

Drowning in 12-month-old Boy Who Was Later Diagnosed with Epilepsy: A Case Report and Review of Literature

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Abstract Introduction: Drowning is an event of respiratory disturbances due to submersion in water, resulting in survival with or without complications, or death. Several risk factors for drowning are epilepsy, male, intentional accidents (neglected/abused or murdered), and lack of supervision. Objective: The aim of this study is to describe a case of drowning, with epilepsy as a risk factor. Case Presentation: A 12-month-old boy was presented due to drowning in a fish pond. He was referred from a district hospital after receiving cardiopulmonary resuscitation. There was an escalation in respiratory problems. While he was planned for discharge he had general tonic clonic seizure. After conducting electroencephalogram, he was diagnosed with epilepsy. We can't identify whether he drowned due to lack of supervision or seizure in the pond. Conclusion: Finding a risk factor is one of the most important management in drowning. Epilepsy is one of the risk factor, which symptom is not always noticed by parents. Although denied, we still have to do rigorous anamnesis to find epilepsy until it is proven otherwise..

Keywords: drowning, risk factor, epilepsy

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1. Introduction

Drowning causes an annual mortality of half a million people worldwide.[1] This is an event of respiratory disturbance due to prolonged submersion in water with the final result of death, or survival without or with complications. There are several terms related to drowning incident which must be understood. The victim may die due to asphyxia while being in the water or after evacuation, or survival [2].

Most of the victims are under 5 years old. The incident locations varied according to victim' age. In children <1 year old, the locations mostly occurred indoor (78%) such as at bathtubs, artificial ponds, buckets, washing machine and toilet. [2,3,4] During the last 10 years (2005–2015), our hospital reported 15 drowning cases, 14 survived and 1 patient died. Most of the cases (14) were children (1–12 years of age).

Rates of drowning vary with age, gender, and race. Drowning are more common in epilepsy, male, intentional accident (neglected/abused or murdered) and lack of supervision. The most important intervention to improve

outcome from drowning is prevention. Therefore, in every drowning case we should notify the risk factors in order to do further prevention. Preventive efforts should focus on adequate supervision, pool fencing legislation, and water safety education, especially in epilepsy children [5].

There are several terms related to drowning incident which must be understood. Good report of drowning case is also very important to improve knowledge base, epidemiological stratification, and appropriate treatment of victims of drowning, and ultimately save lives. This case raises an important issues with regard to find risk factor of a drowning child in order to prevent repeated event in epilepsy patient [2].

In this report we present a case of a twelve-month-old boy who drowned, later had seizure, and finally diagnosed with epilepsy. It was difficult to determine whether seizure was a complication or precipitating event prior to drowning.

2. Case Report

Twelve-month-old boy was presented to pediatric emergency of Hasan Sadikin Hospital as a referral case

after receiving cardiopulmonary resuscitation (CPR) in a district hospital due to drowning. He was found floating, not breathing, and appeared bluish in a fish pond located in front of his house. No one witnessed how he got into the pond. In the next hour after resuscitation, the patient managed to breathe spontaneously, but still had heavy dyspnea and gasping.

He was severely ill, breathless, had slight tachycardia (140 times /minute), tachypnea (60 times/minute), and slight fever (37.8°C). Peripheral oxygen saturation was 93%, he showed slight intercostal retractions, no additional breath sounds, no enlargement of the liver or spleen was found. No other sign and symptoms reported by parents. Laboratory examination results showed anemia (Hb: 9.2 g/dL), low mean corpuscular volume (MCV) (57.5 fl), low mean corpuscular hemoglobin (MCH) (24 pg), and low mean corpuscular hemoglobin concentration (MCHC) (32%). The erythrocyte showed hypochromic microcytic. The leukocyte is in the upper limit of normal value (14,000 /mm³), shift to the left in differential counting, normal sodium level, slight hypokalemia (3.2 mEq/L) and low ferritin level (9.55 ng/mL). Blood gas analysis showed well compensated metabolic acidosis. There was right lung infiltration from chest X-ray.

The patient was diagnosed with drowning and iron deficiency anemia. The patient had received oxygenation therapy, ampicillin and cefotaxime. During monitoring, breathlessness of patients decreased, and vital signs were stable. Serial chest X-ray examination showed inhomogeneous opaque consolidation over the right lung. From the series of X-ray examination, there was no radiological deterioration.

On the third day of hospitalization, he experienced three general tonic seizure. There was no drop of consciousness after seizure. Electroencephalogram which showed epileptic form in left frontocentrotemporal.

