Medical Complications In Acute Ischemic Stroke

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Disclosures

• I have no relevant financial interest, arrangements or affiliation with any of the products mentioned during this presentation.

• In relation to this presentation, there are no conflicting interests to disclose.
Objectives

• Discuss the most common medical complications of stroke
• Discuss the most serious medical complications of stroke
• Understand the best methods to prevent and manage the medical complications of stroke
Outline

• Introduction

• Timing of Complications in Ischemic Stroke (IS)

• Types of Medical Complications

• A Word about Medical Complications in Hemorrhagic Stroke (HS)

• Conclusion
Introduction

• Medical Complications from stroke are common:
  ▪ poor clinical outcomes,
  ▪ increased length of hospital stays,
  ▪ higher rates of readmission,
  ▪ increased healthcare costs,
  ▪ delayed time to rehabilitation,
  ▪ increased mortality

• Majority of deaths that occur in the first week after stroke are attributable to direct effects of stroke

• Mortality beyond the 1st week is largely attributed to medical complications
How common are Post-stroke Complications?

• Post-stroke complications are common, with a frequency reported from 24.2 to 95% (median 75%).\textsuperscript{3,5}
  
  • Common Categories include:
    
    • Neurological;
    
    • Neuropsychiatric: cognitive impairment, delirium, depression, anxiety, fatigue;
    
    • Medical:
### Kumar S, et al.

<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Design</strong></td>
<td>Kalra et al(^\text{a})</td>
<td>Davenport et al(^\text{b})</td>
<td>Johnston et al(^\text{c})</td>
<td>Langhorne et al(^\text{d})</td>
<td>Roth et al(^\text{e})</td>
<td>Weimar et al(^\text{f})</td>
<td>Bae et al(^\text{g})</td>
<td>Hong et al(^\text{h})</td>
<td>Indredavik et al(^\text{i})</td>
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<td><strong>Participants</strong></td>
<td>245</td>
<td>607</td>
<td>279</td>
<td>311</td>
<td>1029</td>
<td>3866</td>
<td>579</td>
<td>1254</td>
<td>489</td>
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<td><strong>Complication rate (total)</strong></td>
<td>60%</td>
<td>59%</td>
<td>95%</td>
<td>85%</td>
<td>75%</td>
<td>29.2%</td>
<td>27.6%</td>
<td>24.2%</td>
<td>64%</td>
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<tr>
<td><strong>Chest infection</strong></td>
<td>12%</td>
<td>12%</td>
<td>10%</td>
<td>22%</td>
<td>4%</td>
<td>7.4%</td>
<td>10.7%</td>
<td>12%</td>
<td>11.2%</td>
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<tr>
<td><strong>Urinary tract infection</strong></td>
<td>20.4%</td>
<td>16%</td>
<td>11%</td>
<td>23%</td>
<td>30.5%</td>
<td>6.3%</td>
<td>8.3%</td>
<td>6.9%</td>
<td>16%</td>
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<tr>
<td><strong>Fever</strong></td>
<td>NR</td>
<td>4%</td>
<td>16%</td>
<td>NR</td>
<td>43%</td>
<td>NR</td>
<td>13.2%</td>
<td>1.2%</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Pain</strong></td>
<td>25.3%</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>43%</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
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<tr>
<td><strong>Pressure sores</strong></td>
<td>3.3%</td>
<td>18%</td>
<td>NR</td>
<td>21%</td>
<td>4.3%</td>
<td>NR</td>
<td>1.4%</td>
<td>3.3%</td>
<td>0.6%</td>
</tr>
<tr>
<td><strong>Falls</strong></td>
<td>NR</td>
<td>22%</td>
<td>NR</td>
<td>25%</td>
<td>10%</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>2.2%</td>
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<tr>
<td><strong>Depression</strong></td>
<td>25.3%</td>
<td>5%</td>
<td>NR</td>
<td>16%</td>
<td>13%</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
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<tr>
<td><strong>Deep vein thrombosis</strong></td>
<td>4%</td>
<td>3%</td>
<td>2%</td>
<td>2%</td>
<td>4%</td>
<td>0.2%</td>
<td>NR</td>
<td>NR</td>
<td>0.6%</td>
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<tr>
<td><strong>Pulmonary embolism</strong></td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>0.2%</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
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<tr>
<td><strong>Myocardial infarction/angina</strong></td>
<td>NR</td>
<td>NR</td>
<td>6%</td>
<td>NR</td>
<td>3%</td>
<td>0.5%</td>
<td>1.2%</td>
<td>1.9%</td>
<td>4.5%</td>
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<tr>
<td><strong>Congestive heart failure</strong></td>
<td>NR</td>
<td>NR</td>
<td>11%</td>
<td>NR</td>
<td>2%</td>
<td>2.9%</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td><strong>Cardiac arrest/arrhythmia</strong></td>
<td>NR</td>
<td>NR</td>
<td>2%</td>
<td>NR</td>
<td>3.2%</td>
<td>8.2%</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td><strong>Gastrointestinal bleed</strong></td>
<td>NR</td>
<td>NR</td>
<td>5%</td>
<td>NR</td>
<td>3.1%</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
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<tr>
<td><strong>Dysphagia</strong></td>
<td>NR</td>
<td>NR</td>
<td>5%</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td><strong>Urinary incontinence</strong></td>
<td>NR</td>
<td>NR</td>
<td>5%</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
</tbody>
</table>
Langhorne et al. Stroke 2000;31:1223-9.6

