- Noninvasive cardiac monitoring, and if no AF or flutter detected, then implantable cardiac monitoring, followed by Anticoagulation therapy</td>
</tr>
<tr>
<td><strong>Atrial Cardiopathy</strong></td>
<td>- Serum NT-proBNP, echocardiography, ECG</td>
</tr>
<tr>
<td><strong>Atrial Septal Defect</strong></td>
<td>- Echocardiography (TEE superior to TTE)</td>
</tr>
<tr>
<td><strong>Atherosclerotic Causes</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Aortic Arch Disease</strong></td>
<td>- Echocardiography (TEE superior to TTE)</td>
</tr>
<tr>
<td><strong>Substenotic Atherosclerosis</strong></td>
<td>- Vessel wall imaging, plaque MRI</td>
</tr>
<tr>
<td><strong>Other Causes</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Cancer</strong></td>
<td>- CT chest, abdomen, and pelvis</td>
</tr>
<tr>
<td><strong>Hypercoagulable State</strong></td>
<td>- Hypercoagulable work-up, including antiphospholipid antibodies</td>
</tr>
<tr>
<td><strong>Arterial Dissection</strong></td>
<td>- MRA with fat-suppressed images</td>
</tr>
</tbody>
</table>

*AF indicates atrial fibrillation; CT, computed tomography; MRA, magnetic resonance angiography; MRI, magnetic resonance imaging; NT-proBNP, N-terminal pro-B-type natriuretic peptide; TEE, transesophageal echocardiography; and TTE, transthoracic echocardiography.*


### Clinical Professionals Involved in Diagnostic Evaluation:

- **Neurologist**
  - Lead physician throughout patient's hospitalization, coordinate all services, initiate diagnostic tests and personnel involved with patient care. Whenever possible, a vascular neurologist should direct the evaluation.

- **Advanced practice provider**
  - Can help to manage post-stroke follow up care, particularly related to secondary prevention.

- **Cardiologist**
  - Necessary specialist to initiate diagnostic studies when cardiac testing is needed.

- **Electrophysiologist**
  - Possible consultant to cardiologist if arrhythmia, specifically atrial fibrillation, is suspected cause of the event.

- **Hematologist**
  - Consultation if hypercoagulability is suspected.

- **Oncologist**
  - Consultation if hypercoagulability is suspected due to occult (or known) malignancy.

- **Radiologist**
  - Accurate, timely imaging results coordination with neurologist, cardiologist and interventional radiologist.

- **Sleep specialist**
  - Recommended consultation since sleep apnea significantly elevates risk of subsequent problems.

- **Stroke coordinator**
  - Follow patient from first contact to optimize timing, maintain records, evaluate process and coordinate discharge.

- **Nurses**
  - Continuous, direct, personal patient contact: accurate implementing of orders and recording of patient progress.

- **Hospital social worker/case manager**
  - Connect patients to needed services, help patients and families navigate the medical system, and communicate patient needs and concerns to larger medical team.

- **Primary care professional**
  - A health care practitioner who will follow the patient after the cryptogenic stroke is diagnosed. Primary care clinicians provide most of the care following a stroke patient’s discharge from the hospital or inpatient rehabilitation. Primary care clinicians should receive a hospital discharge summary and examine whether any part of the evaluation of cause was deferred to the outpatient setting. Because there are important and complex decisions to make early after a stroke, this is when primary care physicians and neurologists may want to collaborate most closely.