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Challenges in Diagnosing Adult Epiglottitis: Limitations of CT scan

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ABSTRACT

Adult Epiglottitis (AE) is a life-threatening but uncommon condition which presents with non-specific symptoms such as sore throat and odynophagia. Because CT scan is readily available in the Emergency Department (ED), it is often used to evaluate adult patients with AE when laryngoscopy is not available and examination inadequate and to exclude other ENT (Ear, Nose and Throat) emergencies. However, up to this date, there is no report of CT scan accuracy in evaluating AE in our literature. Our case is a 26 year old African American female who complains of sore throat and odynophagia after she ate at a barbecue 8 hour prior to the ED visit. On examination, VS (Vital Signs) were stable, throat revealed marked erythema without any peritonsillar abscess. Neck was supple without any cervical adenopathy - Chest=clear, no rales/ronchi - The rest of the exam was within normal limits. Initial CT scan of the neck was read as normal by the on call Radiologist. A direct laryngoscopy had shown findings consistent with acute epiglottitis. Repeat CT scan 24 hours after ED visit confirmed the diagnosis of AE. Patient was started on IV steroids and antibiotics and admitted to ICU. Our case illustrates the challenges facing the Emergency Physicians in diagnosing AE. It reports the role and limitations of CT scan in evaluating AE in the ED.

KEYWORDS: CT scan; Adult Epiglottitis (AE); Direct laryngoscopy.

ABBREVIATIONS: Adult Epiglottitis (AE); Emergency Department (ED); Vital Signs (VS); Ear, Nose and Throat (ENT); Computerized Tomography (CT); Magnetic Resonance Imaging (MRI); Shortness of Breath (SOB).

INTRODUCTION

Adult Epiglottitis (AE) is a relatively uncommon but potentially life-threatening condition and a delay or missed diagnosis can be catastrophic. It should be considered in the differential diagnosis of any adult patient who presents with sore throat and odynophagia. In the majority of the cases, the diagnosis is based on clinical history, physical examination and with help of plain radiography of soft tissue of the neck. Because of the non-specificity of its symptoms, and availability of CT scan in the Emergency Department (ED), CT scan of the neck is used in evaluating AE as well as in excluding other conditions such as deep neck spaces, peritonsillar abscess and complications of epiglottitis such as abscess formation. However, there are currently no published reports on the CT scan accuracy in diagnosing AE.

Our case report illustrates the challenges facing the Emergency Physicians in diagnosing AE and the role and limitations of CT scan of neck in evaluating AE.
CASE REPORT

This is a 26 year old African American female complaining of sore throat, difficulty swallowing and shortness of breath after she ate a barbecue eight hour prior to the ED visit. There is no difficulty speaking, cyanosis but feels anxious. Also had a cough one week prior to this visit.

Review of system: positive for sore throat- negative for SOB

On physical examination:

• Vital signs: Temp: 98.6 - O2 sat=99% (Room Air)- BP=113/78-HR=82, RR=16
• General: not in acute distress
• Throat:
  ▪ marked erythema. No exudates- no peri-tonsillar abscess- uvula midline
  ▪ Neck is supple - no adenopathy.
• Chest: clear- breathing easily on room air- no wheezing/rales/ bronchi.
• Cardiovascular and neurological: Within normal limit.
• The reminder of the physical exam= normal

Laboratory:

• CBC: increased WBC (13,000/µL). Rapid strep throat: negative.
• Mononucleosis spot test: negative.

Initial ED Management:

• Was given Benadryl 50 mg, IV and Solumedrol 125 mg, IV

ED Course:

At 2hr later:
• Persisting sore throat and odynophagia.
• ENT consult called and CT scan of the neck ordered

At 6 hr:
• CT scan result: no acute finding- no asymmetry- no soft tissue swelling (Figure 1)

At 8 hr:
• Direct laryngoscope by ENT showed focal areas of swelling in the epiglottis consistent with Epiglottitis;
• Patient is admitted to ICU and given IV Rocephin, Clindamycin and Decadron with tracheotomy tray at bedside.

At 24 hr:
Repeat enhanced CT of the neck showed thickening of right aspect of epiglottis. Bases of the tongue, vallecula and puriform sinuses are normal. Findings are consistent with acute epiglottitis

At 72 hr:
patient was discharged from the hospital

DISCUSSION

Epiglottitis is a rapidly progressive, potentially lethal inflammation of the epiglottis and larynx that causes airway obstruction. Historically, it was a disease of the childhood, but recent reports have shown an increase in incidence in adult
population. The incidence of AE is about 1.8 cases per 100,000 adults with a reported mortality between 7-20%, whereas the incidence in children has significantly decreased due to routine immunization of children with H. influenza since April 1985. Recent reports have shown that other organisms such as group A beta hemolytic streptococcus or staphylococcus aureus have been implicated in AE. A diagnosis of AE (or supraglottitis) should be elicited in any adult patient with a sore throat and dysphagia with other symptoms such as odynophagia, stridor or drooling. AE displays more non-specific and indolent course than in children making its diagnosis more challenging. Clinically, the differential diagnosis includes peritonsillar abscess, abscess in the deep neck space, laryngitis and ingested foreign body.

In the majority of cases, AE is diagnosed by history and confirmed by physical examination by ENT specialist. Lateral plain neck radiographs may be helpful in diagnosing AE. It is performed on a single lateral upright view of the neck in extension with a portable equipment in the ED. Since acute airway obstruction can occur any time, no X-rays should be done until airway is secure. Reported sensitivity is 88-100 % and specificity between 87-96 % in diagnosing AE. Typical finding include enlargement of epiglottis (thumb sign) typically more than 8 mm, thickening of the ary-epiglottis folds more than 7mm is a sensitive and specific sign and arytenoids and pre-vertebral soft tissue swelling. However x-rays finding in adults are more subtle than in children and epiglottis may be normal.