Cumulative proportion (%) of patients experiencing complication

- Pain
- Falls
- Depression
- Chest infection
- UTI
- Pressure sore
- DVT

Time (weeks) from index stroke
From Langhorne et al: Most common medical complications.\(^6\)

<table>
<thead>
<tr>
<th>Complication</th>
<th>Percent * (At 30 months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falls</td>
<td>25</td>
</tr>
<tr>
<td>Urinary tract infection</td>
<td>24</td>
</tr>
<tr>
<td>Chest infection</td>
<td>22</td>
</tr>
<tr>
<td>Pressure sores</td>
<td>21</td>
</tr>
<tr>
<td>Depression</td>
<td>16</td>
</tr>
<tr>
<td>Shoulder pain</td>
<td>9</td>
</tr>
<tr>
<td>Deep venous thrombosis</td>
<td>2</td>
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<tr>
<td>Pulmonary embolism</td>
<td>1</td>
</tr>
</tbody>
</table>
From Johnston et al: Most serious medical complications in IS.

<table>
<thead>
<tr>
<th>Complication</th>
<th>Percent</th>
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</thead>
<tbody>
<tr>
<td>All pneumonias</td>
<td>5</td>
</tr>
<tr>
<td>Aspiration pneumonia alone</td>
<td>3</td>
</tr>
<tr>
<td>Heart failure</td>
<td>3</td>
</tr>
<tr>
<td>Gastrointestinal bleeding</td>
<td>3</td>
</tr>
<tr>
<td>Cardiac arrest</td>
<td>2</td>
</tr>
<tr>
<td>Angina/MI/cardiac ischemia</td>
<td>1</td>
</tr>
<tr>
<td>Deep venous thrombosis</td>
<td>1</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td>1</td>
</tr>
<tr>
<td>Hypoxia</td>
<td>1</td>
</tr>
<tr>
<td>Urinary tract infection</td>
<td>1</td>
</tr>
<tr>
<td>Sepsis</td>
<td>1</td>
</tr>
<tr>
<td>Cellulitis</td>
<td>1</td>
</tr>
<tr>
<td>Peripheral vascular disorder</td>
<td>1</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>1</td>
</tr>
<tr>
<td>Pulmonary edema</td>
<td>1</td>
</tr>
<tr>
<td>Dehydration</td>
<td>1</td>
</tr>
</tbody>
</table>

24% from the placebo arm had at least one medical complication!
Secondary Complications and Mortality?

- Week 1: 90% directly related to sequelae of stroke (edema, herniation, etc.)
  - However, DVT formation may take place as early as 2 days after stroke onset, with a peak incidence between day 2-7.
- Week 2-4: Pulmonary Embolus, Infections
  - Risk remains high for up to 12 weeks;
- Week 8-12: Bronchopneumonia, Heart disease
Infections
Bacterial PNA is one of the most important complications in stroke patients:
  - The most common cause was thought to be solely due to aspiration!

Preventive Strategies:
  - Withhold oral feeding until demonstration of intact swallowing;
  - NG or PEG tube use reduces risk (but there is always still some risk of aspiration!);
  - Frequent changing of patient’s bed position and pulmonary physical therapy;
Urinary Tract Infections (UTIs)

- Most hospital-acquired UTIs are associated with use of indwelling catheters (6-30%);
- Intermittent catheterization does not reduce the risk of infection;
- Timed bladder emptying programs have shown some efficacy;
- If urinary infection is diagnosed, appropriate antibiotics should be chosen following core medical principles;
Stroke patients may be more susceptible to infection due to sympathetically-mediated suppression of the peripheral immune response.
Post-stroke Cardiac Complications

• Includes:
  • Myocardial infarction,
  • Cardiac arrhythmias,
  • Congestive heart failure, and
  • Takotsubo cardiomyopathy

• In a clinical cohort from Japan, an incidence of 1.2% of Takotsubo CM existed in consecutive patients w/in the first 2 weeks after an ischemic stroke.
Venous Thromboembolism

