



# **Drowning, the Burden of Fatality: A Case Report**

**Amadi, Ekechi Stella <sup>a,b,c\*</sup>, Diri, Robert Ogbodede <sup>a</sup>,  
Amaewhule, Mary Nnenda <sup>a,b</sup>, Wakama, Rita. <sup>a</sup>,  
Nonju, Tamunobarabiye. <sup>b</sup>, Agbarakwe, Blessing <sup>a</sup>  
and Nwamadi, Christian Chisom <sup>a</sup>**

<sup>a</sup> Department of Internal Medicine, Dermatology and Pulmonology Unit, Rivers State University  
Teaching Hospital, Harley Street, Old GRA, Port Harcourt, Rivers State, Nigeria.

<sup>b</sup> College of Medical Sciences, Rivers State University Nkpolu-Oroworukwo, Rivers State, Nigeria.

<sup>c</sup> Dermatology in Clinical Practice, Faculty of Life sciences, University of South Wales,  
United Kingdom.

## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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**Case Report**

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## **ABSTRACT**

**Introduction:** Drowning is a leading cause of death worldwide. The burden of fatality still remains on the health provider and caregiver despite improved survival rates after rescue. There are few case reports that exist with regards to drowning within Rivers State, Nigeria

**Aim:** This case report's aim is to review the management of a drowning patient after initial rescue and the burden of dealing with unpleasant outcomes.

\*Corresponding author: E-mail: [ekechiamadi@yahoo.com](mailto:ekechiamadi@yahoo.com);

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**Presentation of Case:** We report the case of a teenager who was submerged for about 35 minutes in a fresh water river who received chest compressions by a bystander rescuer; he was later referred to a private secondary healthcare facility and later to a tertiary facility with intensive care unit after initial improvement in a previous tertiary care hospital.

**Discussion:** This case reports the events surrounding a teenager who suffered from drowning and unfortunately had the final outcome of death after a fortnight period. The long term survival has been noted to be poor in those with submersion time more than 30 minutes just as it was in this index case. The patient in this case had no chronic medical condition which may have reduced the risk of immediate fatal death. The patient was referred to another tertiary center where there was a functional intensive care unit at that time however he passed way after a couple of days.

**Conclusion:** Drowning regardless of initial survival is still burdened with a high risk of morbidity and mortality. Immediate referral to a facility with an intensive care unit is likely to improve prolonged survival.

*Keywords: Aspiration pneumonitis; drowning; respiratory distress.*

## 1. INTRODUCTION

Drowning is a term that has been modified and redefined to include all deaths resulting from submersion in liquid regardless of the time of death following drowning as agreed in a consensus agreement at 2002 World Congress on drowning held in Amsterdam [1]. Drowning was previously defined as death secondary to asphyxia while immersed in a liquid, usually water, or within 24 hours of submersion [1]. The current definition of drowning states that drowning is a process resulting in primary respiratory impairment from submersion in a liquid medium which the outcomes could be death, morbidity or no morbidity [1, 2]. Drowning is the sixth leading cause of death for people of all ages and the second leading cause of death for children aged 1-14 years, after motor vehicle collisions in the United States of America [1]. Drowning is a major public health concern worldwide. Over 350,000 persons die from drowning yearly worldwide [1].

## 2. CASE STUDY

A 19 year old single male secondary school student went out swimming with friends in a freshwater river around their residence when he became suddenly submerged in the deep area where he remained for about 35 minutes under water before he was rescued by his friends. Chest compressions were done by one of them and he expelled about 1 liter of water mixed with blood. He was fully conscious after then and was taken to a primary health care facility by his friends. He was later referred due to worsening of symptoms such as pleuritic chest pain, and dyspnea despite receiving some intravenous medication and investigations carried out. He

had no known chronic illness and his haemoglobin genotype was AA. There was no use of alcohol or any other drug prior to swimming in the river.