After more in-depth history taking on his mother, it was known that the patient often had empty gaze. Patient never had general tonic clonic or focal seizure. There was no family history of seizure.

The final diagnosis of this patient was drowning, iron deficiency anemia, and symptomatic general epilepsy. Patient received valproic acid (20 mg/kg body weight/day) and cefixime for treatment. On the 7th day of hospitalization, general condition was improved, and the patient was discharged.

We did not perform standard drowning report as recommended by International Liaison Committee on Resuscitation (ILCOR) because there was insufficient data submitted from the referral hospital.

3. Review of Literature

Drowning is still one of the leading causes of death in children. In 2000, WHO estimated that 450,000 people die each year due to drowning (1 person per minute). Drowning is the 4th highest accident in the world, after traffic accidents, suicide and violence. [2,6,7] Based on data from the National Health for Statistics in 1997, drowning is the second leading cause of death in children aged 1-14 years in the United States. In Indonesia, there has been no data of incidence and prevalence of drowning.

Drowning in children generally occur in residential swimming pools, while other cases occur in bath tub, drains, ponds, lakes, and sea. Outdoor drowning is more common in boy than girl, with 3: 1 ratio [1].

Although not many, there are still several cases of drowning in Child Health Department Hasan Sadikin Hospital, and the mortality rate was not high because of proper management. This case report and review of literature will discuss drowning, its terminology, classification, risk factors, pathophysiology, treatment, and prognosis.

3.1. Definition

Previously, there were several terms were proposed to describe the pathophysiological process of drowning and its clinical implication. The proposed terms such as “near-drowning”, proposed by The Standard Nomenclature of Athletic Injuries, to describe a critical aquatic predicament resolved by successful water rescue, “delayed death subsequent to near-drowning”, “drown without or with aspiration”, “near drowning without or with aspiration”, “delayed death subsequent to near drowning”, “wet and dry drowning”, “active drowning”, “passive drowning”, “silent drowning”, and “secondary drowning” [2].

All these terms have been lacking of clarity. A drowning victim without apparent clinical signs of aspiration may be found, after careful searching to have pathologic aspiration. It was also confusing after being translated into language other than English.

Therefore, it is important that a uniform terminology is used to improve understanding and reporting these events. According to WHO and the World Congress on Drowning in 2002, drowning is the event of respiratory disturbances due to being submerged in the water with the final result of death, or survival without or with complications. Several terms were used to describe drowning. The latest consensus, “Utstein definition and style” is recommended in reporting drowning. Recommended Guidelines for Uniform Reporting of Data From Drowning define drowning as a process resulting in primary respiratory impairment from submersion/immersion in a liquid medium. The victim may live or die after drowning, but regardless the outcome, the victim had involved in a drowning incidence [1,2,6,8].

3.2. Classification

Drowning classification can be based on the temperature of the water is divided into: [9]

1. Drowning in warm water (temperature > 20°C)
2. Drowning in cold water (temperature > 5° - < 20°C)
3. Drowning in very cold water (temperature < 5 ° C)

Classification based on the salinity (osmolality of water): [9]

1. Drowning in freshwater
2. Drowning in the sea water although there is no clinically significant difference between freshwater and seawater.

Incidence of drowning can give two results, which are: [2]

1. Immersion, is to be covered in water. For drowning to occur usually at least the face and airway are immersed.

2. Submersed. During submersion, the entire body, including the airway is under water.

3.3. Risk Factor

In the United States, the incidence of drowning occurs more frequently in male than female. Ratio of the incidence was 2: 1 in infants and increased in adolescents, >10: 1. Four out of five drowning victims are known to be male. Most of the victims were <5 years old and the second most frequent age of victims were 15-19 years old. The location of the incidents varied according to the age of victims. In the children <1 year old, the location mostly occurred indoors (78%) such as bathtubs, artificial ponds, buckets, washing machine and toilet. In children 1-4 years old, 55% of incidents occurred in a private pool and 25% occurred in lakes or rivers. In children 5-9 years old, 54% of incidents occurred in the river or lake, and 31% occurred in the pool. In children 10-14 years old, 61% of incidents occurred in lakes or rivers and 21% occurred in the pool. For 15-19 years old adolescents, 69% of incidents occurred in the river or lake, 12% in the pool and 10% in the ocean. Bathtub is dangerous for 6 months to 1 year old infants who are able to sit upright in a bathtub but less able to pull their bodies out of the water when they dropped into it. Teenagers are at risk of drowning due to carelessness and their tendency to try drugs and alcohol [1,6].