Because CT scan is readily available in the ED, it often is used in the evaluation of AE and indicated in patients who are unable to undergo adequate physical examination, to exclude other ENT emergencies and identify local complications such peritonsillar or deep neck abscess when direct laryngoscopy is unavailable. CT scan is only recommended for patients with stable airway and requires airway monitoring since patients will be in a supine position which increases the risk of acute respiratory distress. Furthermore, it may require a relatively lengthy period of time away in the Radiology suite with associated anxiety with the procedure itself. To our knowledge, there is no reported sensitivity or specificity of CT scan of the neck in diagnosing AE in our literature, it is advisable to follow the current guideline: CT scan is not recommended to establish such diagnosis initially, should only be used to exclude other ENT emergencies and to aid in the diagnosis of AE when an adequate laryngoscopic examination cannot be performed or unavailable.

CONCLUSION

In conclusion, our case report illustrates the challenges facing the Emergency Physicians in diagnosing AE and the role and limitations of CT scan. Since there is no reported sensitivity or specificity of CT scan of the neck in diagnosing AE in our literature, it is advisable to follow the current guideline: CT scan is not recommended to establish such diagnosis initially, should only be used to exclude other ENT emergencies and to aid in the diagnosis of AE when an adequate laryngoscopic examination cannot be performed or unavailable.

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Assessment of the Pittsburgh Sleep Quality Index among Physician's Speciality Who Work Night Shifts

Feriyde Çalışkan Tür, Ibrahim Toker, Bamsı Tür, Serkan Hacar and Burcu Türe

ABSTRACT

Objective: As with other people, sleep quality has an impact on a physician’s work safety. Aim of this study is determine the sleep quality among medical specialists whose working night shifts, and detect other independent factors that affect their sleep quality. This is essential for improving the physician health and their daily performance for patient care.

Methods: A qualitative study was design with a cross-sectional method. Sampling was conducted with stratification among night shift physicians who work in the emergency, internal medicine and surgical departments at an education and research hospital. Scores on the Pittsburgh Sleep Quality Index (PSQI) and the Swedish Demand-Control-Support Questionnaire (DCSQ) were assessed.

Results: One hundred eight physicians who worked night shifts responded to the questionnaire. The average age of the physicians was 31.3±5.9, and 40.7% were women. The average PSQI score in male participants was significantly higher (8.1±3.7 vs. female 7.6±3.9; p=0.014). The majority of physicians (83.3%) had high PSQI values, i.e., scores of 5 or more. No significant difference was found in the average PSQI values between the emergency and internal medicine physicians and surgeons (p>0.05). The most important factors that affected physicians’ sleep quality were the number of night shifts per month, age, gender and the existence of a chronic disease.

Conclusion: The sleep quality of medical specialists who work night shifts is equally low. The existence of a chronic disease, age, gender and higher numbers of night shifts affect sleep quality as powerful independent factors.

KEYWORDS: Sleep quality; Sleep disorder; Medical specialties; Emergency physician; Night shift work.

INTRODUCTION

Along with the scientific improvements, performance and wakefulness situations of mankind became more comprehensible. Sleep is not only a state of unconsciousness in which body rhythm is restored, but also, it is an unalterable and inevitable period of reconstruction and regain the energy for humans daily routine, as by physicians working on night shifts. Therefore measure the quality of sleep is important for increase the productivity. The Pittsburgh Sleep Quality Index is a psychometric and nonpolysomnographic test, can be used to measure the sleep quality.
Sleep health of a physician, as they are a part of the society and healthcare system, is very important. Sleep can affect, in short term quality of their work performance, and in long term the academic career and their health. Background studies mostly have assessed the effect of sleeplessness on the performance of physicians. But the differences and effecting factors on the sleep quality between the specialties in medicine is not investigated. Emergency physician’s sleep quality (who must passed all the night shift) compared to medical colleagues in other specialties are unknown. A qualitative data must be determined for follow the sleep quality and make an improvement in healthcare and patient outcome with the healthy physicians. These reasons led us to perform this study of physicians from different specialties working night shifts from a workload management perspective by assessing scores of sleep quality.

The primary object in this study is to determine the sleep quality of nightshift worker physicians (emergency medicine, internal medicine and surgical branches) and to propound the meaningful differences. And the secondary object is to determine the factors, that could effect the sleep quality, originated from social life and working conditions. Than after the effecting factors are decided, can healthcare thinker give better policy for accomplish the objectives.

METHOD

A qualitative study was design, which was cross-sectional conducted in January, 2014, was applied as a face-to-face questionnaire to nightshift worker physicians who were volunteers and are working at the third level health care.

Selection of Participants

The study population is composed of 146 physicians who worked night shifts. Three stratums were constituted; emergency, internal medicine branches and surgical branches with stratified sampling in population. All the emergency physicians were taken into study (n=37), and samples were randomly chosen from internal (total n=39; infectious disease, internal medicine, cardiology, neurology, pediatrics, or radiology), and surgical branches (total n=39; neurosurgery, general surgery, orthopedics, otolaryngology, urology, ophthalmology, and anesthesiology): they were approached for participation from the monthly night on-call list which was prepared double blind.

INTERVENTIONS

Besides the demographical data (age, sex, years employed in work, chronic disease, sleep problems), physicians were administered the Pittsburgh Sleep Quality Index (PSQI) and the Swedish Demand Control Support Questionnaire (DCSQ). Approval from Katip Celebi University Medical School ethics committee was obtained before commencement of the investigation. Physicians were illuminated with informed consent form before they agree their consent to the study. Emergency medicine physicians worked a 16-hour night shift (4 p.m. to 8 a.m.) whereas those from other physicians worked a 32-hour shift (8 a.m. until 4 p.m. the next day). Other than emergency physicians have had a small sleepy time period in the late night and were on call.

Sleep quality was measured with PSQI questionnaire, consists of 19 questions. PSQI assesses the sleep quality with questions asked under 7 different components (subjective sleeping quality, sleep latency, sleeping time, habitual sleep efficiency, sleep disorders, usage of sleeping pills and daytime dysfunction). Each question was given a score interval of 0-3. Points of 7 components were collected. If total score are 5 or more, the sleeping quality was considered to be low. Study of validity and reliability of the scale in Turkish was conducted before.