On admission to the accident & emergency(A&E), he was in respiratory distress, afebrile, anicteric, dehydrated with tachypnea, fine crepitations at both lung bases, with reduced SPO<sub>2</sub> (82%), had tachycardia, grade 1 hypertension with normal heart sounds 1 and 2. He was assessed by both surgical and medical teams. His urgent chest x-ray findings showed pulmonary alveolar oedema and full blood count showed leukocytosis and neutrophilia. Arterial blood gas levels were unavailable at the center at that time. He was placed on intranasal oxygen therapy at 4-6 L/min immediately, stat dose of 60mg frusemide; 75mg diclofenac a non-steroidal anti-inflammatory drug and 4mg dexamethasone tablets b. d for 3 days, to continue with daily doses for another 3 days. He was taken into the medical ward after initial resuscitation.

He made clinical improvement evidenced by resolved tachypnea and tachycardia, improved SPO<sub>2</sub> which was 100% on room air after four days on admission however he had persistent systolic hypertension and fine basal crepitation. On the fifth day he became clinically worse evidenced by persistent high grade fever all day long. The patient was tepid sponged and the anti-inflammatory drugs such as diclofenac and dexamethasone were continued. The fever abated the next day and he was afebrile for a few days. A repeat chest x-ray showed streaky shadows at both mid lung zones with the accentuation of the broncho-pulmonary vasculature. There was normal heart size and

bony cage is intact with an impression of aspiration pneumonitis. Electrocardiogram was essentially normal.

On the 9<sup>th</sup> day he later developed acute watery stools which were non-bloody and non- mucoid occurring four times within 6 hours, each stool output was about 100mls. He became febrile (38.2°C), lethargic, dehydrated with dull percussion notes, reduced breathe sounds at the left lower lung zone and basal crepitation in both lung fields on chest examination. A diagnosis of acute bacterial gastroenteritis on background aspiration pneumonitis was made. Intravenous (IV) antibiotics (metronidazole and ceftriaxone), intravenous infusion with Ringer's lactate and intramuscular artesunate, an antimalarial drug was given based on the recurrent fever. The region in which the patient is being cared for is endemic for malaria which is known to cause high grade fever. Lomotil 4mg stat was given, then 2mg per after each loose stool. He was also placed on 50 mg of zinc tablets. The oxygen therapy was continued when necessary as it was noticed that the SPO<sub>2</sub> started dropping from 100% on room air to 91%.

On the 11<sup>th</sup> day of admission the gastroenteritis resolved but dyspnea persisted. The Pulmonary unit was invited to take over management and chest physiotherapy was recommended. He received nebulization with salbutamol 5mg stat dose and intranasal O<sub>2</sub> was continued at 5L/minute. He was placed on hydrocortisone 200 mg stat, then commence 100 mg 6 hourly, antibiotics were changed to IV Meronem with continuing of IV 0.9% saline.

These interventions did not resolve symptoms as fever, tachycardia, and tachypnea with reduced SPO<sub>2</sub> continued even on intranasal oxygen. The patient was referred to another tertiary center where there was a functional intensive care unit (ICU) facility at that time. A couple of days later on follow up of the patient, he was said to have passed on.

### 3. DISCUSSION

This case reports the events surrounding a teenager who suffered from drowning and unfortunately had the final outcome of death after a fortnight period. This experience is indeed a very sad one to the physician, care givers, family members and friends. This outcome has been reported in several instances. Drowning can take