In each case of drowning, precipitating events should be known and reported. Drowning can be precipitated by injury or a medical condition. Seizure is the most common initiating event in all age group. Impairment of judgement, loss of consciousness from any etiology, and/or motor function, circulatory arrest, hyperventilation before breathholding under water, and trauma may also precipitate drowning [2].

3.3. Epilepsy

According to International League Against Epilepsy, operational clinical definition of epilepsy is: (1) at least two unprovoked (or reflex) seizure occurring more than 24 hours apart. (2) One unprovoked (or reflex) seizure and a probability of further seizure similar to the general recurrence risk (at least 60%) after two unprovoked seizures, occurring over the next 10 years; (3) diagnosis of an epilepsy syndrome [10].

Epilepsy is a clinical diagnosis which can be made based on anamnesis. Neurologic examination may be normal or showed neurologic deficit. To confirm the diagnosis electroencephalogram was done [11].

Imaging is most useful for children with epilepsy. Early in the course of epilepsy it may be difficult to decide whether a child has a localization-related epilepsy. Therefore, an epileptic children should undergo neuroimaging if one or more of the following are present: [11]

1. Evidence to suggest epilepsy is localization related (e.g. focal) with the exception of typical benign idiopathic partial epilepsy.
2. Abnormal neurologic examination, including focal deficit, stigmata of neurocutaneous, cerebral malformation syndrome, or a history of significant developmental delay, arrest, or regression.
3. Children younger than 2 years, excluding those with simple febrile seizure.

Imaging is not indicated in childhood absence epilepsy, juvenile absence epilepsy, juvenile myocloning epilepsy, and benign epilepsy with centro-temporal spikes (BECTS) [11].

As mentioned above, epilepsy is one of the risk factor for drowning. Children with epilepsy have been estimated to be at 4 to 14 times the risk of drowning compared to children without epilepsy.[12] Based on available efficacy and effectiveness evidence alone, for children with newly diagnosed or untreated epilepsy, initial monotherapy should be started with valproic acid, carbamazepine, phenobarbital, phenytoin, or topiramax. Among these antiepileptic drugs (AED), there is no clear first-choice AED exists for initial monotherapy for children with newly diagnosed epilepsy based solely on efficacy of effectiveness. Selection of the initial AED therapy for a child with newly diagnosed or untreated GTC seizure requires integration of patient-specific, AED-specific, and nation specific variables that can affect overall response to therapy [10].

3.4. Pathophysiology of Drowning

Most children drown without enough time to seek for help. Small children can survive for 10-20 seconds trying to get out of the water before the final phase of drowning. Children who are struggling in the water will make water pickings, so the surrounding people think they are playing with the water. When drowning happen, all the organs are at risk for hypoxia.¹ Depth and duration of hypoxia is the most important factor in determining further condition to patient. Other factors include water volume aspirated, water temperature, type of contents in water (seawater, fresh water or chemicals), clean or dirty water, the occurrence of neck or spine trauma, the presence of seizures before drowning, cardiac infarction and alcohol or drugs. Death can occur directly due to cerebral hypoxia or hypoxia, CO₂ poisoning, or cardiac arrest. Aspiration of freshwater or saltwater will lead to hypoxemia. Aspiration of 1-3 mL / kg of water can cause pulmonary vasoconstriction and pulmonary hypertension. When a person drowns in salt water, the patient will have intrapulmonary shunt and lung development declining and leads to ventilation perfusion imbalance. When being drowned in fresh water, pulmonary surfactant will be damaged or lost, resulting non-cardiogenic pulmonary edema which will lead into acute respiratory distress syndrome (ARDS). Hypothermia will lead to two effects in terms of drowning. Although the cold water is important in reducing body metabolism and distribute non-vital organ blood flow to vital organs, common side effects of cold temperatures is also dysrhythmia (sinus bradycardia, atrial fibrillation or ventricular, asystole) and fatigue [8].