OUTCOMES

Primary outcome of the study is to assess the sleep quality among night shift worker physicians with PSQI. Secondary outcome is determining the other factors that can affect the sleep quality such as from social live or workplace. This paper focuses on the results of the PSQI; the results DCSQ will be published in a separate research paper.

ANALYSIS

Statistics were assessed in the software of Statistics Package for Social Sciences (SPSS for Windows Ver. 20.0, SPSS Inc., IL, USA). Homogeneity of variables and normalcy of distribution were assessed by histogram. Mann-Whitney U and Kruskal-Wallis significance tests were used for the comparison of dependent and independent variables. Independent variables with pearson correlation less than 0.50 were taken into multiple regression model as a result of normative correlation. Quantitative data were given as percentage (%) and qualitative data as mean ± Standard Deviation (SD). Statistically analysis value of p<0.05 was accepted to be significant by confidence interval of 95%.

RESULTS

115 physicians were taken into study (78.8% of night shift worker physician). While, two declined to participate, and the questionnaires of five physicians were incomplete, thus data from 108 physicians were evaluated. Mean age of the participants was 31.3±5.9 (25-52 years), 40.7% were women and 21.3% were specialists and associate professors. In responses to socio-demographic questions, 84.3% of the physicians did not state any complaints of sleeping problem, 9.3% had restless leg syndrome and 0.9% had sleep apnea. Other socio-demographic properties were shown in table 1 and table 2.

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Total average of PSQI was 7.9±3.8 (interval 4-18). Physicians of 83.3% had a bad PQSI total score (>=5). No difference between specialists and resident physicians was found with regard to sleep quality (mean PSQI total score 7.3±2.9 vs. 8.1±3.7). No significant difference was found between total average point of PSQI and specialty groups of physician (p>0.05) (Table 1). Emergency physicians were compared to other specialties by PSQI total point, no significant difference was detected (Table 3). Correlations with factors lower than 0.5 were sex, age, number of night shifts in a month and existence of a chronic diseases besides physician’s specialty, found to be strong determining factors in PSQI total scores (95% CI, constant total PSQI values, Models 1 and 2, p<0.05, R²=0.12 and 0.16 and Durbin Watson=1.97) (Table 4A and Table 4B).

DISCUSSION

Studies expose that a person needs eight hours of sleep per day.13 Sleep withdrawal is a state of insufficiency for needed daily performance.1,2 Chronic nonoptimal levels of sleep duration or poor sleep quality leads to sleep withdrawal. Such circumstance in medicine increases the possibility of malpractice amongst its harm for health professionals.12-15 Also it can worse residents training process and their supervision by their instructor, while they have to work on nightshifts together.16-18 This study present results, that night shift worker physicians have poor sleep quality and it is not different among their specialty’s or seniority’s in work. This result is new than in literature.

Factors affecting the sleep quality are sleep time during...
laying on bed (in percentage and duration) and number of awakening and disruption from sleep.\textsuperscript{19,20} But for emergency physicians compared to other’s night shift, sleeping is mostly impossible and they must be awake whole the night. Even one single disrupt from sleep can drop the sleep quality can cause sleepiness during the day and decrease in performance. In case of recurrence this leads to sleep withdrawal.\textsuperscript{19,20} Sleep withdrawal have negative effects on cognitive functions.\textsuperscript{13,21-23} Accidents, death risk and hazardous effects on psychological and physical health have been seen as consequences of sleep withdrawal.\textsuperscript{11,21-25} Sleep withdrawal can cause sleep diseases by accumulating and symptoms such as sleep apnea and involuntary leg movements.\textsuperscript{1,2,18-23} Also, it was mentioned that poor sleep hygiene is a part of sleep disorder stated under insomnia.\textsuperscript{2} In our questionnaire research, sleeping time was found to be below 6 hours in 65.7% of participants. Symptoms of sleep withdrawal such as restless leg syndrome and sleep apnea were on our physicians. The call of nature sleep hygiene was neglected, too.

Mortality and morbidity have connection with sleeping time.\textsuperscript{26,30} Blood pressure and cardiac vascular structure might be negatively affected due to hypoxemia, and respiration re-

<table>
<thead>
<tr>
<th>Group</th>
<th>PSQI total score</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-4</td>
<td>&gt;=5</td>
</tr>
<tr>
<td>Emergency Physicians</td>
<td>7 (18.9%)</td>
<td>30 (81.1%)</td>
</tr>
<tr>
<td>Internal medicine and Surgery</td>
<td>11 (15.5%)</td>
<td>60 (84.5%)</td>
</tr>
<tr>
<td>Total</td>
<td>18 (16.7%)</td>
<td>90 (83.3%)</td>
</tr>
</tbody>
</table>

Odds R: 1.3, %95 CI: 0.3-2.2, p>0.05

Table 3: Distribution of PSQI total component by points between emergency physician and other specialties.

<table>
<thead>
<tr>
<th>Pearson Correlation</th>
<th>PSQI total point</th>
<th>Age</th>
<th>Sex</th>
<th>3 specialty groups</th>
<th>Chronic Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>.016</td>
<td></td>
<td>.101</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>.064</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 specialty groups&lt;sup&gt;c&lt;/sup&gt;</td>
<td>-191&lt;sup&gt;*&lt;/sup&gt;</td>
<td>-180&lt;sup&gt;*&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronic Disease</td>
<td>.357&lt;sup&gt;b&lt;/sup&gt;</td>
<td>.198&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.040</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of night shifts/month</td>
<td>.190&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-.253&lt;sup&gt;b&lt;/sup&gt;</td>
<td>.069</td>
<td>-0.414&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-0.066</td>
</tr>
</tbody>
</table>