place in any form of liquid, commonly in large bodies of water; however in children it can even occur in shallow water [3]. It has been known that drowning is noted to be more in men [4, 5, 6 ,7]. The reason being that males tend to be more adventurous, engage in risky practices and tend to use alcohol and recreational drugs that are more likely to impair judgement [4]. The modal age group varies from different reports from Nigeria. Mckeever and Hossain reports that the modal age group of drowning cases is 10-19 years which this index case falls into; with more than half of the cases being below 20 years [6]. Uchendu et al and Seleye-Fubara et al had modal ages to be the 3<sup>rd</sup> & 4<sup>th</sup> decades and 50-59 age group in their own studies respectively [5, 7]. Freshwater bodies are also known to have higher frequency of drowning incidents not because it is more hazardous to the lungs than sea water (salt water), but because unguarded inland waters and swimming pools are visited more frequently [3]. Salt water bodies comprises of sea water and its offshoots such as tributaries, rivers, deltas and creeks. Port Harcourt is in Rivers State which is a coastal part of Nigeria where this case of drowning occurred. It is characterized by both fresh and salt water bodies [8]. Rivers were noted to be the most common place where accidental drowning takes place just as it was in this case [5, 6, 7]. It is known that those with chronic health challenges such as epilepsy are likely to have a higher risk of drowning [1, 4, 9]. The patient had received bystander resuscitative measures basically chest compressions which helped in saving his life in the immediate time prior presentation to a health facility. Bystander resuscitative measures such as basic cardio-pulmonary resuscitation using chest compressions and mouth breaths is being taught in different schools and amongst different career persons including athletes in Nigeria [10, 11]. Basic life support resuscitation has been known to increase survival in drowning patients by up to 91% of cases in the initial stage after rescue [12]. The long term survival has been noted to be poor in those with submersion time more than 30 minutes just as it was in this index case [13]. Most deaths occurred after termination of initial resuscitation or during initial hospitalization just as it was seen in this case. Factors that have been known to influence long-term survival include older age, illicit substance use, pre-drowning activity, submersion duration, cardiopulmonary resuscitation duration, intubation, defibrillation, medications and inpatient markers of illness severity [14].

The patient in this case had no chronic medical condition which may have reduced the risk of immediate fatal death. It has been seen in a study group in Canada that fatal drowning is higher in those with physical disabilities, cardiovascular disease, seizure disorder and neurocognitive disease which cuts across all age groups and gender [15]. Sickle cell trait has been linked with sudden death in extreme physical conditions particularly under high altitude such as underwater activities particularly if they develop sickle cell crisis [16]. This patient did not have any of these risk factors.

The clinical presentation of drowning patients vary individually however it has been noted that aspiration of both water and foreign substances including micro-organisms can occur which was as in this case [1]. Hypothermia is a common phenomenon although in this case his body temperature on admission into the facility was high, this is understandable since it was a referred case and the body have warmed up after being pulled out of water. Fever experienced in this case was likely due to an infection which had resulted in pneumonia as documented in other cases [17]. Diarrhoea in this case can also be as a result of systemic infection or electrolyte imbalance as seen in this index case. A variety of other clinical manifestations can also be seen in a drowning patient such as ocular bobbing and pontine haemorrhage reported in an older adult in India [9]. Neurological, cardiac and respiratory problems are also predominant in drowning victims [1, 4]. Management of drowning is aimed at correcting hypoxemia and acidosis, maintaining core body temperature and treatment of infections [1]. This patient received all the needed care available within the facility as he even made some clinical improvement; however he worsened and had to receive intensive care in another facility. Mechanical ventilation has been noted to combat acute respiratory disease found in drowning patients [1, 2, 18]. The use of continuous positive airway pressure (CPAP) if available is advised if oxygen saturation is low and if the patient is still dyspneic despite being on 100% oxygen [1]. If it is not available, early intubation, with appropriate use of positive end-expiratory pressure (PEEP) is encouraged [1]. Hyperoxemia may be a complication and should be looked out for by assessing arterial blood gases and oxygen saturation [1]. Despite all these interventions the damage done during drowning may not be fully reversed. In a study done in Australia revealed that the non-fatal cases were in higher proportion

when compared to the fatal cases and survival has improved over the years; however females were more likely to survive than males [19]. Adolescents were also likely to survive more than toddlers [19]. The hospital admission rate was also higher for non-fatal cases just as this index case was also admitted. The increase in survival rates seems to pose a threat in the campaign for prevention; as the best bet in drowning is to prevent all the risky behaviours and ultimately supervise the young children since the general outcome remains unpredictable and it still carries a high burden of fatality [1, 4, 14, 19].

#### 4. CONCLUSION

Drowning is a highly preventable cause of death. Non-fatal deaths are common due to increasing survival rates beyond the first twenty four hours after submersion. Regardless of initial survival of the patient, drowning is still burdened with a high risk of morbidity and mortality. Immediate referral to a facility with an intensive care unit is likely to prolong survival.

#### DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

#### ETHICAL APPROVAL

As per international standards or university standards written ethical approval has been collected and preserved by the authors.

#### CONSENT

As per international standards, parental written consent has been collected and preserved by the authors.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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