

## A case of acute kidney injury by near-drowning

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### Abstract

Acute kidney injury following immersion or near-drowning is rarely described and no data from Malaysia have been found. We report a case of acute kidney injury following a near-drowning event. A 20-year-old man who recovered from near-drowning in a swimming pool 5 days earlier presented to our clinic with abdominal pain, anorexia, nausea and polyuria. Dipstick urinalysis showed a trace of blood. The serum creatinine level was 10-fold higher than the normal range. A bedside ultrasound showed features suggestive of acute tubular necrosis. He is then referred to the hospital with the diagnosis of acute kidney injury with the possibility of acute tubular necrosis secondary to near-drowning. We suggest that any patient presenting after immersion or near-drowning to be should assessed for potential acute kidney injury.

### Introduction

Notified fatalities in Malaysia due to drowning from the year 2000 to 2007 were 600-700 per year.<sup>1</sup> No local data were available on near-drowning cases. Drowning is defined as death due to asphyxia, with or without fluid aspiration, while immersed in fluid, whereas near-drowning is defined as survival from an immersion incident with or without fluid aspiration.<sup>2</sup> Most literature on drowning and near-drowning focus on the pulmonary insults such as pulmonary oedema and aspiration pneumonia.<sup>3</sup> However, other end organs that can be affected by near-drowning or immersion include the brain (hypoxic encephalopathy, cerebral oedema), the heart (arrhythmia) and the haematological system (disseminated intravascular coagulation).<sup>3-6</sup> Considering that immersion or near-drowning induced acute kidney injury is not uncommon,<sup>7</sup> reports on them are surprisingly few. None were found from Malaysia. There are several postulated theories on the mechanism behind this injury but they are still poorly understood. This is a report of a 20-year-old man who developed acute kidney injury following near-drowning in fresh water.

### Case Summary

A 20-year-old Malay man presented to our clinic complaining of pain in his abdomen over the flank associated with nausea and loss of appetite. He also volunteered a history of polyuria. He

has gone to another general practitioner a day prior to this with similar complaints and was prescribed liquid antacids. He decided to seek a second opinion due to the persistence of his symptoms. Five days before presenting to our clinic, he has almost drowned. He had gone swimming in a swimming pool. He was already quite exhausted when he developed cramps in his legs and sunk to the bottom of the pool. He swallowed a lot of water but was rescued. He did not lose consciousness throughout his ordeal and went back home after that incident.

On physical examination, he was conscious and alert; initial blood pressure was 180/100 mm Hg with a heart rate of 80 beats per minute. A repeat blood pressure reading taken later was 150/90 mm Hg. Body temperature was normal. Abdominal examination only revealed vague and mild tenderness over both flanks and loins region. Examination of the respiratory system was normal. On inspection, urine was clear. However, a quick dipstick urinalysis done in the clinic showed a trace of blood. No proteinuria was detected from dipstick urinalysis. Blood was sent to a private laboratory for investigation. Serum creatinine level was 1213 (<133)  $\mu\text{mol/L}$ , haemoglobin 13.0 (13.0-18.0) g/dL, leucocyte 7.0 (4.5-11.5)  $\times 10^9/\text{L}$  (neutrophils 59%, lymphocytes 32%, eosinophils 2% and monocytes 7%) and platelet 252 (150-400)  $\times 10^9/\text{L}$ . A bedside ultrasound of both kidneys showed features suggestive of acute tubular necrosis (Figure 1).



**Figure 1.** Ultrasound image showing enlargement of both kidneys with prominent medullary pyramids and widened gaps between them. (R KID= right kidney; L KID= left kidney)

The patient was referred to the hospital with the diagnosis of acute kidney injury with the possibility of acute tubular necrosis secondary to near-drowning.

It is unfortunate that we were unable to contact the patient or his next of kin to follow up on his progress.

## Discussion

Immersion or near-drowning can affect different major organ systems in the body. A retrospective study done by Spicer et al. at hospitals in Sydney found that acute kidney injury associated with near-drowning occurs in 50% of near-drowning emergency room admissions.<sup>7</sup> Although the real incidence of renal failure following near-drowning is not known, it is still thought to be less frequent compared to lung, brain or heart injury.<sup>8</sup> Most of the acute kidney injuries resulting from near-drowning are mild, reversible and self-limited.<sup>7</sup> However, there is a small percentage of patients who progress to the severe end of the spectrum, associated with shock, multisystem failure requiring renal replacement therapy.<sup>7</sup>

The predominant underlying pathophysiology leading to acute kidney injury following immersion or near-drowning is thought to be widespread tissue hypoxia and subsequent reperfusion injury. Vasoconstriction from cold water immersion increases venous return and raises cardiac output. On the contrary, removal

from water acutely decreases cardiac output. It is unclear if this acute change in cardiac output is responsible for renal hypoperfusion. The tubular epithelial cells are often affected by these ischemic injuries, causing acute tubular necrosis. Hypovolemia, hypothermia and rhabdomyolysis have also been suggested to contribute to severe acute kidney injury.<sup>7,9,10</sup> Acute kidney injury associated with clinical rhabdomyolysis and myoglobinuria was associated with longer immersion time and wearing of a wet suit.<sup>7</sup> As with other similar case reports, why renal injury predominates in the absence of other post-immersion injury sequelae remains unknown.<sup>7,9</sup> The possible explanation is renin-angiotensin surge when returning to dry land after whole-body immersion.<sup>5</sup>

All near-drowned victims may deteriorate even if they appear 'normal' on presentation and should be ideally observed for at least 24 hours.<sup>2</sup> Spicer et al. recommend that any patient presenting after immersion or near-drowning should have their serial serum creatinine measurement taken.<sup>7</sup> Admission dipstick urinalysis is also a simple yet useful screening test for potential acute kidney injury in immersion or near-drowning victims as haematuria is associated with acute kidney injury and urinary protein of 2 to 3+ is associated with a higher peak of serum creatinine.<sup>7</sup>

## Limitations

There maybe limited investigations that can be done in a general private practice setting because of financial constrain faced by the patient as each test is charged individually. Most private clinics do not have an in-house clinical laboratory and patients' samples are sent to private laboratories instead. Thus, baseline blood investigations which may be routinely or more conveniently done in a hospital setting, may have to be forsaken for something more basic as is in this case. In addition, the patient's outcome was not known. It would be very informative and interesting to look at the course of illness and eventual recovery status. Despite these limitations, it is important that general practitioner recognises acute kidney injury as a complication of near-drowning. Early detection and prompt referral cannot be over-emphasised.

**Conclusion**

The diagnosis of acute renal failure should not be overlooked in patients with a history of immersion or near-drowning. Clinicians should be aware that these patients can present with acute kidney injury even after several days of immersion or near-drowning.<sup>10</sup>

**Conflict of interest statement**

We declare that we do not have any conflict of interest.

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