a<0.05, b<0.01, c=Groups: Emergency, Internal Medicine and Surgery

Table 4A: Correlations (4A) among the variables and Regression (4B).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1&lt;sup&gt;*&lt;/sup&gt;</th>
<th>Model 2&lt;sup&gt;**&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-0.057</td>
<td>-0.003</td>
</tr>
<tr>
<td>Sex</td>
<td>0.079</td>
<td>0.065</td>
</tr>
<tr>
<td>3 Specialty groups</td>
<td>-0.101</td>
<td>-0.008</td>
</tr>
<tr>
<td>Chronic Disease&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.42</td>
<td>0.43</td>
</tr>
<tr>
<td>Number of nightshift/month&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-</td>
<td>0.96</td>
</tr>
<tr>
<td>Constant</td>
<td>6.91</td>
<td>4.88</td>
</tr>
<tr>
<td>F</td>
<td>15.45</td>
<td>10.97</td>
</tr>
<tr>
<td>R&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.119</td>
<td>0.157</td>
</tr>
</tbody>
</table>

a: p<0.001, b: p<0.05, Durbin Watson=1.97
<br Modelo 1 (4 variables) Predictor: Chronic disease (95% CI for B=0-2.9-0.6)
<br Modelo 2 Predictor: Chronic disease and number of nightshift/month (95% CI for B=0-2.1-1.8)

Table 4B: Regression estimates for PSQI total point.
sleeping hours, including education, with law and joint councils due to negative effects of night shift worker is a necessity. Suggestion is physicians won’t be pass 80 hours in a week and 16-30 hours at once a shift. Thus, sleep withdrawal, medical mistakes and accidents can be avoided. On the other hand, this suggestion hinders medical studies which require a long process, including education, and patient care. It can take more shift number in a month. But, this study suggest that more night shifts number in a month will more overcome decrease in sleep quality.

Basic on literature is clear, that regulating the working hours, including education, with law and joint councils due to negative effects of night shift worker is a necessity. Suggestion is physicians won’t be pass 80 hours in a week and 16-30 hours at once a shift. Thus, sleep withdrawal, medical mistakes and accidents can be avoided. On the other hand, this suggestion hinders medical studies which require a long process, including education, and patient care. It can take more shift number in a month. But, this study suggest that more night shifts number in a month will more overcome decrease in sleep quality.

Conclusion

A strong connection was found in the modeling design in night shift physicians between sleep quality and their chronic diseases, number of nightshifts in a month, age, sex and speciality. Chronic diseases in participant physicians were determined to be hypertension, endocrine disease, depression and obesity. This result provides the prescience that sleeplessness will directly affect the physician’s health and therefore their productivity.

Why wasn’t a meaningful difference on sleep quality among speciality groups is an interesting point. In generally accepted application in Turkey, emergency physicians work 16 hours at night shift and rarely on 14-24 hours midshifts. Other branch physicians usually work 30 hours without a break, but have mostly a short sleep period in the night. For education are emergency medicine residents and instructors 32 hour in work (once in a week). The exposure of sleep withdrawal seemed to be the same, according to PSQI results. But, similarity of sleep quality of physicians in the three specialty groups might be a result of similarly arduous workload they had. Probably they might be stress caused by night shifts. Emergency physicians are far more likely to see over 60 patients in a shift which is half the length and much more likely to work over 9 shifts per month. We have assessed the stress level of the night shifts physician with DCSQ too, and will give the results in a separate paper. The working conditions on night shifts seems to be hard in emergency medicine, at least as in other physician specialty groups. When health care managers want to improve working standards for night shift worker physicians, they could assess the sleep quality and their healthy.

Limitations

This study is conducted in a single-center. But a big sample was being better to detect more details. Most participants were residents of the specialty programs naturally. A questionnaire of sleep quality by nightshift worker compared on non night shift worker physician should be done further.

Generalizability

We believe that our results can be valuable to other physician-staffed hospital services as well as when comparing the sleep quality by PSQI, especially by emergency physicians with different hospital systems and different staffing. Assessing sleeping quality with scoring method is suitable.

Conclusion

Sleeping quality of night shift worker physicians is equally low in all specialties. Disarray in physicians sleep quality pointed as a problem, which might affect their performance, health, labor force and academic success. All medical professions should be informed on sleep disorders and factors affecting it. It is important to eliminate the manageable factors for the productivity and safety of the health professions.
ACKNOWLEDGMENT

Thanks to Prof. Dr. Y. Demiral, who was instrumental in this study design.

Authors intellectual contributions on this study were as listed: 1) Dr. Feriye Çalışkan Tür performed the study, acquisition of data, analysis and interpretation of data 2) Drs. Feriye Çalışkan Tür, Ibrahim Toker and Bamsı Tür made substantial contributions to conception and design, 3) Drs. Feriye Çalışkan Tür, Ibrahim Toker, Bamsı Tür, Serkan Hacar and Burcu Türe made acquisition of data 3) Drs. Feriye Çalışkan Tür and Bamsı Tür drafted the manuscript and revised it critically for important intellectual content; 4) Dr. Feriye Çalışkan Tür gave final approval of the version to be published; and 5) Drs. Feriye Çalışkan Tür, Ibrahim Toker, Bamsı Tür, Serkan Hacar, Burcu Türe, all agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Case Report

Life Threatening Airway Angioedema Secondary to Captopril

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INTRODUCTION

Angioedema associated with Angiotensin-Converting Enzyme Inhibitors (ACEI) is an emergency, which can develop in 0.1-1% of the recipients. Severe life-threatening total airway obstruction secondary to angioedema can occur rarely. In this case report, the clinical approach, diagnosis and treatment of ACEI induced angioedema with special focus on the differential diagnosis from hereditary angioedema are discussed.

KEYWORDS: Angioedema; Captopril induced angioedema; Hereditary angioedema; Difficult airway.

