

Acute Kidney Injury After Near-Drowning In A Pool Case Report

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Abstract

Introduction: Acute kidney injury is a neglected complication of submersion injury.

Case Report: A young man presented to a hospital after a near drowning event. He was clinically stable and discharged well from the hospital. He sought medical attention few days later for non-specific symptoms. His was found to have severe acute kidney injury despite being fairly well and clinically stable. He was treated and recovered without need for hemodialysis.

Conclusion: Acute kidney injury presents in a delayed fashion after submersion injury. Acute kidney injury may not be apparent immediately after a drowning event and victims should be re-evaluated for acute kidney injury a few days after the initial event.

Keywords: Submersion, drowning, acute kidney injury, acute renal failure, rhabdomyolysis

Introduction

Drowning is a traumatic scenario that is uncommonly encountered. Pulmonary and neurologic complications are the most worrying. Healthcare providers tend to neglect other less apparent complications when the victim is well.

Case Report

A 35 year old male with no past medical history of note, first presented to the Emergency Department (ED) of another hospital after a near-drowning (ND) incident. He was swimming in a pool (freshwater) together with his young son who was seated around his shoulder. At one point his son panicked and struggled and grabbed patient around his neck, resulting in him submerging on and off underwater. The duration of struggle was less than 2 minutes and there was no loss of consciousness. He was able to pull himself out of the water after a passerby threw him a float. He felt generalized weakness, slightly breathless and nauseous after that.

His initial parameters in the ED were temperature 35.8°C, pulse rate 108/min, blood pressure 129/58 mmHg, respiratory rate 18/min and oxygen saturation of 99% on

room air. Physical examination was largely unremarkable except cold peripheries. His chest x-ray was clear and he was discharged well on the same day with temperature at 37.2°C and oxygen saturation at 100% on room air.

He attended our ED 3 days later with non-specific symptoms. His chief complaint was feeling lethargic since then, associated with nausea and having a metallic taste in his mouth. Other complaints include vomiting 1-2 times a day, mild upper abdominal discomfort, feeling feverish, mildly breathless and low backache. His oral intake decreased past few days but he was still passing same amount of urine with no discoloration. His parameters then were temperature 36.9°C, pulse rate 71/min, blood pressure 129/65 mmHg, respiratory rate 19/min and oxygen saturation of 98% on room air. Physical examination was again unremarkable. His chest x-ray was clear. However, laboratory investigations revealed elevated creatinine (Cr) (1065 µmol/L) and urea (20.5 mmol/L). His venous blood gas showed a pH of 7.38, pCO₂ of 30 mmHg, bicarbonate 18 mmol/L, base excess of -7 and lactate of 0.54mmol/L. His creatine kinase (CK) was also found to be elevated at 25404 U/L.

He was started on intravenous hydration and admitted. Aggressive intravenous hydration was commenced with good urine output. He was reviewed by Nephrology and started on oral sodium bicarbonate. An ultrasound of the

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kidneys and bladder showed both kidneys of normal size but increased renal echogenicity. His Cr levels increased to a peak of 1267 µmol/L 3 days after admission (6 days after ND event) before improving while his CK levels steadily decreased after hydration. He was not started on dialysis. Patient reported improvement in symptoms only after 2-3 days of treatment. He was discharged well 9 days after admission with a creatinine of 152 µmol/L, urea of 8.9 mmol/L and creatine kinase of 103 U/L. His creatinine levels 7 weeks after the ND incident was back to normal levels.

Discussion

Acute kidney injury (AKI) in drowning cases had been described previously but due to its scarcity and poorly understood mechanism, it is often under-recognized.

Commonly described mechanisms for AKI in drowning include:

- ❑ Renal hypoxic ischemia (from hypoxemia from pulmonary insufficiency or systemic hypotension) with subsequent reperfusion injury
- ❑ Rhabdomyolysis

Other mechanisms:

- ❑ Hypothermia (may or may not be associated with drowning) induced renal impairment has been described. Reduced renal blood flow is considered as the mechanism although the specific pathophysiology is unknown
- ❑ Profound renal vasoconstriction due to intense sympathetic activity and stress-related release of angiotensin II with resulting renal hypoperfusion and hypoxia¹
- ❑ Increased oxygen demand for tubular transport (due to enhance solute delivery and reactive oxygen species mediated mechanisms at the cellular level)¹¹
- ❑ Unknown

This is an unusual case of acute kidney injury (AKI) associated with drowning. Most cases of acute kidney injury in the context of drowning are in the context of severe hypoxemia with multi-organ involvement. A retrospective analysis of 95 cases by Gorelik et al.¹ this year also showed that AKI in drowning is associated with need for resuscitation, mechanical ventilation and with the degree of acidemia, lactic acidemia, and ventilatory failure. In this case, the patient was relatively well with stable vital signs, not requiring any form of supplemental oxygen or hemodynamic support.

Table 1. Summary of cases of delayed diagnosis of AKI in well victims

Case Report	Type of presentation	Year of publication	Type of water body	Time from drowning to presentation (days)	Duration of observation during first visit (hours)	Time between initial and 2 nd visit (days)	Presenting complaint	Peak creatinine levels (µmol/L)	Hemodialysis required
Amir ³	Delayed	2013	Fresh	4	-	-	Flank pain, nausea, loss of appetite, polyuria	1213 (5 days after incident)	Unknown
Logan ⁴	Delayed	2017	Sea	1	-	-	Nausea, fatigue	451 (3 days after incident)	No
Hegde ⁵	Delayed	2003	Sea	2	-	-	Myalgia, reddish urine and subsequent anuria	707 (2 days after incident)	Yes
Alp ⁶	Reattendance	2016	Sea	Immediate	24	2	Nausea, flank pain, vomiting	707 (3 days after incident)	No
Seong ⁷	Delayed Reattendance	2012	Lake	3	12	3	Tiredness, anorexia, anuria	1017 (6 days after incident)	Yes
Hottelart ⁸	Reattendance	2004	Lake	Immediate	24	5	Tiredness, anuria	1600 (6 days after incident)	Yes
Current case	Reattendance	Pending	Fresh	Immediate	<6	3	Lethargic, nausea, metallic taste in mouth	1267 (6 days after incident)	No

A case series of 30 patients by Spicer et al.² in 1999 showed serum bicarbonate, pH and base excess to be predictors of AKI in drowning on univariate logistic regression analysis. Base excess was the best predictor by multivariate logistic regression analysis.

Our literature search revealed that AKI in seemingly well victims of near drowning is often diagnosed after a delay of a few days from the initial event. This is due to victims presenting late³⁻⁵ or due to AKI not being evident or picked up during the immediate medical visit post drowning⁶⁻⁸ and only detected the 2nd time the victims re-attended. Summary of the cases is shown in Table 1. Similarly, AKI in our case is only picked up 3 days after the initial near-drowning event even though the patient had been evaluated at a medical facility immediately after the event.

AKI often continues to progress beyond the initial presentation as seen in case reports.^{4,9,10} Serum creatinine of 67% of patients with AKI continued to peak beyond the first day in the case series by Spicer.² The case series by Gorelik¹ noted that mean creatinine levels reached a maximum at 48 hours from presentation for cases with higher degree of renal impairment.

Conclusion

We suggest that for all near-drowning or immersion cases, a 24 hour period of observation in the emergency department observation unit may not be enough to pick up AKI and that provision should be made for a follow-up re-evaluation after a few days if the victim is deemed well enough to be discharged from the ED following an immediate presentation after near-drowning.

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