



CASE REPORT

A Mixed Case Report of Long-Term Management of Ascites and Anasarca From Liver Disease on a Remote Pacific Island

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Remote and austere medicine can be challenging when caring for healthy individuals and requires ingenuity when managing patients with unexpected, complex disease processes, whether acute or chronic. We report the case of an adult male who presented to an isolated clinic setting with acute exacerbation of chronic liver disease. Medical management was complicated by limited transportation resources, both for supplies and patient movement. There was concern that the patient's clinical status could decompensate into a life-threatening illness that might not be adequately treated in this remote setting. Through the use of collaborative decision-making with the patient and by telemedicine consultation, the patient was successfully stabilized on the island until routine transport to a higher level of care was available. Knowledge of climbing systems and alternative transportation arrangements were integral to our ability to provide prolonged care for this patient in a remote setting. Knowledge of the use of medicinal plants was key in offsetting the side effects of other medications used. We are reminded that creative and collaborative problem-solving epitomizes wilderness and austere medicine.

Keywords: chronic disease, austere, hepatitis, herbal medicine

Introduction

Improvements in the management of chronic disease, ease of travel, and increased staffing in remote settings have resulted in medical providers caring for patients in austere settings who may not have previously met remote medical clearance requirements. Healthcare professionals in remote settings should possess a thorough understanding of acute, as well as chronic, disease management and have an aptitude for dealing with unexpected circumstances by using nontraditional medical therapies and interventions.

Case Report

Midway Atoll is a 6.2-km² island that is part of a national wildlife refuge managed by the US Fish and Wildlife Service. Because the refuge is not open to public visitation

and has no indigenous population, its inhabitants consist of US Fish and Wildlife Service personnel and support contractors, totaling fewer than 100 people. The island clinic is staffed by a contract physician assistant and is intended for the evaluation of routine and occasionally urgent medical issues, but it has limited emergency capability and monitoring equipment. The facility contractors also include personnel for the small fire department (1–3 persons) who are certified emergency medical technicians and can assist with patient care as needed.

Our case report presents a male in his late 50s with chronic hepatitis C infection and suspected liver cirrhosis who was working as a contractor on Midway Atoll. Pre-employment medical screening for contractors was limited, and the patient's chronic medical history was not shared with workplace clinic providers. Although clinic staff were aware the patient would embark on a once-monthly, 2100-km, fixed-wing contracted flight to see his gastroenterologist in Honolulu, medical staff were unaware that his liver disease had recently progressed and required intermittent therapeutic paracentesis by this gastroenterologist to remove excess fluid from the abdomen.

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The wildlife refuge has specific requirements for aircraft that use the airfield. At the time of our case study, only 1 company had 1 aircraft with the necessary certifications. Three days before the next scheduled monthly flight was due to arrive, the company went out of business, leaving the island's inhabitants without commercial aviation support for supplies or routine transportation.

The following week, the patient presented to the clinic. He had been scheduled to see his gastroenterologist but had had to cancel his appointment because of the canceled fixed-wing flight. He was concerned about his worsening abdominal distention and endorsed weight gain from his baseline of 70 kg to approximately 85 kg, which had occurred in the month since his previous routine evaluation by his gastroenterologist. He was unable to button his pants or shirts. Additionally, he had developed spontaneously weeping wounds at multiple sites across his body. During the physical examination, we noted no evidence of jaundice or scleral icterus. Lower extremity pitting edema was noted to the level of the knees, and bilateral periorbital edema was evident. To manage his fluid status, the patient had decreased his oral fluid intake. He had not taken any diuretics in the past and did not endorse taking any chronic disease medications or supplements currently. His vital signs were within expected ranges, and there was no evidence of pulmonary edema. The diagnosis of symptomatic ascites with anasarca was made based on the clinical presentation.

Diagnostic assessment capability at the clinic was limited. No point-of-care testing was available except for blood glucose levels. Standard clinic practice had been to send any necessary diagnostic studies to a Honolulu laboratory on the monthly flight, but this was no longer possible. A 12-lead electrocardiogram was available in the clinic, but quality assurance testing and calibration documentation could not be found. No ultrasound machine was available on the island.

Available interventions and medication in the island clinic were limited. The small dry goods store had relied on the scheduled monthly flight to deliver products and thus would receive no further supplies. There would be no further fresh food available until a new logistics chain was established for the island; residents were left with only the food stores in the island's converted shipping container freezers. The small tropical island's few natural resources were protected because of its federal refuge status.

Paracentesis was not considered a viable solution for this patient for multiple reasons. The clinic lacked the necessary procedural supplies, and improvisation with sterile needles, tubing, and vacuum canisters was not feasible. The lack of ultrasound capability was considered

a safety concern. Furthermore, should the procedure cause complications, such as bowel perforation, infection, or epigastric vessel injury, these could not be handled locally.

A telemedicine discussion was initiated with the clinic's contracted physician medical director to discuss the patient's presentation and available treatment options. It was agreed that the patient did not meet the criteria for an urgent medical evacuation via a commercial fixed-wing aircraft. The decision was made to start treatment with daily low-dose (20 mg) oral furosemide, a low-sodium diet, and close monitoring. Risks, benefits, and alternatives of the care plan were reviewed with the patient, who agreed and believed that all alternatives should be explored before pursuing an evacuation.

Spironolactone, alone or in combination with furosemide, is generally regarded as the preferred diuretic regimen for ascites-related fluid overload.¹ However, spironolactone was not available in the clinic pharmacy. The inventory included a single bottle of 90 tablets of unexpired oral furosemide 20 mg.