CASE DESCRIPTION

A 38 year old female patient was brought to emergency department by the first aid team following an epileptic seizure. She was in a postictal state at arrival. The patient was oriented and cooperative but fell asleep easily. Her Glasgow coma score was 14. Here vital signs were as follows: Blood pressure 190/124 mmHg, pulse 88/min, breathing rate 22/min, temperature 36.5 °C, and oxygen saturation in room air was 99% by pulse oximetry. Her physical impression was normal. She had no active complaints. Her medical history included meningitis in childhood, hypertension, and epilepsy. Her daily medications included sodium valproat 1000 mg/daily and candesartan 8 mg daily. Her elevated blood pressure was treated prehospital with 50 mg of captopril. A finger sticks blood sugar test was 134 mg/dL. Twenty minutes after arrival in the emergency department, tachypnea, perioral oedema, and rhonchi developed. Treatment with methylprednisolone, 100 mg IV , ranitidine, 20 mg IV , and pheniramine, 45.5 mg IV were started immediately. Salbutamol 5 mg was also administered by nebulization. Thirty minutes after arrival rapidly developing bilateral tongue angioedema was observed. Epinephrine 0.3 mg (1:1000) was injected intramuscularly. A room air arterial blood gas measurement demonstrated an oxygen saturation of 58%. When stridor developed, preparation for a cricothyrostomy was done. The patient’s clinical status deteriorated rapidly as her oxygen saturation dropped down to 56%, the patient lost consciousness. When a laryngeal mask was inserted, the patient’s oxygen saturation was raised to 95%. With these airway interventions cardiac arrest was avoided. Because of severe widespread and indurated submandibular swelling, a tracheostomy was performed instead of oral intubation (Figure 1). Two units of (300 unit/70kg) Fresh Frozen Plasma (FFP) were infused. Within 10 to 15 minutes after administration of the FFP, apparent regression in submandibular hard thickenings was noted (Figure 2). Even so,
the ambulatory support and aspiration, ventilation of the patient could not be restored and the patient had a cardiac arrest, due to an unknown reason after fifteenth minute. Cardiac compressions were immediately initiated. The tracheostomy tube was removed by the emergency physician and a modified endotracheal tube was placed through the tracheostomy site. Ventilation with an ambu bag was successfully accomplished (Figure 2). After 3 minutes of Cardiopulmonary resuscitation (CPR), Return of Spontaneous Circulation (ROSC) was achieved. The patient was further stabilized and admitted to the intensive care unit. In biochemistry, a Na⁺ of 103 mmol/L was noted. Renal function tests were normal. Her severe hyponatremia was treated with a hypertonic sodium infusion. Complement testing was achieved by the second day (from blood samples taken during angioedema) and demonstrated a mild decrease in C4 and C1 esterase inhibitor levels, but controls were normal at day 9 and 15 (Table 1). She was discharged neurologically intact on the seventh day and follow up by the allergy clinic was arranged.

DISCUSSION

Angioedema is characterized by sudden development of oedema in the mucosa and submucosa. Angioedema due to ACEI generally develops in face and neck area without urticaria. Sometimes there may be severe abdominal pain due to visceral oedema of the intestines, mimicking symptoms of appendicitis or Familial Mediterranean Fever. Accumulation of bradykinin, increased number of mast cells and increasing histamine release play a role in the pathophysiology. Female gender, African race, and genetic polymorphism are enhancing risk factors. Major triggers are food, trauma, or an autoimmune event. Angiotensin-Converting-Enzyme Inhibitor (ACEI), such as captopril, lead to bradykinin accumulation because of their kininase-like activity. ACEI's are the cause of 10-25% of all angioedema cases. Defective or reduced substance P and des-Ard9-BK enzymes that metabolize bradykinin, result in an increase of this substance in circulation. Vasodilatation, increased vascular permeability, and oedema develop due to the bradykinin effects. ACEI induced angioedema, causes death by airway obstruction in 10% of cases. In 16% of cases angioedema can recur. Captopril induced an-

<table>
<thead>
<tr>
<th>Complement (Normal range)</th>
<th>C1 INH (15-35 mg/dL)</th>
<th>C4 (16.0-38.0 mg/dL)</th>
<th>C1 esterase inhibitor function (70%-130%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Durin angioedema</td>
<td>14.1</td>
<td>12.2</td>
<td></td>
</tr>
<tr>
<td>9th day</td>
<td>32.3</td>
<td>26.4</td>
<td></td>
</tr>
<tr>
<td>15th day</td>
<td>19 (N)</td>
<td>37</td>
<td>%90</td>
</tr>
</tbody>
</table>

C1 INH: Complement 1 esterase inhibitor, C4: Complement 4, C1: Complement 1

Table 1: Changes in C1 INH and C4 values by day in angioedema case. Moreover, the C1 esterase inhibitor function was tested.
Angioedema is the clinical diagnosis in our case and no family history was reported. Former usage of ACEI was unknown.

There is no concurrence in the treatment of angioedema. Conventional treatment for angioedema due to allergic etiologies includes the administration of antihistamines (H1 and H2), steroids, and epinephrine administration. These treatments, however, are generally not effective against ACEI associated angioedema. Treatment with Complement 1 esterase inhibitors (C1 INH) or with icatibant (Bradykinin B2 receptor antagonist) is successful in Hereditary angioedema (HAE). Fresh frozen plasma administration is one of the suggested treatments. FFP prevents bradykinin release by providing kininase II, like Angiotensin-converting enzyme. In our case, conventional treatment was administered, but was not successful. Treatment ultimately succeeded with the infusion of FFP which provided kininase II, like angiotensin-converting enzyme. Afterward, regression in tongue and in submandibular hard swelling occurred (Figures 1 and 2).

Anatomical staging may be used to predict the risk of angioedema-related airway obstruction. Stage I; facial rash, facial and lip oedema. Stage II; soft palate oedema. Stage III; tongue oedema. Stage IV; laryngeal oedema. Admission to intensive care must be done in stages III and IV. Our case did not respond to the initial treatment and, stages III and IV airway obstruction developed rapidly.

In our case, the most important differential diagnosis was HAE. Quantitative (HAE type 1) or functional (HAE type 2) defect occurs in C1 INH by HEA. Low serum C4 levels confirm the diagnosis of HAE type 1. In 15-20% of HAE cases, even when C1 INH level is normal, its function is impaired (HAE type 2). Another possible diagnosis could be acquired C1 INH deficiency that can be seen in autoimmune disease or lymphoma. Normal levels of C1 INH and its function measured in our case led to the diagnosis of ACEI induced angioedema.