During drowning, the victim gives an effort to breathe, which cause water aspiration into the lungs. [9,13] However, there is 10-20% of "dry drowning", defined as laryngospasm which happens before the first aspiration. [13,14] Either aspiration or laryngospasm, it will lead to oxygenation reduced and hypoxemia. Pathophysiology of drowning is closely related to hypoxemia which occurs in various organ systems, especially the respiratory system, cardiovascular, and central nervous system (CNS). In the respiratory system, both fresh water and sea water will

cause damage to the alveolar / capillary unit that decrease functional residual capacity and pulmonary edema, and furthermore can cause ARDS. Aspiration 1-3 mL / kg of water will cause significant disruption in gas exchange inside the body. [9,13] Disturbances in other organ systems will occur secondary to hypoxemia and acidosis. Hipovolemia can occur in the cardiovascular system due to permeability of capillary increase due to hypoxia, thus decreasing cardiac output and will lead to shock. In addition, as a result of hypoxia on the heart muscle, it will cause myocardial dysfunction with ventricular dysrhythmias and asystole manifestations. Damage in the CNS can occur due to hypoxemia and / or head / spine injury. In addition to these organ systems, hypoxemia may cause interference to other organ systems such as disseminated intravascular coagulation, hepatic and renal insufficiency, disorders of the gastrointestinal system, and multiple organ failure [9].

3.4.1. Anoxic Ischemic Injury

In animal experiments where subjects are drowned intentionally, the animals looked panicked and trying to reach the surface. During this phase a small amount of water went into the hypopharynx and cause laryngospasm. There was a decrease in blood oxygen saturation and visible loss of consciousness due to hypoxia. Vomiting may occur and be aspirated. Approximately, 10% of the animal continued to experience laryngospasm until death, hence they did not obtain any significant aspiration into the lungs. Sustained hypoxia will lead to apnea. These processes are also added with the presence of cardiovascular changes, such as tachycardia, followed by severe hypertension and bradycardia reflex due to the release of catecholamines, then arrhythmias will possibly happen. Cardiac output and blood oxygen levels will decline rapidly, and within 3-4 minutes will lead to circulatory failure and myocardial hypoxia. Heart will contract ineffectively with no pulse (pulseless electrical activity). Diving reflex can maintain cerebral and myocardial blood flow in experimental animals, but remains controversial in humans because of this reflex is weaker in humans than in animals [2].

3.4.2. Central Nervous System Injury

Many hypoxemia and ischemia happened in the CNS. Central nervous system has a little energy reserves and requires a supply of oxygen and nutrients constantly. Within 2 minutes without oxygen, adenosine triphosphate will be used up. Impaired blood flow to the CNS can continue after resuscitation. Secondary damage to the CNS can occur because of the release of glutamate and other excitatory amino acids which can increase the secretion of calcium and sodium influx into the cell and continue in the terminal state. This means that the damage and death of cells and it is irreversible. Cerebral edema may occur, while the mechanism is not fully understood. It is estimated that the edema is due to the disturbance of cerebral blood flow which cause vasogenic edema. Extensive cerebral edema can increase intracranial pressure, which can worsen ischemia. In children with blood glucose levels > 250 mg / dL, they are more likely die or live in a vegetative state than children with normal blood glucose levels. Hyperglycemia after hypoxia-ischemia aggravates CNS damage in various ways.

Control of hyperglycemia by using insulin in humans is not recommended because it has not been scientifically tested. Hypoglycemia should be immediately corrected, to avoid iatrogenic hyperglycemia [2].

3.4.3. Damage to Other Organs

All organs can be damaged. ARDS can occur in lungs, tubular necrosis may occur in renal and lead to acute renal failure, the hematological system can occur disseminated intravascular coagulation (DIC), bleeding, diarrhea and elevated levels of liver function can be found in gastrointestinal system. Damaged intestinal mucosa will facilitate the occurrence of bacteremia and sepsis [2].

3.4.4. Aspiration of Fluid and Lung Damage

Management in the case of drowning in freshwater or saltwater is not entirely different. Sea water is hypertonic (3% NaCl solution like), thus attracting intravascular and interstitial fluid into the alveoli. The sea water will damage the surfactant, the surface pressure of the alveoli will increase, so alveoli become unstable and atelectasis can be occurred. Fresh water dissolves surfactant also makes the alveolar become unstable and collapse. Hypoxemia and pulmonary insufficiency continue to ventilation-perfusion mismatching, decreasing lung compliance. Aspiration 1-3mL / kg of fluid can result in hypoxemia and decrease lung expansion power as much as 10-40%. Non-cardiogenic pulmonary edema may occur. When the ratio of PaO₂ and FiO₂ <200 with diffuse bilateral pulmonary infiltrates, it can be considered as ARDS. [1,2].

