Risk Factors for Stroke Associated Pneumonia

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Abstract:

Background: stroke associated pneumonia is a major cause of poor outcome afterstroke. It increases the death rate among stroke patients by 3 fold in 30 days. We aimed at identifying factors that could predict the development of stroke associated pneumonia in acute stroke patients. Aim of study: to evaluate the risk factors that predict the development of pneumonia in acute stroke patients (stroke-associated pneumonia). Patient and method: we prospectively examined a series of acute stroke patients >18 years old admitted within 7 days of onset of symptoms who progressed to have a clinical diagnosis of pneumonia within the first 10 days of admission for the frequency of a predefined set of variables concluded from previous studies. Results: Over the period of 10 months, 46 patients were included, of which 52.2% were males, mean age was 64.98 years, 69.6% of them had hemorrhagic stroke, 52.2% of them had left brain stroke while 8.7% of them were bilateral. Per the Oxford Community Stroke Project (OCSP) classification, 47.8% of them had Total Anterior Circulation Syndrome (TACS); 43.5% of them had Partial Anterior Circulation Syndrome (PACS); and 8.7% of them had Posterior Circulation Syndrome (POCS). We found that their National Institute of Health Stroke Scale (NIHSS) was high (mean = 17.3 ± 4.79, median = 17), but there premorbid disability measured by the modified Rankin Scale was low (mean = 0.78 ± 1.576, median =0). Dysphagia was present in 82.6% of the patients, and 91.3% of them were hypertensive. Examining for oral health revealed that 76.1% of our patients had badoral health. Factors that were infrequent among our patients were diabetes mellitus (28.3%); smoking (26.1%); history of chronic respiratory illness (8.7%); atrial fibrillation (4.3%); and congestive heart failure (0%). Conclusion: Age, stroke severity, hypertension, and dysphagia, were the most outstanding risk factors associated with development of SAP. On the other hand, diabetes, atrial fibrillation, congestive failure of heart, long-lasting pulmonary illness, plus weak relation between SAP and smoking.

Key wards: Risk Factors, Stroke, Pneumonia

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Introduction

Cerebrovascular illness is defined as sudden beginning of a neurologic deficit that is of important in terms of vascular disease. So stroke diagnosis can be made by medical history, examination, laboratory investigation and brain radiological imagining. Cerebral ischemia is caused by a reduction in blood flow that lasts longer than several seconds. Neurologic symptoms are manifest within seconds because neurons lack glycogen, so energy failure is rapid. Stroke has occurred if the neurologic signs and symptoms last for more than 24 hours or brain infarction is demonstrated. Ischemic strokes are classified by the underlying cause of the vascular occlusion. Complications of post-stroke have traditionally been neglected, but there is increasing evidence that medical complications are common sequelae after stroke, and rates have been reported between 30 and 96% in a variety of studies. Complications are frequent in stroke, especially in severe stroke. Hardly any patient with severe stroke goes through stroke unit treatment without any complications like infections, falls, deterioration, pain, ischaemic heart disease, and others. Focus should be on prevention and early detection of complications. Pneumonia is common after stroke during the immediate and late periods. The cause of pneumonia in patients with stroke is multifactorial. Decreased alertness, severe neurological deficits, and dysphagia are highly associated with the development of pneumonia during hospitalization. Pneumonia is defined as an infection of the pulmonary parenchyma. Varying terminologies (e.g.: chest infection, stroke-associated pneumonia [SAP], aspiration pneumonia, post-stroke pneumonia) and diagnostic approaches are used for the spectrum of lower respiratory tract infection complicating stroke in patients not complaining from pneumonia before. Diagnosis of SAP remains particularly stimulation for many causes. Clinical pic of pneumonia plus stroke not well recognize, cough decrease and sputum also inadequate for collection, so stroke and pneumonia may lead to change in alert and mental prominence. Aim of study: to evaluate the risk factors that predicts the development of pneumonia in acute stroke patients (stroke-associated).

Patients and Methods:

Prospective observational study on a series of patients admitted to the neurology wards in Alimamain Alkadhimain Medical City in Baghdad city and Alsadr teaching hospital in Najaf city. The study took place from April-2018 to February-2019. We included patients with the clinical diagnosis of stroke (ischemic or hemorrhagic) proven by brain imaging admitted within 7 days of onset of symptoms who proceeded to have SAP proven clinically (fever > 38 °C, productive cough, tachypnea, crepitations in the base of lung) and radiologically with the supporting opinion of a pulmonologist within 10 days of admission. We excluded patients with chest infection or an active pulmonary disease (acute exacerbation of chronic obstructive pulmonary disease, acute bronchitis, active lung malignancy, or asthma) before or at time of admission, and patients admitted after 7 days from onset of symptoms of stroke. Assessment of the candidates for the study included: demographic data (age and sex), stroke severity assessment using the National Institute of Health Stroke Scale (NIHSS) a 42 points scale, premorbid clinical state using the modified Rankin Scale (mRS), assessment of stroke risk factors (diabetes, hypertension, heart failure, and atrial
fibrillation), presence of clinical dysphagia –by bedside swallowing test- or nasogastric tube, past medical history of respiratory problems (COPD, asthma, bronchial carcinoma), smoking history, and assessment of oral health by visual inspection of oral hygiene and denture. Assessment also included the type of stroke (ischemic or hemorrhagic), side of the lesion (left or right or both), and subtype of stroke according to the Oxford Community Stroke Project \(^{(11)}\).

