Urgent, STAT, Super STAT, ASAP! Achieving timely lab testing for the Emergency Department

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Learning Objectives

• Describe the clinical need and TAT requirements for lab results in the assessment of acute ischemic stroke patients
• Define test TAT metrics used to assess lab quality performance
• Discuss different strategies for achieving timely testing for the emergency department

Case Study

16:00 80 yr female fell in her living room. Grandson found her displaying symptoms of right facial droop and slurred speech

http://www.strokeassociation.org/STROKEORG/Professionals/Target-Stroke; Accessed 03/12/15
Case Study: CODE STROKE

16:00 80 yr female fell in her living room. Grandson found her displaying symptoms of right facial droop and slurred speech
- EMS
17:20 ED CODE STROKE

Acute Ischemic Stroke

- Acute ischemic stroke is 4th leading cause of death in USA
- Standard Care Treatment:
  Intravenous tissue plasminogen activator (tPA)
  - Only FDA-approved pharmacological therapy for treatment of patients with acute ischemic stroke
  - Associated with ↑ odds of favorable outcome (OR 1.9; 95% CI, 1.2-2.9) when administered within 3 h of symptom onset
    - European Medicines Agency expanded use to 4.5 h
    - US FDA limits use to within 3 h of symptom onset
- Rapid patient evaluation, diagnosis & treatment of ischemic stroke in the ED is paramount
  - Narrow treatment window for acute ischemic stroke

Tissue Plasminogen Activator (tPA)

- Serine protease that activates fibrinolytic pathway
- Major risk is intracranial hemorrhage, which may be fatal
Importance of Time in tPA Treatment

• From the GWTG-Stroke data (2003-2009), among 25,504 acute ischemic stroke patients treated with IV tPA within 3 hours of symptom onset at 1082 hospital sites:
  o Door-to-needle times ≤ 60 minutes was associated with lower odds of in-hospital mortality (adjusted OR, 0.78; 95% CI, 0.69 to 0.90; P<0.0003)
  o For every 15 min reduction in door-to-needle time, there was a 5% lower odds of in-hospital mortality (adjusted OR, 0.95; 95% CI, 0.92-0.98; P=0.0007)
• AHA/ASA Goal: Door-to-needle time < 60 min for at least 80% of ischemic stroke patients


2013 AHA/ASA Guideline for the Early Management of Patients with Acute Ischemic Stroke

Patient Assessment:

- Patient history
- Lab findings
- Neurological assessment
- Brain imaging
- Cardiovascular assessment

2013 AHA/ASA Guideline for the Early Management of Patients with Acute Ischemic Stroke

• Because time is critical, a limited number of essential diagnostic tests are recommended:

<table>
<thead>
<tr>
<th>Labs to consider</th>
<th>IV tPA Exclusion Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose</td>
<td>&lt; 50 mg/dL (2.7 mmol/L)</td>
</tr>
<tr>
<td>Complete blood count (CBC)</td>
<td>Platelets &lt; 100,000/mm³ (&lt; 100 x 10⁹/L)</td>
</tr>
<tr>
<td>Prothrombin time (PT)</td>
<td>&gt; 15 sec</td>
</tr>
<tr>
<td>International normalized ratio (INR)</td>
<td>&gt; 1.7</td>
</tr>
<tr>
<td>Activated partial thromboplastin time (aPTT)</td>
<td>&gt; Upper limit of normal</td>
</tr>
<tr>
<td>Troponin</td>
<td></td>
</tr>
<tr>
<td>Creatinine</td>
<td></td>
</tr>
<tr>
<td>Electrolytes</td>
<td></td>
</tr>
</tbody>
</table>

Case Study: CODE STROKE

15:30
Time of symptom onset – patient last known normal

16:00
80 yr female fell in her living room. Grandson found her displaying symptoms of right facial droop and slurred speech

17:20
ED CODE STROKE
Lab tests ordered, collected & sent to lab

- Patient history
  Stroke 17 yr ago, Type II diabetes, atrial fibrillation (coumadin)