The patient initiated furosemide therapy the following morning and was instructed to increase his fluid intake to prevent renal injury. He was evaluated daily in the clinic to monitor symptoms, evaluate vital signs, and record body weight on the clinic scale. Initially, the patient reported challenges with nocturia, which compromised his quality of sleep. Within the first 72 h, he noted resolution of his weeping wounds. Before the end of the first week, the patient's abdominal distention had decreased, and he was able to close the top button of his pants.

We were concerned that continued furosemide therapy might cause an electrolyte abnormality that could not be monitored in the clinic. No medical-grade supplemental potassium was available in the pharmacy to offset possible hypokalemia. However, the tropical island was populated with coconut palm trees with ripe coconuts.

Thus, where the island pharmacy fell short, the "island pharmacy" offered an opportunity. Coconut water has been identified as a good source of natural potassium.^{2,3} Some research has estimated that 1 L of coconut water can contain approximately 51 mEq of potassium.⁴ The typical volume of water in a coconut is approximately 500 mL, thus providing a potassium dose within the range of empiric replacement while the patient was on the loop diuretic.^{5,6} In a clinic visit during the first week of therapy, the patient agreed to consume the water from 1 coconut daily to replenish his potassium stores (Figure 1).

Coconut water is most nutritious when taken from fresh coconuts harvested while still on the palm tree.² To harvest the coconuts, a system was needed to ascend the approximately 10-m tall palm trees, but no heavy equipment was available on the island. Therefore, an



Figure 1. Picture of a “prescription” on one of the harvested coconuts. Note that the patient name “John Smith” is fictitious.

improvised ascender system was created from rope debris found on the island beaches. The clinic provider climbed palm trees each week to harvest sufficient coconuts for the patient (Figure 2). The coconuts were then stored in the island’s commercial kitchen, where staff had experience cutting open and harvesting coconut water.

Within 14 d of starting diuretic therapy, the patient endorsed significant weight loss. He was no longer having difficulty with abdominal distention, and he was able to button his shirts. After another 2 wk of continued furosemide therapy, he was still approximately 7 kg above his baseline weight. Daily evaluations with the scale in the clinic showed no further weight loss.

Soon thereafter, the island was notified that a research vessel would be passing by on a patrol of the area. Because of the prolonged supply chain interruption to the island, a unique medication delivery system was implemented. The clinician was able to phone in a prescription for spironolactone to a commercial pharmacy at the ship’s home port in Honolulu, and the patient phoned the pharmacy with payment information. The prescription was delivered by the pharmacy to the vessel, whose medical personnel delivered it to the patient during a brief stop at the island.

Within 14 d of adding spironolactone 100 mg daily, the patient noted that he had returned to his baseline weight and experienced resolution of all symptoms.

Subsequently, the patient was able to leave the island via a government fixed-wing aircraft that was in the area for a familiarization flight. He had a follow-up appointment with his gastroenterologist, who recommended continuing spironolactone as monotherapy and took over prescribing responsibility.

Discussion

Cirrhosis with anasarca is an example of complex chronic disease management that is usually managed within the confines of traditional healthcare facilities but can now be seen in austere settings, where the consequences of acute exacerbation are significant and potentially life-threatening. Standard care typically is sodium restriction and diuretic initiation (spironolactone with or without furosemide).^{7,8}

Fluid status monitoring can be challenging in the austere environment. Ascites can be tracked via serial recording of abdominal girth. In the present case, exact measurements were not recorded, but girth was tangentially evaluated by the patient’s ability to successfully use the snaps on the bottom of his shirts and close the top button on his pants.

Hypokalemia is a known complication of liver disease, and monotherapy with loop diuretics could have exacerbated the issue.⁷ Empiric potassium supplementation was warranted given the inability to reliably check potassium levels in the austere setting.

Coconut water has been shown to have applicability in multiple areas of medical practice.² Studies have shown equivalency to normal saline when used as an intravenous resuscitation fluid in healthy volunteers.⁹ Coconut water taken orally has been studied for recovery and as an oral rehydration fluid.² Medical professionals operating in austere environments may benefit from knowledge of the use of coconut water for patient care.

Potassium supplementation is available through myriad food sources. Potassium-rich foods include both shelf-stable and fresh foods. Fruit sources include dried apricots (1900 mg K⁺ per 100 g), dates, and bananas.



Figure 2. Clinic provider using ad hoc rope system to climb coconut tree to harvest coconuts for patient consumption.

Legumes are known sources of potassium, with white beans having the highest content (561 mg K⁺ per 100 g). Other foods common to athletes, such as salmon, avocado, and sweet potato, are also relatively high in potassium.¹⁰

This case highlights how telemedicine, second-line therapies, ingenuity, and knowledge about prevention of complications can temporize a disease process before problems progress to emergencies. Nonmedical skills, such as local plant use, nonstandard transportation platforms for supplies, and familiarity with rope systems, can potentially assist in the care of patients in austere environments.

Conclusions

Astute clinicians in remote locations will likely continue to encounter patients with unexpected health conditions that require creativity, collaboration, and skill to manage. This case illustrates many aspects of wilderness and austere medicine, including limited resources, difficult evacuation logistics, telemedicine, prevention of complications through an understanding of medication side

effects, and even nonmedical technical skills, such as improvised climbing techniques. Creative problem-solving is key to successful medical management in the austere environment. Potassium supplementation using coconut water may be a safe and effective alternative when traditional therapies are unavailable, although a lack of objective dosing and the limited prospective data should be carefully considered before implementing the practice.

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