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Non-Fatal Drowning: Measuring Respiratory Rate as Part of "Beach-Side" Clinical Assessment of Physiological Respiratory Stress

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Abstract

An average of 115 people drown in Ireland each year. Drowning is the third commonest cause of unintentional injury-related death globally. The United Nations 'Global Drowning Prevention' resolution was adopted in April 2021. The WHO recognises almost 360,000 drownings annually. There are an estimated 8-10 non-fatal drownings for each fatal drowning. The evidence base underpinning clinical management of non-fatal drowning is sparse. The use of respiratory rate in non-fatal drowning may provide a "*beach-side*" objective, quantifiable clinical measure of evolving physiological respiratory stress.

Introduction

Drowning is the third leading cause of unintentional injury-related death globally.[1] An average of 115 people, mostly males, drown in Ireland each year.[2] Drowning is "*drastically under-estimated*" with notifications "*the tip of the iceberg*".[1,3] There are an estimated 8-10 non-fatal drownings for each fatal drowning.[4]

Drowning disproportionately impacts children and adolescents in low and middle income countries.[5] Almost 360,000 people drown each year, with children under 5y age "facing the greatest risk".[6] The United Nations General Assembly adopted the first ever 'Global Drowning Prevention' resolution in April 2021.[5] This UN resolution, a shared initiative of Bangladesh and Ireland, expressed "*deep concern over 2.5 million largely unrecognised drownings*" in the past decade.[5] This UN resolution established drowning as an important social equity issue, with many drownings preventable through scalable low-cost interventions for all countries.[5] The economic, health and social costs of drowning are enormous.[1,5]

Drowning is the process of respiratory impairment from submersion/immersion in liquid.[1,3] Drowning outcomes are either fatal or non-fatal.[1] In non-fatal drowning the process of respiratory impairment from submersion/immersion in liquid stops before death. In non-fatal drowning, outcomes are no morbidity, some morbidity or severe morbidity.[1] The volume of fluid inhaled with drowning is usually small, limited due to voluntary breath-holding and laryngospasm.[3] Aspiration of water inactivates lung surfactant causing alveolar collapse, atelectasis, alveolar oedema, ventilation-perfusion mismatch, collectively and significantly impairing pulmonary gas exchange.[3] The initial clinical management of salt and freshwater drowning are similar.[4] There is a "*dire lack of evidence*" guiding clinical practice for drowning.[7,8]

"*Beach-side*" clinical assessment of non-fatal drowning is inevitably limited. Measurement of respiratory rate in non-fatal drowning may provide a "*beach-side"* objective, quantifiable clinical measure of evolving physiological respiratory stress.

Case Report

The author, a GP, was enjoying a sunny summer afternoon on a beach in Ireland. There was sea-lifeguard training underway nearby, in choppy water. One young adult lifeguard ran into the sea and commenced swimming but turned before reaching the target buoy and swam back to shore, coughing. The lifeguard staggered ashore, then collapsed. The fellow lifeguards immediately attended. When the lifeguard did not stand, I attended.

The initial limited "beach-side" clinical examination revealed: The lifeguard was alert, coughing, respiratory rate 30-40/min, pulse 100-110bpm, pink mucosa (no hypoxia). The rural bush telegraph speaks fast, and the coastguard arrived with a sphygmomanometer, stethoscope, and pulse oximeter. Systolic BP was >110mmHg, SpO2 97-99%, few basal lung crackles and respiratory rate consistently 30-40/min. I phoned an emergency ambulance, then the university hospital Emergency Department (ED), alerting ED clinicians to a possible non-fatal drowning. The sole abnormal clinical findings were persistent tachypnoea and a few crackles. Notably, the SpO2 was consistently normal. The coastguard replaced the wetsuit with dry clothing. The local police arrived, ensuring unimpeded ambulance access. The rural bush telegraph speaks loudly. The ambulance crew arrived, providing full "*beach-side*" assessment, supplemental oxygen, and transport to hospital. The lifeguard spent two nights in a university teaching hospital, made a full recovery and was discharged. We witnessed a successful collaborative community effort: fellow lifeguards, coastguard, police, ambulance and hospital team.

Discussion

Drowning is regrettably common.[1,5] The research evidence base informing clinical guidelines for management of non-fatal drowning is sparse.[7] All people with suspected non-fatal drowning should attend hospital*, "even if apparently recovered*."[4] The "*Beach-side*" clinical assessment of non-fatal drowning is inevitably constrained. Respiratory rate is an objective quantifiable clinical measure. The use of respiratory rate may support the "*beach-side*" presumptive clinical diagnosis of non-fatal drowning and help identify evolving physiological respiratory stress.

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