CONCLUSION

This case demonstrates the complications and treatment of severe ACEI induced angioedema. The progressive airway obstruction was treated with a surgical airway and the infusion of Fresh Frozen Plasma (FFP). HAE type 1 and 2 were ruled out from the diagnosis with normal results of C1 INH level and C1 function tests. While other treatment options are currently under study, current options to the emergency physician for the medical management of patients with ACEI associated angioedema and airway obstruction can primarily include the administration of FFP.

CONFLICT OF INTEREST

The authors have no commercial associations or sources of support that might pose a conflict of interest.

REFERENCES

Strengthening Community Based Health Care Provision Capacity is Critical for Emergency Preparedness – Lessons from Iraq and Uganda

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INTRODUCTION

Women, children and the poor constitute the most vulnerable groups in emergencies. Continuity of delivery of services at the community level is critical in preventing morbidity and mortality. Insecurity and other disasters reduce access to public health services. Conventional emergency preparedness emphasizes community capacity development after a disaster to build resilience and thereby mitigate against effects of a similar occurrence in the future. Lessons from Iraq and Uganda seem to indicate that this should be addressed as part of preparedness. Our review of the context in two completely different settings supports this view. We present here, work undertaken in Iraq to strengthen community level Maternal Newborn and Child Health (MNCH) provision before the insecurity following the invasion by Islamic State of Iraq and Syria (ISIS) and experiences from Northern Uganda during the insecurity caused by the Lord’s Resistance Army and Ebola Disease outbreaks.

IRAQ - ACCESS TO MATERNAL NEW-BORN AND CHILD HEALTH LIMITED FOR THE MOST VULNERABLE

In 2013 the Ministry of Iraq decided to use Traditional Birth Attendants (TBAs) as a strategy to reach the unreached mothers. TBAs are usually mature women in society who attend deliveries but are often consulted for other health matters. TBAs are considered a vital link with the formal health services. Available evidence shows that TBAs can prevent some perinatal deaths if well prepared.1 There is also emerging evidence that deployment of adequate numbers of well trained and supported cadres at the community level can improve Maternal and Child health (MNCH) provision before the insecurity following the invasion by Islamic State of Iraq and Syria (ISIS) and experiences from Northern Uganda during the insecurity caused by the Lord’s Resistance Army and Ebola Disease outbreaks.

In Iraq and most of the Middle East, the Traditional Birth Attendant (TBA) is an integral part of family organization. She is referred to as Djiddah, Jidda or Jiddha which literally means grandmother. She is consulted on a number of health decisions including provision of delivery, child care services and female circumcision.3 About 13% of Iraq women seek the services of TBAs and in Al Anbar, Kirkuk, Ninewa and Salahadin, the number varies from 13 – 16%. A Ministry of Health survey in 2011 found 2,210 TBAs linked to both rural (79%) and urban (21%) health centers. Although TBAs are predominantly rural based, they have a significant urban presence in Bagdad, Kirkuk, Babil, Sulahadin and Karbala. Most of the TBAs (56%) are middle aged (between 40 and 60 years) and 3% were below 30 years indicating a growing interest in the art among the young. 38% of TBAs are literate. The Ministry of Health

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and USAID developed a program to train TBAs and established a system of support supervision and equipping them from October 2013. This is outlined in a Ministry of Health TBA Strategy endorsed in February 2014.4

In June 2014 the security situation in Al Anbar, Kirkuk, Ninewa and Salahadin deteriorated significantly with the Islamic State of Iraq and Syria (ISIS) taking up most of the Northern provinces. This led to significant restriction of access and utilization of public health services. For many rural, poor communities, these TBAs remain an important source of service, thanks to the work undertaken to train and equip these cadres. As insecurity increased, most rural poor mothers depended largely on these women for care.

INSECURITY IN UGANDA AND ACCESS TO SERVICES

In a totally different context, northern Uganda experienced insecurity resulting from the insurgency by the Lord’s Resistance Army (LRA) for decades. By 2006 the war had displaced almost 1.5 million people into internal displacement camps.5 A major constraint in the provision of health services was the low levels of staffing which was below 50% of the establishment in 2008.6 Health services were often offered by Community Health Workers, Traditional Birth Attendants and other traditional healers. The role of these providers became even more significant in the control of communicable diseases including Ebola.7 Based on these lessons, deliberate efforts were made to create linkages between the health services and these informal providers. Various strategies including recognition of their presence and roles, rewarding them for making referrals, and sensitizing them against harmful practice were utilized while providing them with appropriate skills. This view is widely supported by other observations and studies.8,9 In the Ebola outbreak August 2000 to January 2001; these community based providers became critical in community education against harmful burial practices, disease surveillance and contact tracing.10 In surveillance, a category referred to as ‘alert’ was introduced in the reporting for community level workers to report anybody in the community who died suddenly and had fever or haemorrhage. This became a critical input in the control of Ebola in Northern Uganda.

CONCLUSIONS

From these two totally different contexts we conclude that the health community has to rethink the role of communities in situations of severely restricted access to care. The delivery of Maternal Newborn and Child Health (MNCH) services in situations of restricted access as in emergencies needs to use the community available resources to continue care. In the case of communicable diseases, the case is even stronger in Africa. After infecting over 25,000 people and causing over 9000 deaths in Sierra Leone, Liberia and Guinea, the Ebola Virus Disease outbreak was showing signs of decline until the second week of February 2015 when an upward trend was seen following an unsafe burial in Guinea. This resulted in 11 new cases from this burial alone.11 This resurgence was due to communities refusing the safe burial practice instructions by health staff. It is commendable to note that the global strategy has now resorted to a locally driven public health approach of contact tracing, community mobilization and treatment based in the affected localities.12 Building capacities of local communities in delivery of services has greater potential than has been appreciated in public health.