- Neurological assessment
  National Institute of Health Stroke Scale = 5

- CT scan
  Negative for intracranial hemorrhage

- EKG
  Atrial fibrillation, 77 bpm

18:08
Lab tests ordered, collected & sent to lab

<table>
<thead>
<tr>
<th>Test</th>
<th>Patient results</th>
<th>Reference Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose</td>
<td>96 (5.3)</td>
<td>69-175 mg/dL (3.8 – 9.7 mmol/L)</td>
</tr>
<tr>
<td>Platelets</td>
<td>283 x 10^9</td>
<td>150–440 x 10^9 /L</td>
</tr>
<tr>
<td>PT</td>
<td>14.4</td>
<td>9.7-12.1 sec</td>
</tr>
<tr>
<td>INR</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>aPTT</td>
<td>28.7</td>
<td>26.2-36.9 sec</td>
</tr>
<tr>
<td>Troponin</td>
<td>&lt;0.034 (&lt; 34)</td>
<td>&lt; 0.034 ng/mL (&lt; 34 ng/L)</td>
</tr>
</tbody>
</table>

18:30
IV tPA administered to patient

Door-to-needle time: 70 min
Symptom onset to IV tPA TAT: 3 h

Informed consent for fibrinolytic therapy
Why is Test Turnaround Time (TAT) Important?

- Laboratory support for patient-centered care
- Operational efficiency
- Customer (Physician/ Nurse/ Patient) satisfaction
- TAT is a key performance indicator of laboratory services
  - One of the most noticeable signs of laboratory service
  - Used by many clinicians to judge the quality of the lab
  - Delays in lab test TAT is a major source of complaints from laboratory services users

Customer Satisfaction Surveys

- Customer (e.g. Physician) satisfaction surveys are used as a surrogate indicator for the quality of lab services
  - Important component of lab quality assurance program and a quality indicator accepted by accreditation organizations (e.g. 2014 CAP, GEN.20316)

  2009 CAP Q-Probe study

<table>
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<tr>
<th>Expectation</th>
<th>Physicians</th>
<th>Nurses</th>
<th>Lab Personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAT Order</td>
<td>14%</td>
<td>12%</td>
<td>10%</td>
</tr>
<tr>
<td>TAT Delivery</td>
<td>13%</td>
<td>9%</td>
<td>7%</td>
</tr>
<tr>
<td>TAT (Overall)</td>
<td>12%</td>
<td>8%</td>
<td>6%</td>
</tr>
</tbody>
</table>

- Limitations – Subjective and may not accurately reflect views of patients and other stakeholders

Clinical and Lab Perceptions of TAT Expectations

- Lab services and test users should work together to develop and agree on TAT goals that meet the needs of the medical staff and can be reasonably achieved

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<th>Lab Personnel</th>
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<tbody>
<tr>
<td>TAT Order</td>
<td>Median = 37.5 min, n = 1352 physicians</td>
<td>Median = 60 min, n = 119 labs</td>
<td>Median = 91 min, n = 119 labs</td>
</tr>
</tbody>
</table>

**Definition of TAT**

- Institutions should define TAT and what you are measuring
  - Consider the total testing process and workflow
  - Defining TAT should be a multi-disciplinary cooperative effort

**Defining TAT Goals**

- Seek resources for guidance

- 2013 AHA/ASA Guideline “Door-to-needle” TAT ≤ 60 min (Door to tPA administration)

- E.g. CAP Q-Probes

**Comprehensive Stroke Center (CSC) Standards**

- CSC Certification requires monitoring key quality stroke care metrics
- DSPM.3, EP2b: Documentation indicates ability to complete and report lab tests in < 45 minutes from being ordered
STAT Testing Approaches for the ED

In general,
• Stat testing in central laboratory
• Satellite lab testing in the ED
• Point of Care Testing

One size does not fit all, and will vary between institutions

Improving ED STAT Test TAT Performed in the Central Laboratory

Flow diagrams of patient arrival (door) to specimen collection

Median door to order TAT: 54 min
Median door to order TAT: 11 min

• Preanalytical clinical workflow is an important TAT consideration
• “Multidisciplinary collaboration and teamwork between the ED and laboratory were central to the success of reducing troponin (door to result report) TAT to < 60 min…”

Specimen Type Consideration for Rapid TAT

• Serum specimens
  o With silica clot activator recommend 30 min for blood clotting
  o With thrombin clot activator recommend 5 min for blood clotting
  o Blood from patients receiving anticoagulant therapy may take longer to clot

<table>
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<th>Specimen Type Consideration for Rapid TAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Plasma or anticoagulated whole blood specimens can mitigate blood clotting time issues</td>
</tr>
<tr>
<td>• Requires adequate volume filling and mixing with anticoagulant</td>
</tr>
<tr>
<td>• Differences in test results between plasma, serum and whole blood have been reported → need to validate specimen types</td>
</tr>
<tr>
<td>• 2010 CLSI GP34-A Validation and Verification of Tubes for Venous and Capillary Blood Specimen Collection; Approved Guideline</td>
</tr>
</tbody>
</table>