Statistical analysis expressed by the frequency of categorical variables (sex, and presence or absence of dysphagia, diabetes, hypertension, atrial fibrillation, heart failure, pulmonary disease, or smoking or a history of smoking) and by the range, mean ± standard deviation and median of the categorical variables (age, mRS, and NIHSS) using IBM\(^{®}\)SPSS\(^{®}\) statistics tool v.23.

**Results:**

46 patients were included in our study, of which 24 males (52.2%) and 22 females (47.8%). Age ranged from 41 to 90 years (64.98 ± 13.663, median = 68 years). Ischaemic stroke cases were 14 (30.4%) while 32 (69.6%) of them were haemorrhagic. Subtyping the stroke patients using the Oxford Community Stroke Project (OCSP) which divides the stroke according the clinical and radiological presentation into Total Anterior Circulation Syndrome (TACS), Partial Anterior Circulation Syndrome (PACS), Posterior Circulation Syndrome (POCS), and Lacunar Syndrome (LACS); showed that 22 patients (47.8%) had TACS, 20 (43.5%) had PACS, and only 4 (8.7%) had POCS. Left side of the brain was involved in 24 patients (52.2%), right side in 18 patients (39.1%), while 4 patients had bilateral involvement (8.7%), all of the 4 had haemorrhages. Table 1 summarizes patients’ basic clinical and demographic data.

Severity of stroke according to the NIHSS ranged from 8-27 out of 42 (mean = 17.3 ± 4.793, median = 17), while the pre-stroke morbidity severity as measured by the mRS ranged from 0 to 5 (mean = 0.78 ± 1.576, median = 0).

Dysphagia was present in 38 patients (82.6%), hypertension in 42 patients (91.3%), diabetes mellitus in 13 patients (28.3%), atrial fibrillation in 2 patients (4.3%), and no one of the cases had heart failure.

Pulmonary chronic morbidity (asthma, COPD, bronchiectasis, or bronchial carcinoma) was present in 4 patients (8.7%), and smoking history was positive in 12 patients (26.1%) one of them was an ex-smoker quitted before one year. Assessment of oral health showed that 35 patients (76.1%) had poor oral health in form of caries, ill-fitting teeth, and unhealthy mucosa.
Table: Patients’ basic data

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No.</th>
<th>%</th>
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<tbody>
<tr>
<td><strong>Gender</strong></td>
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</tr>
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<td>52.2</td>
</tr>
<tr>
<td>Female</td>
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<td><strong>Stroke type</strong></td>
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<td></td>
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</tr>
<tr>
<td>Haemorrhagic</td>
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<td>69.6</td>
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<tr>
<td><strong>Stroke subtype</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TACS</td>
<td>22</td>
<td>47.8</td>
</tr>
<tr>
<td>PACS</td>
<td>20</td>
<td>43.5</td>
</tr>
<tr>
<td>POCS</td>
<td>4</td>
<td>8.7</td>
</tr>
<tr>
<td><strong>Stroke side</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left</td>
<td>24</td>
<td>52.2</td>
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<tr>
<td>Right</td>
<td>18</td>
<td>39.1</td>
</tr>
<tr>
<td>Bilateral</td>
<td>4</td>
<td>8.7</td>
</tr>
</tbody>
</table>

Discussion:

Despite the advances in stroke management, post-stroke complications, particularly pneumonia, remain a major cause of morbidity and mortality worldwide. Studies were conducted worldwide to identify the risk factors that could predict the occurrence of pneumonia in an aim to develop preventive strategies for the development of pneumonia. Dysphagia and risk of aspiration remains the major risk factor agreed upon by all studies,\(^\text{12,13}\) and in our study the frequency of patients having clinical dysphagia including those fed by nasogastric tube was 82.6%. This reflects that aspiration is the major, although not the only, cause of pneumonia following stroke.\(^\text{14,15}\) Although intubation has been used for long time as protective measure against aspiration, studies had shown that it serves a little in accomplishing that goal.\(^\text{14}\)