REFERENCES


Cost-Effectiveness of the Sucralfate Technetium 99m isotope Labelled Esophageal Scan to Assess Esophageal Injury in Children after Caustic Ingestion

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ABSTRACT

Background: Ingestion of caustic material by children is a considerable health problem. The 99mTc-labelled sucralfate esophageal scan proved to be an accurate method to identify injury to the esophagus after caustic substance ingestion. The purpose of this study was to calculate the cost-effectiveness of a sucralfate scan as compared to the gold standard of using endoscopy under general anesthesia. A secondary outcome was to assess the positive predictive value of the sucralfate scan.

Methods: A 10-year retrospective medical folder audit was conducted of all children admitted to our hospital with a history of caustic ingestion who underwent a sucralfate scan to identify evidence of caustic esophageal injury/inflammation. The patients who had a negative sucralfate scan were assessed as having no significant injury and were discharged without further investigation or management. The patients with a positive result went for a subsequent endoscopy.

Results: 234 patients were included. The total costs saved by performing a sucralfate scan only were R 446,964.00 (South African Rand) in 234 patients. The positive predictive value of performing a sucralfate scan is 47.3%.

Conclusion: A sucralfate scan as primary diagnostic method for caustic injury proved to be cost-effective and with less chance of complications.

KEYWORDS: Sucralfate; Caustic; Esophageal Injury; Cost-Benefit Analysis.

INTRODUCTION

Ingestion of caustic material by children continues to be a significant problem in developed countries.1 Over 200,000 of such cases were reported in the United States in 2009 alone,2 of which 807 required hospitalization.3 Accurate figures on the incidence of this type of injury in developing countries are not available however the large number of children requiring esophageal replacement for caustic injury indicates that this is a serious public health problem.4

The extent of the esophageal injury after ingestion of caustic substances has been determined using different methods, such as traditional radiology, CT-scan, ultrasound and endoscopy.5

In 2001, Millar et al. showed the accuracy of a 99mTc-labelled sucralfate scan in de-
detecting esophageal injury after ingestion of caustic substances. When sucralfate comes into contact with damaged tissue it adheres. This has been part of its efficacy in the treatment of peptic ulcer. Sucralfate mixed with radioactive technetium 99m will bind to the damaged area, which will then be visible as a hot spot on the scan. It has been our practice since validating the sensitivity of the sucralfate scan to perform a scan as a screening investigation after a child has been admitted with a history of caustic ingestion with or without clinical evidence of buccal or pharyngeal mucosal injury. Endoscopy to determine the extent of the damage was only performed after a positive scan. If the sucralfate scan showed no sucralfate adherence to the esophageal mucosa endoscopy was not performed since the negative predictive value of the sucralfate scan has proven to be 100%.

Since 2001 at the Red Cross War Memorial Children’s Hospital (RCH) in Cape Town, the initial standard diagnostic test in children who have ingested a caustic substance has been a radio-nuclear sucralfate test. It is preferred over endoscopy under general anesthesia as the latter is an invasive method and general anesthesia in children is associated with morbidity and mortality.

The type and amount of the caustic substance ingested are important factors determining the extent and severity of the injury and the incidence of complications. There is still doubt which of the two, acidic or alkali ingestions, result in more severe injuries.

The main purpose of this review report was to calculate the cost-effectiveness of a sucralfate scan as compared with standard endoscopy. A secondary aim was to determine the positive predictive value of the sucralfate scan with that of fiberoptic upper gastrointestinal endoscopy. We also made a comparison between the result of the scan and the nature of the swallowed substance, and the result of the scan and the length of stay in the hospital.

MATERIALS AND METHODS

A 10-year retrospective medical folder audit was conducted of all children with caustic injuries to the esophagus who underwent a sucralfate scan in RCH from January 2003 to June 2013. Local ethics and research committee approval were obtained.

The nuclear medicine department of the RCH identified eligible patients. The medical records of these patients were searched for information on date of injury, date of admission, age at admission, date of procedure, date of discharge, result of the sucralfate scan, complications and whether or not they had an endoscopy, including result.

When the patients had a negative result on the sucralfate scan (thus no significant injury), they did not have a subsequent endoscopy. The result of the sucralfate scan was considered positive if we were able to see adherence of the radioactive isotope in the esophagus on the scan.

The result of the sucralfate scan was compared to the nature of substance swallowed and the length of stay was compared to the pH values of the substances. The finance department of the RCH provided costs of endoscopy, broken down for specialist, procedure, operation room fees and costs of anesthetics.

Data Analysis

The positive predictive value of the sucralfate scan was calculated using the endoscopy as criterion standard. Because an endoscopy was not performed if the outcome of the scan was negative, calculating the sensitivity, specificity and negative predictive value of the scan were not possible.

Categorical variables were compared using Fisher exact tests. Length of stay was compared for children with and without abnormal mucosa using the Mann-Whitney U test.

RESULTS

Two hundred and seventy-nine eligible patients were identified. Thirty-five medical folders were missing, however, and four medical records did not involve a history of caustic ingestion. For another four patients an endoscopy was not documented, in spite of their positive sucralfate scan. Two patients underwent endoscopy even though there was no evidence of them ever having had a sucralfate scan in their medical folder. These 45 patients were excluded from analysis. The median age of the remaining 234 children was 2 years (IQR 1.5 to 2.1).

143 patients (61.1%) had a negative result on the sucralfate scan, and therefore did not undergo a subsequent endoscopy. The cost of performing an endoscopy was estimated at 4,867.00 Rand while the cost of performing a sucralfate scan was estimated at 1,285.00 Rand. Therefore, the cost saving of performing a sucralfate scan without performing a subsequent endoscopy will save 3,582 Rand per patient. If these patients would have been assessed with endoscopic diagnostic procedure, this would have resulted in a cost of 143 x 3,582.00 Rand more. This calculation resulted in an estimated saving of 512,226.00 Rand in these 143 patients.

The sucralfate scan in 48 children was false positive; it showed mild adherence in the esophagus while the endoscopy showed no damage. If these patients would have been treated according to the criterion standard diagnostic procedure, the costs of the sucralfate scan would have been saved, amounting to 48 times 1,285.00 Rand, which is 61,680.00 Rand.