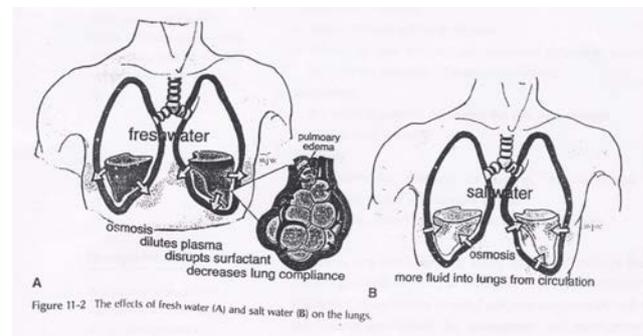


Figure 1. Effect of freshwater and saltwater in the lung (Source: Aehlert B. [15])

3.4.5. Fluid and Electrolyte Disturbances

If a person swallowed sea water in large quantities, it can occur hypernatremia because of osmolarity and high sodium content of sea water. The fluid is then drawn into the lungs or gastrointestinal and cause hemoconcentration. Hypernatremia and hemoconcentration may indicate damage to the CNS with hypoosmolar-diuresis response. Water intoxication can occur in children who ingested fresh water, resulting hyponatremia and hemodilution. Sudden hypoosmolar can result swelling and hemolysis of the cell. This process continues to be hyperkalemia or hemoglobinuria and ends with kidney failure [2].

3.4.6. Hypothermia

Based on the core body temperature, hypothermia divided into mild (34-36C), moderate (30-34C) and weight (<30C). Loss of body heat can occur through

conduction and convection processes in the water. In a state of severe hypothermia, progressive bradycardia, impaired cardiac contractility, a decrease in vasomotor tone can occur and cause inadequate perfusion, hypotension and shock. Central respiratory depression, hypoventilation, and apnea could also happen. Drowning at a temperature of <25-29 ° C will show the appearances of death to a victim [2].

3.5. Diagnosis

Diagnosing pneumonia associated to drowning is difficult. In the previously healthy patients, the symptoms and further examinations that support the diagnosis of pneumonia, for example chest X-ray, can be obtained. From the radiological examination, it can be obtained bilateral and diffuse infiltrates.

Fever and leukocytosis can be found in laboratory examination. Examination of sputum culture can show actual pathogens, bacterial colonization, or contamination of the environment. Every drowning patient's blood cultures should be examined especially when there are signs of infection or in critical condition [1,2,3,6,8,9,13,14].

3.6. Management

The principle management of drowning is to overcome the interference of oxygenation, ventilation, circulation, acid-base balance, and prevent damage to the CNS. As soon as the drowning victim rescued, CPR needs to be conducted. Oxygen should be given as soon as possible on their way to the hospital. All drowning victims must be hospitalized regardless of their conditions. Asymptomatic patients should be observed for a minimum of 24 hours in the hospital. Slow death can occur as a result of extensive atelectasis, acute pulmonary edema and hypoxemia after the patient leave the emergency room.

Airway must be clean from vomit and foreign objects. Abdominal thrusts are not recommended to remove the fluid from the lungs. When a presence of foreign body is suspected, maneuvers chest compression or back blows are more advisable. If the patient can breathe spontaneously, give 100% humidified oxygen using a mask. If the victim is not breathing, emergency ventilation need to be conducted immediately after clearing the airway. Further oxygen administration is adjusted with the results of arterial blood gas analysis [12,16].

Vital sign monitoring, repetitive cardiopulmonary and neurological assessment, chest X-ray examination, and oxygenation assessment through blood gas analysis or peripheral oximetry should be performed on all patients. Other examinations can be given to the patients depending on their clinical conditions and the location of the accident. Almost half of asymptomatic patients with minimal symptoms are having deterioration or hypoxemia at 4-8 hours after the incidents. Monitoring of body core temperature is important; the best measurement can be performed on the tympanic membrane due to its strong correlation with the temperature of the brain. Heated blanket can be used to warm up the patient [3,15,16].

3.6.1. Antibiotic Prophylaxis

Prophylactic antibiotics are not recommended due to lack of significant advantage. They also give resistance

effect to drowning patients who received prophylactic antibiotics at the time got pneumonia symptoms [16].

3.6.2. Antimicrobial Therapy

Antibiotics need to be given to drowning patients who give signs of infection such as fever, pulmonary infiltrates, and evidence of systemic infection and hemodynamic instability. The first line antibiotic is broad-spectrum penicillin with beta-lactamase inhibitor combinations. If the patient shows the sign of severe infection, administration of aminoglycoside can be considered [15,16].