Kocijanic et al. Biochemia Medica. 2014;24(3):368-75
Improving ED STAT Test TAT Performed in the Central Laboratory

- Changes in lab specimen management, including the use of a pneumatic tube and computerized order management, resulted in a progressive decrease in lab TAT for ED

**Figure**: Frequency distribution for turnaround times during the 3 study intervals.

Improving STAT Test TAT Using a Satellite Laboratory in the ED

- Central lab located in different building 300 m from ED
  - Dedicated couriers transported the specimens
  - Pneumatic tube system considered but found to be costly

- Implemented satellite lab (lab analyzers) in the ED

<table>
<thead>
<tr>
<th>Median Collect to receipt TAT</th>
<th>Median Collect to report TAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Lab</td>
<td>22 min</td>
</tr>
<tr>
<td>Satellite Lab</td>
<td>1 min</td>
</tr>
</tbody>
</table>

Considerations for Improving STAT Test TAT

- Preanalytical (Sample receipt and processing)
  - Barcode-labeled specimens
  - Different colored labels for STAT specimens
  - Designated pneumatic tube / receipt station for STAT specimens
  - Designated STAT processing area with STAT centrifuge
  - Front-end automation for automated receipt, centrifugation and aliquoting

- Analytical
  - Instrument selection - test analysis time and performance
  - Instrument redundancy
  - Auto-repeat, -dilutions, -reflex testing
  - Auto-verification

- Post-analytical
  - Interfaced result reporting to electronic medical record

- Staffing
- Workflow
Improving STAT Test TAT Using Point-of-Care Testing (POCT) in the ED

- POCT is lab testing performed close to the site of patient care, typically by non-laboratory personnel
  - Can work well with clinical patient flow
  - Typically no sample transport or processing required
  - Results immediately available to caregiver

- Implemented POC troponin testing for chest pain patients in the ED

<table>
<thead>
<tr>
<th>Receive-to-result Troponin TAT</th>
<th>Door-to-troponin result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-POC testing period (min)</td>
<td>30 105</td>
</tr>
<tr>
<td>Post-POC testing period (min)</td>
<td>11 51</td>
</tr>
<tr>
<td>Absolute reduction (min)</td>
<td>19 54</td>
</tr>
<tr>
<td>% reduction</td>
<td>65 51</td>
</tr>
</tbody>
</table>


Continuous Monitoring of Test TAT Performance

- Electronic laboratory information systems (LIS) and electronic medical records (EMR) facilitate data capture
  - Examples: Time of patient registration (arrival), order, collection, receipt, result, etc.

- TAT distribution is often non-gaussian in nature
  - Non-parametric statistical analysis (i.e. Median and percentiles)

Frequency

Turnaround Time →


Continuous Monitoring of Test TAT Performance

- TAT is a key performance indicator of laboratory services
Continuous Monitoring of Test TAT Outliers

- Test outlier rates may serve as proxies for physician (dis)satisfaction.
  - Assumption: If reporting goals are established by both the lab and providers that use lab services, then clinicians will be satisfied when the TAT goals are met and dissatisfied when TAT goals are not met.

Test TAT Outlier Root-Cause Analysis

- Proactive monitoring of quality indicator data and risk analysis of nonconforming events (e.g., TAT outliers) may identify common causal factor(s) → potential continuous quality improvement opportunities.

Summary

- Important to understand the clinical needs and test TAT requirements for patient management decisions.
- Test TAT, TAT outlier rates, and physician satisfaction survey results are key indicators of laboratory quality.
- Laboratory test TAT definitions, goals and approaches to achieving timely testing depend on the institution and operational processes.
Assessment Question

Comprehensive Stroke Center certification requires documentation indicating the ability to achieve order to report lab test turnaround time within what timeframe?

A. < 30 minutes  
B. < 45 minutes  
C. < 60 minutes  
D. < 90 minutes

Assessment Question

Lab test turnaround time is best defined as:

A. Order to report  
B. Collect to report  
C. Receive to report  
D. Definition is institution-dependent

Assessment Question

Which strategy may be used for achieving timely testing for the Emergency Department?

A. STAT testing performed in the central lab  
B. STAT testing performed in a satellite lab in the ED  
C. Point of Care Testing  
D. All of the above
Assessment Question

Which of the following specimen types may cause prolonged delay in preanalytical specimen processing?

A. Whole blood
B. Plasma
C. Serum with silica activator
D. Serum with thrombin activator