Stroke severity, as estimated by the National Institute of Health Stroke Scale (NIHSS), is the other predictor of the development of pneumonia, as well as other infections, agreed upon by most of the studies in this topic, in addition to being an independent predictor of poor prognosis and mortality \(^\text{16,17}\). Many studies focused on deriving a clinical score for the prediction of pneumonia after acute stroke, and nearly all of them incorporated both dysphagia and stroke severity, like the A2DS2 score,\(^\text{6,18}\) the AIS-APS score,\(^\text{19,20}\) the ICH-APS score,\(^\text{21}\) and others.\(^\text{22}\) In all of these studies the score of > 10 on the NIHSS was strongly associated with poor outcome,a higher NIHSS score is
associated with a deteriorated level of consciousness and decreased bulbar reflexes making aspiration more likely.\(^{(23)}\) In our study the least number scored was 8 in 2 patients only while the rest of them were above 10. This finding was consistent with what was found in other studies and enables us to focus our attention on patients who need special care to avoid the poor outcome.

The third most important factor referred to by most studies as an independent predictor of development of SAP as well as poor outcome is older age. Age is said to be associated with more severe neurological outcome, and impaired swallowing function and cough reflex.\(^{(24)}\) In our study the mean age was 64.98 and the standard deviation was 13.663 reflecting higher age of the affected patients.

Premorbid disability as measured by the modified Rankin Scale was investigated in few studies, in these studies a mRS of \(>3\) was considered predictor of developing SAP.\(^{(19,21)}\) In our study most of the patients had no significant disability prior to admission, and only 8 patients (17.4\%) had a mRS \(\geq 3\) while the rest of them had a score below 2. Stroke type (ischaemic vs. haemorrhagic) and anatomical location were also studied to examine their effect on development pneumonia. Various classifications of the anatomy of the lesion were proposed, some used already present classifications (WHO, OCSP, etc.) while others put their own divisions (e.g. anterior vs. posterior circulation, right vs. left). The result of these studies concluded that haemorrhagic stroke was associated with increased risk of SAP more than ischaemic stroke,\(^{(12,13)}\) and in terms of stroke subtype per the OCSP classification, total anterior circulation as well as posterior circulation strokes were more associated with SAP than partial anterior circulation strokes.\(^{(19)}\) In our findings there was a difference in the distribution according to OCSP classification of our patients, for that there were fewer patients with posterior circulation strokes and more partial anterior circulation stroke patients although total anterior circulation strokes remained dominant. The relation of the TACS with increased risk is linked to increased severity, while the reduced number of POCS patients is probably explained by the increased mortality among them due to early complications of stroke (local oedema and brainstem herniation) before the patient could develop or be diagnosed with pneumonia.

Many other risk factors were identified in previous studies with conflicting results. These factors included male sex, cardiovascular risk factors (hypertension, diabetes mellitus, atrial fibrillation, congestive heart failure), respiratory risk factors (COPD, asthma, bronchiectasis, carcinoma, smoking), and oral health. Ruijun Ji et al.\(^{(19,21)}\) Presented that age, cardiac failure, COPD, atrial fibrillation, present smoking, pre-stroke requirement, decrease in score of GCS, painful during swallowing, SAP parameters is stroke and blood glucose. Finlayson et al.\(^{(25)}\) Showed that male gender, non-lacunar ischemic stroke, and preadmission dependence were prognosticators also. Yet S. Schepp\(^{(22)}\) and De Castillo et al.\(^{(13)}\) Found an inverse relationship between diabetes and SAP. Also there were 2 studies who found that atrial fibrillation was also infrequent in patients with SAP.\(^{(13,24)}\) De Castillo et al. also found that alcohol intake is also a predictor of SAP.
In our study male sex, older age, and severe stroke were characteristic of our patients, on the other hand, diabetes, atrial fibrillation, COPD, and smoking were much less common among our cases. The less common factors can be explained by the fact that they are by themselves not very common in our sample of patients and there is a need for comparative studies to identify their role as predictors of SAP. In the case of diabetes the explanation is that diabetic patients are more subjected to have lacunar and minor strokes which have less chance of being complicated by SAP. (22)

Interestingly none of our patients had a history of congestive heart failure neither diagnosed with it upon admission, for which we have no explanation.

Hypertension was investigated by all the studies concerned with SAP predictors, none of them found a significant relationship between hypertension and development of SAP. In our study 91.3% (42/46) of the patients had history of hypertension or diagnosed on admission, but this could be explained by the fact that the disease is common itself, the need for comparative study to confirm or refute this is warranted.

C. Sellars et al. (17) found that oral health status could be an independent predictor of the risk for development of SAP with a sensitivity of 66.7% and a specificity of 38.8%. In our study 35 patients (76.1%) had a poor oral health by simple estimation of oral denture and mucosa, which is in keeping with the above finding.

**Conclusion:**

Age, stroke severity, hypertension, dysphagia, and poor oral health were the most outstanding risk factors associated with development of SAP. On the other hand, diabetes, atrial fibrillation, congestive failure of heart, long-lasting pulmonary illness, plus weak relation between SAP and smoking.

**References:**