3.7. Prognosis

The primary outcome of drowning is categorized as death or survival. Survival indicates victim remained alive after the acute event and any acute or subacute sequelae. A victim who is successfully resuscitated at the scene but succumbs to a condition that is causally related to drowning should be categorized as "death due to drowning" [2].

Some factors that affect the prognosis of the patients, including:

- Duration underwater
- Duration and severity of hypoxia
- Water temperature
- Duration and severity hypothermia
- Diving reflex
- The age of the victim
- Contamination of water
- Duration cardiac arrest
- Initial treatment given
- Presence of head, neck or spine trauma

The presence of neurological damage in drowning patient depends on onset of spontaneous respiratory effort after extraction from the water. Almost all subjects who ultimately survive without neurological sequelae are making spontaneous respiratory efforts within five minutes after extraction from water. The neurological complications rate in survivor was reported only 2% [17].

3.8. Recommended Guideline for Reporting Data from Drowning

The Utstein consensus conference developed a reporting template to help investigators report methods and result. A summary template is shown in Figure 2. There are 2 kind of data: core data which should be reported in all studies; and supplementary data, which are recommended but not essential. Core data were considered important and feasible to be reported in most system worldwide. Supplementary data were considered important but not an essential information or important information which is difficult to capture realibly. The data includes victim information: victim identifier, gender, age, incident date and time of day, precipitating event, race or ethnic category, resident of city, county, state, country, and preexisting illness. The next data is about scene information: was the event witnessed?, body of water?, loss of consciousness, ss, pre- Emergency Medical Services (EMS) resuscitation, EMS called?, initial vital signs assessed by EMS, time of first EMS resuscitation attempt, neurological status, type of water/liquid, water temperature, time of submersion and removal from water

if known, EMS vehicle dispatched, time of first EMS assessment, cyanosis, method of CPR., pupillary reaction, temperature, blood pressure, and oxygen saturation. The third data is about emergency department treatment such as vital signs, oxygen hemoglobin saturation, arterial blood gas analysis, initial neurological function, airway and ventilation requirement, pupillary reaction, and toxicology testing. The fourth data was about hospital course: airway and ventilation requirement, serial neurological function, complicating illnesses of drowning. The fifth is about disposition: death, date of hospital discharge, neurological outcome at hospital discharge, quality of life, cause of death, other injuries, and morbidities. The last item is outcome.

3.9. Recommendation of Water Safety for Children with Epilepsy

Someone with epilepsy should never take bath alone, stay in the bathroom at all times when the child is in the bathtub. Start training child to shower by using a handheld sprayer in the bathtub with no water and the drain open. When the child is old enough to want to bathe along, they should opt for shower instead of bath. Keep the bathroom door unlocked and open. If the child falls often during seizures, consider using a tub seat with a safety strap [12,18].

controlled seizures, tell the life guard. Avoid swimming in open water, like lakes or rivers, unless the child is well supervised and wearing life jacket. Have the child wear a brightly colored swimsuit and life jacket so he/she is easier to see [12,18].

Check your home for drowning hazards, such as ponds, pools, cisterns, and buckets. Keep the toilet lid down. Keep the bathroom door closed (except during a bath or shower). If a seizure occurs in the water, support your child's head and keep their face out of the water. Bring them to the shore or side of the pool and place them on their side and call for help [18].

4. Discussion

Drowning is still one of the leading causes of death in children (WHO). Globally, drowning is the 4th highest accident after traffic accidents, suicide, and violence. Cases of drowning in children generally occur in residential swimming pools, while other cases occur in bath tub, drains, ponds, lakes, and sea. Cases outdoor drowned is more frequent in male than in female, with the ratio of 3: 1.[1] Agreeing with these data, our hospital reported 15 case of drowning in this past 10 years, and 14 cases was children (aged 1-12 years old). Drowning causes mortality in one half million people worldwide annually. [1] In Indonesia, there has been no data of incidence and prevalence of drowning. Our reporting system has not been well-established and we still had never reported drowning as suggested by ILCOR. This is in accordance to statement that drowning until now is still underreported [2].

In this case, it was found that the patient has several risk factors for the occurrence of drowning; including sex (male), the age which is less than 5 years old and epilepsy which also known as risk factor for the occurrence of cases of drowning on this child. This case that involves a less than 1 year-old child, who were drowning in artificial ponds, is similar to general cases. We can't identify whether he had seizure in the pond or lack of supervision. Therefore we cannot judge that seizure is the precipitating factor in this case.