• Paretic limb is most at risk;
• Risk might be reduced by good hydration and early mobilization; intermittent pneumatic compression devices while on bed rest of limited risk reduction [CLOTS-3 trial];
• Current, the standard of practice would suggest by the PREVAIL study (Sherman DG et al.) that low-dose enoxaparin reduced the risk of VTE by 43% as compared to UFH [RR 0.57, 95% CI 0.44-0.76, p=0.0001] without an increased risk of hemorrhage.\(^\text{10}\)
  • OR for DVT: 0.34; PE: 0.36
  • OR for ICH: 1.39; systemic hemorrhage: 1.44

• Use LMWH for prophylaxis to reduce risk for VTE! Mobilize all stroke patients as early as possible, ideally by 24 hours.
Swallowing and Nutrition Complications

• Dysphagia occurs in up to 50% of patients with unilateral hemiplegic stroke and is an independent risk-factor for poor outcome;

• Carnaby et al. looked at 306 patients in a small single center, prospective, randomized clinical trial, and by using a standardized swallow program with frequent compensation strategies and diet modifications versus usual care.²

• Swallow complications reduced from 63% to 46% (p<0.01) and PNAs were reduced from 47% to 26% (p<0.001).
GU and Bowel Complications

- Urinary incontinence (UI)
  - Prevalence has been documented as anywhere from 37-79%;
  - High occurrence of detrusor hyperreflexia (spastic bladder);
  - Also, hyporeflexic bladder can be associated;
- Fecal incontinence (FI):
  - The greatest risk factor for development is UI
- Constipation:
  - Can effect up to 60% of stroke patients
- For UI/FI/constipation, supportive care (possibly w/ external catheter) and medical management are essential!
Immobility Complications (1)

- **Pressure Sores/Ulcers**
  - Use of support surfaces, frequent repositioning, optimizing nutritional status, and moisturizing sacral skin are appropriate preventive strategies to prevent pressure ulcers\(^8\)

- **Osteoporosis**
  - Hip fractures are 7-fold increased in stroke patients in the 1\(^{st}\) year post-stroke
Immobility Complications (2)

• Falls
  • Are common in every stage of stroke treatment;
  • Risk factors include cognitive impairment, depression, polypharmacy, and sensory impairment;
  • Exercise, calcium supplementation, and bisphosphonates improve bone strength and decrease fracture rates in stroke patients;
  • Home evaluations and modifications are essential;

• An assessment of fall risk is recommended for every stroke patient!
Spasticity / Pain

• Studies have shown spasticity effects 17-38% of stroke patients and usually occurs within the first few weeks or months following stroke, usually involving the elbow (79%), the wrist (66%), and the ankle (66%).

• Excluding Post-Stroke Central Pain Syndrome (a thalamic-based syndrome), post-stroke shoulder pain occurs in 9-40% of patients after a stroke.

• Working with an excellent physiatrist is essential to addressing these issues!
Post-Stroke Depression / Post-Stroke Fatigue

• Post-stroke depression and fatigue are two of the most common neuropsychological complaints:
  • Stroke patients report up to 50% and anywhere from 29-77% of them have both complaints, respectively.

• More recently, post-stroke fatigue has been reported to be linked to pro-inflammatory cytokines, especially interleukin-1 alpha and beta.9
Have we gotten better?

• A recent comparison from a single stroke center in Norway compared medical complication rates in the 1st week post-stroke in 2003 versus in 2013, treated in a dedicated stroke unit.¹

• After adjusting for stroke severity, only 45% of strokes (n = 185 patients) experienced 1 or more complications versus 74% of strokes (n = 489 patients) for moderate strokes.
But, what about hemorrhagic strokes?

• Otite et al. looked at the Nationwide Inpatient Sample from 2004 to 2013 and looked medical complications after acute intracerebral hemorrhage in the U.S. and found:7
  • 29% of all ICH admissions in the US have at least 1 medical complication;
  • Acute renal failure (>2-fold increase) and DVT risk have increased (> 50% increase unadjusted);
  • Sepsis and PNA have declined over the last decade;

• Medical complications in hemorrhagic strokes must be aggressively addressed!
Summary

• Post-Stroke Medical Complications are common

• Majority of deaths that occur in the first week after stroke are attributable to direct effects of stroke

• Mortality beyond the 1st week is largely attributed to medical complications

• A heightened awareness (in designated stroke units) of commonly encountered early and late medical complications & the knowledge to prevent/manage them can help improve patient outcomes!
Questions?

• Thank you for your attention.
• Any comments?
  • Contact me at teddy.youn@neurology.ufl.edu
References

3. Huang JF. Continuum (Minneap Minn). 2017 Feb;23(1, Cerebrovascular Disease): 93-110.