The total costs saved by performing a sucralfate scan as primary diagnostic procedure instead of performing an endoscopy are 446,964.00 Rand (approximately 40 000 USD) in 234 patients.
Not every patient received a subsequent endoscopy. Therefore we could only calculate the positive predictive value. Of 91 positive scans, 48 proved to be false positive. This leaves us with 43 true positive scans and a positive predictive value of 43/91 = 47.3%.

In 14 cases the substance swallowed was unknown. Of the remaining 220 cases, 143 (65 percent) had damage to the esophagus due to cleaning agents. In 28 cases the pH value could not be determined. Twenty-one of the latter had swallowed potassium permanganate crystals (n=21). The remaining cases were divided in acidic (pH<6), alkaline (pH>8) and neutral (6<pH<8). These cases were compared to the result of the scan in terms of normal and abnormal mucosa (Table 1). There was no significant difference in mucosal damage between the groups (P=0.80). Length of stay in the acidic and potassium permanganate groups was significantly longer (P=0.044) than in the alkaline and neutral groups. The most common complications seen were strictures (n=7) and pneumonia (n=5).

![Table 1: Sucralfate scan results versus the nature of ingested substance.](image1)

![Table 2: Sucralfate scan results versus length of stay.](image2)

**DISCUSSION**

The sucralfate scan seemed to be a cost-effective investigation in that we were able to avoid performing an endoscopy in over 50% of the patients admitted with a history of caustic substance ingestion. The sucralfate scan is a non-invasive procedure and in 143 children, no endoscopy was needed at all. This saved costs, avoided general anesthetics and avoiding endoscopy has all the clinical advantages of minimizing the potential morbidity of a general anesthetic and a fibreoptic endoscopy in a child and is of course less distressing for the children.

The costs for procedures in the OR are significantly lower than private hospitals because the RCH is a state hospital. The above costs did not include professional fees, which a patient pays at a private hospital. So the advantage in costs a sucralfate scan has would probably be even bigger considering the fact that the time to perform an endoscopy is longer and requires more specialized staff.

The predominant symptoms at presentation were usually mild gastrointestinal symptoms. This research, and that of others, showed that one should be also alert for other complications of noxious substance ingestion. Respiratory complications such as pneumonia from aspiration and other potentially dangerous side effects of caustic ingestion, such as strictures or dysphagia, must also not be forgotten.

While in the literature there is still doubt on this issue, we found that alkaline substances were related to longer hospital stay, and thus probably caused more severe injury. However, alkaline substances did not have a significantly more damaged mucosa than acidic or neutral substances.

While sucralfate scans are able to identify microscopically damaged tissue; endoscopy is limited and only able to pick up macroscopic tissue damage. Oversensitivity has also been documented in our initial paper describing the use of sucralfate. Perhaps a number of false positive sucralfate scans could also be contributed to a longer time interval between the sucralfate scan and the endoscopy. Due to several logistic reasons, some patients underwent endoscopy more than one day after the sucralfate scan was performed. In these cases, very mild tissue damage may already have healed.

One of the limitations of this study is its retrospective nature, which accounts for several inconsistencies and for missing patient folders. A further limitation is that this study design did not cover any potential false negative sucralfate scans. However, none of the children who had a negative sucralfate scan developed any strictures, further symptoms or was re-admitted. Finally, the estimate of costs saved by doing a sucralfate scan as primary diagnostic method were calculated on rates for patients with medical insurance. The hospital does not have an overview of the individual costs of every anesthetic or equipment used, but uses standardized rates. Costs saved on the salary of medical specialist could also not be included in the cost calculations for the hospital. Thus there is a considerable underestimate of the overall cost.
The question remains whether endoscopy and/or a sucralfate scan are always indicated after ingestion of a caustic substance. It has been proposed to be unnecessary in asymptomatic patients as the injury then is most likely low-grade.\textsuperscript{12,14} Although these cases require monitoring, intervention can usually be avoided.\textsuperscript{15} However, it is well documented that patients without evidence of buccal or pharyngeal injury can have significant oesophageal mucosal injury.

Besides the diagnostic advantages, performing a Sucrelafate scan may also have therapeutic advantages. It has an inhibitory effect on stricture formation by enhancing mucosal healing and suppressing stricture formation.\textsuperscript{16}

In the future, more sensitive methods may become available. For instance, Eliakim and Koslowski have evaluated effectiveness of the pill-cam, a camera in the shape of a pill shooting frames 4 or 14 times per second, in detecting oesophageal pathology. This has not yet been tested on patients with caustic ingestion, but may be promising.\textsuperscript{17,18} Since this article is intended to advocate cost saving, this method would not be a suitable alternative, for cameras are more expensive.

Another promising method is the 99mTc-Pertechnetate scan, which yields a positive result when the injury in the esophagus is grade 2a or lower. In that case no intervention is needed.\textsuperscript{16} Lastly, 99mTc-PYP scintigraphy has been found sensitive and specific for the detection of caustic oesophageal injury in small laboratory animals, but has not yet been tested on humans.\textsuperscript{19}

The initial endoscopic grading of caustic injuries is the main factor predicting patient survival and functional outcome.\textsuperscript{20} If the sucralfate scan is positive, a subsequent endoscopy still needs to be performed to assess the extent of damage and determine the grade of the injury.

More research has to be performed to determine the possibility of initial grading of the injury with a sucralfate scan. The amount of sucralfate attached to the lesions should be compared to the damage assessed by an endoscopy, performed shortly after the other.

In many homes, caustic solutions are still too often stored in unlabelled containers or drinking bottles stored on the ground floor and easily accessible by crawling toddlers, which children can drink or be given accidently by other adults.\textsuperscript{21,22} Campaigns are required warning parents and caretakers not to put caustic solutions in accessible containers or bottles.

After this research, it can be concluded that the sucralfate scan is indeed a cost-effective method to assess damage to the esophagus in children after caustic substance ingestion. Other hospitals with considerable numbers of patients with caustic damage to the esophagus may want to consider using this method as well, since it minimizes the potential morbidity of using an endoscope.

CONFLICTS OF INTEREST: None.

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