Drowning patient often require CPR or other intervention by emergency medical systems. Our patient was transferred to the district hospital by his family. Until now, Indonesia has yet to have EMS. What was developed in Indonesia is the 118 Emergency Ambulance Service which is only present in our five of the biggest city (Jakarta, Palembang, Yogyakarta, Surabaya, and Makassar). This is a public ambulance service without regular funding from government. Occasionally the municipal council contributes. About 5% of the services funding comes from patients that can afford to pay. [19] Our patient received CPR after reached the district hospital.

Our patient has slight tachycardia which may be due to slight fever. Tahcyarrhythmias, one of drowning complication, can happen due to drowning in water that is 10°C or colder. [2] Our patient drowned in fish pond which temperature is believed to be more than 10°C.

There was no interference with disseminated intravascular coagulation, hepatic and renal insufficiency, disorders of the gastrointestinal system, to multiple organ

Patient ID		Location of drowning:	
Gender = M <input type="checkbox"/> F <input type="checkbox"/> U* <input type="checkbox"/>	Age = _____ or _____	bucket <input type="checkbox"/>	toilet <input type="checkbox"/>
Date of birth DD/MM/YY		bath tub <input type="checkbox"/>	lake <input type="checkbox"/>
Date of event:		ocean <input type="checkbox"/>	pool <input type="checkbox"/>
DD/MM/YY		river/flowing water <input type="checkbox"/>	Other <input type="checkbox"/>
Times:		Event witnessed? Yes <input type="checkbox"/> No <input type="checkbox"/>	
Call received _____		If yes: time of event = _____	
EMS resus _____		witnessed/monitored by layperson <input type="checkbox"/> healthcare personnel <input type="checkbox"/>	
		At scene:	
		Loss of consciousness Yes <input type="checkbox"/> No <input type="checkbox"/>	
		CPR before EMS Yes <input type="checkbox"/> No <input type="checkbox"/>	
		by layperson <input type="checkbox"/> healthcare personnel <input type="checkbox"/>	
		techniques used: rescue breathing <input type="checkbox"/>	
		chest compression <input type="checkbox"/>	
Precipitating event known?			
No <input type="checkbox"/>	If yes: Intoxication <input type="checkbox"/>	Pre-existing medical List _____	
Yes <input type="checkbox"/>	Trauma <input type="checkbox"/>	Drugs _____	
		Other _____	
EMS assessment/management:			
Spont breathing Yes <input type="checkbox"/> No <input type="checkbox"/> U* <input type="checkbox"/>	Initial neuro state: GCS: E _ V _ M _		
Signs of circulation Yes <input type="checkbox"/> No <input type="checkbox"/> U* <input type="checkbox"/>	or A <input type="checkbox"/> V <input type="checkbox"/> P <input type="checkbox"/> U <input type="checkbox"/>		
Airway interventions Yes <input type="checkbox"/> No <input type="checkbox"/> U* <input type="checkbox"/>	or A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/>		
ED assessment/management:			
Spont breathing Yes <input type="checkbox"/> No <input type="checkbox"/> U* <input type="checkbox"/>	Initial neuro state: GCS: E _ V _ M _		
Palpable pulse Yes <input type="checkbox"/> No <input type="checkbox"/> U* <input type="checkbox"/>	or A <input type="checkbox"/> V <input type="checkbox"/> P <input type="checkbox"/> U <input type="checkbox"/>		
Tracheal Tube/ventilation Yes <input type="checkbox"/> No <input type="checkbox"/> U* <input type="checkbox"/>	or A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/>		
Initial temp _____ BP _____ RR _____ SpO ₂ _____ FIO ₂ _____			
Outcome:			
ROSC: Any Yes <input type="checkbox"/> No <input type="checkbox"/> U* <input type="checkbox"/>	Survived to: ICU/ED Yes <input type="checkbox"/> No <input type="checkbox"/> U* <input type="checkbox"/>		
>20 min Yes <input type="checkbox"/> No <input type="checkbox"/> U* <input type="checkbox"/>	hosp. admission Yes <input type="checkbox"/> No <input type="checkbox"/> U* <input type="checkbox"/>		
	hosp. discharge Yes <input type="checkbox"/> No <input type="checkbox"/> U* <input type="checkbox"/>		
DNAR order Yes <input type="checkbox"/> No <input type="checkbox"/> U* <input type="checkbox"/>	If discharged alive, CPC _____ U* <input type="checkbox"/>		
Date of discharge or death: DD/MM/YY			

Figure 2. Example of Revised Utstein Drowning Data Form (Source: Idris, et al. [2])

A child with epilepsy should be enrolled in swimming lessons if possible. Tell the coach the child has epilepsy or seizure. Swim with the child or request that the child should be with someone who swims well enough to help if he/she has seizure while in the water. Make sure that the child swims in a supervised pool. If the child has poorly

failure found in this case. The results of laboratory tests were within normal limits, except hemoglobin. We have excluded hemolytic anemia, which can be caused by drowning after ingesting large amount of water and the patient also had low MCV, MCH, MCHC, and ferritin level. So the anemia is caused by iron deficiency.

There was no electrolyte disorder that usually occurs after drowning. Children can last more than 24 hours after drowning. According to data from 80% of cases of drowning 40-50% of them died and only 20% were able to survive.

Brain is the organ most susceptible to hypoxic ischemic injury. Unfortunately, the initial neurologic examination of presentation often is of limited use in predicting outcome. Children who have normal initial examination findings continue to have normal finding, children who present comatose or severely impaired require serial examinations over the following 24 hours to clarify the prognosis. Those who survive and have a good outcome generally demonstrate spontaneous, purposeful movement, and normal brainstem function in the first 24 hours. The duration of consciousness after drowning when good recovery is still considered possible seem to vary in the literature, from 24 hours to two-week period [5].

Repeated or continuous EEG may provide useful information to assist the differentiation between patients with good and poor neurological outcome. Reactivity to auditory and painful stimulations is more important sign of good prognosis than the dominant EEG frequency alone. A bad outcome can be associated with burst-suppression, status epilepticus, and nonreactivity. Somatosensory evoked potentials are valuable in assessing prognosis and they are less susceptible than EEG to sedation and metabolic factors. However, the accuracy in predicting neurological outcome is still not very good [20].

After the manifestation of seizure occurred to the child, EEG was performed and it showed an abnormal result which indicated an epileptic form waves in his left frontotemporal, with no burst-suppression. He was diagnosed with epilepsy. This is in accordance to the literature that stated that epilepsy is a risk factor for the occurrence of drowning in children.

We believe the boy had epilepsy before drowning because the incidence of neurologic sequelae from drowning was low, [17] and after drowning he showed no decrease of consciousness. And after more in-depth anamnesis the parents admit that patient often had empty gaze. It may be a part of seizure which unfortunately was neglected by parents. He was treated by valproic acid 20 mg/kgBW/day and until this case was reported there was no subsequent seizure.

Epilepsy is a risk factor for the occurrence of drowning in children. As recorded, there was 306 drowning cases in children in the UK during 1988-1989. Ten cases were associated with epilepsy suffered by the child. Children with uncontrolled epilepsy pose a greater risk of drowning. The risk of drowning in people with epilepsy is raised 15 to 19 fold compared with people in the general population. It is important that people with epilepsy and their caregivers be informed of these risk so that death can be prevented. In this case, the patient's mother did not know if the child suffers from epilepsy because the child didn't experience seizure before. The manifestations experienced by the child were only stunned and blurred vision. After

more in-depth history taking, the parents admitted that the patient often has empty gaze.

Cases of drowning occur when a child is swimming or bathing. They usually happen due to a lack of supervision of children. In this case, drowning incident occurred in a fish pond in front of the house without protection while the mother was cooking in the kitchen and the children playing alone. This incident can be avoided by childproofing the pool and providing supervision of the child.

The limitation of this case report is that we did not perform standard drowning report as recommended by ILCOR because there was no complete data submitted from the referral hospital. The standard report is important to establish consistency in reporting of drowning-related studies and to improve the clarity of scientific communication and the comparability of future scientific report. It can also help identify appropriate prevention strategies as well as the best treatment for victims of drowning and ultimately save lives.

5. Conclusion

Drowning causes an annual mortality of half a million people worldwide, which is still underreported. In each case of drowning, precipitating event should be known and reported. One of the most frequent precipitator is seizure. Although denied, we still have to do rigorous anamnesis to find epilepsy until it was proven contrary. Several terms for describing drowning should be abandoned. It is important that a uniform terminology is used to improve understanding and reporting these events, to help identifying appropriate prevention strategies as well as the best treatment for victims of drowning, and ultimately save lives [7,15,16,21,22].

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