*Case Report*

**SAGE Open Medical Case Reports**

# How much is too much? Pushing the limits of fluid removal via paracentesis

SAGE Open Medical Case Reports
Volume 10: 1–4

DOI: 10.1177/2050313X221109689
journals.sagepub.com/home/sco
SAGE

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**Abstract**

Peritoneal fluid accumulation can be caused by a multitude of factors. Patients with chronic cirrhosis can suffer from recurrent ascites requiring repeat paracentesis for fluid removal and symptom control. A paracentesis is a commonly performed procedure with a low risk profile that can be performed at the bedside by appropriately trained individuals. A large volume paracentesis is often therapeutic and focus should be placed on removing as much fluid as safely tolerated. We present a 57-year old Caucasian male with worsening abdominal distention and recurrent ascites who presented for progressive shortness of breath. Given the large volume of ascites noted, the patient underwent a passive bedside paracentesis with 29 L removed. The patient tolerated the 5-h procedure well without any post-procedure complications, challenging the extent of volume removal during bedside paracentesis.

**Keywords**

Paracentesis, ascites, cirrhosis

Date received: 6 January 2022; accepted: 7 June 2022

## Introduction

Ascites is the pathological collection of fluid in the peritoneal cavity.[1] In patients suffering from ascites, a thorough history and physical examination can often elicit the cause of their fluid accumulation. Ascites due to portal hypertension from underlying cirrhosis remains the most common cause of abdominal fluid collection in the United States.[2] Although noninvasive measures (pharmacological) implementations are first-line, invasive measures may need to be considered. Assessment and analysis of the fluid can help clinicians understand the underlying etiology. The best method of obtaining and removing abdominal fluid is to perform a procedure known as a paracentesis. Paracentesis is a bedside procedure that utilizes a needle that enters the peritoneal cavity to help retrieve the fluid of interest. Symptom control during a therapeutic paracentesis can often be achieved with removal of 1–5 L of fluid. Any volume removed greater than 5 L is considered a large volume paracentesis (LVP).[3] The following case represents a patient undergoing a paracentesis where the amount of fluid removal presses on the boundary of comfort.

## Case

### *History of present illness*

A 57-year old Caucasian male with a past medical history of hypothyroidism, gastroesophageal reflux disease, type 2 diabetes mellitus, alcohol use disorder, history of medication/medical non-compliance, and recent incarceration (01/2021) presented to the emergency department (ED) with worsening shortness of breath (SOB). His SOB started approximately 2–3 days prior to his ED arrival and has progressively worsened. His SOB is associated with a mild nonproductive cough but is without chest pain or wheezing. The patient has not experienced any fever at home, chills, night sweats, or recent sick contacts.

In addition, the patient reports experiencing worsening abdominal distention over the past few months. The abdominal swelling was first noticed nearly 6 months prior and prompted a visit to an external hospital (not affiliated with the current hospital). At the external hospital, he had significant ascites requiring a paracentesis in the ED with noted improvement in his symptoms (SOB predominantly). Unfortunately, records were not obtained from his prior ED visit, but the patient denied having any work up (images) at the time. Once he obtained his first paracentesis, the patient had improvement in his symptoms for nearly a week. Shortly after, the fluid had reaccumulated and continued to worsen. His abdominal distention had become worrisome

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and subsequently resulted in abdominal pain from the tense nature and progressive distention. He also reported mild bilateral lower extremity swelling without associated pain, trauma, or recent falls. The patient reports not being compliant with his outpatient appointments and is not currently taking any medications at home. The patient does not adhere to a specific diet and denies limiting his alcohol use. He drinks approximately 4–6 beers a day, every day for the past 30 years.

## Physical examination

Vital signs on admission revealed a heart rate of 112 beats per minute, a respiratory rate of 21 breaths per minute, a temperature of 98.7°F (37°C), a blood pressure of 106/98 mmHg, and oxygen saturation of 91% on room air.

Physical examination revealed a patient who was alert and oriented with no signs of hepatic encephalopathy. The patient was noted to be in mild distress due to being short of breath. Head, eyes, ears, nose, and throat examination was negative for facial edema, scleral icterus, oral lesions, or visual defects. Cardiovascular examination was unremarkable. Pulmonary examinations revealed decreased breath sounds bilaterally without wheezing or crackles. Abdominal examination was significant for a severely distended and tense abdomen. A protruding umbilicus was noted alongside multiple telangiectasias and dilated, tortuous abdominal veins. Musculoskeletal examination revealed 2+ pitting edema of both lower extremities extending to the mid-thighs. Range of motion in all extremities was normal. No asterixis was noted. Neurological examination revealed normal muscle strength and deep tendon reflexes in both upper and lower extremities. Cranial nerves were unremarkable.

## Initial workup

Lab workup on admission revealed mild leukocytosis (white blood cells 12.9 K/uL), normal platelet count (226 K/uL), normal plasma sodium (136 mmol/L), elevated creatinine (1.5 mg/dL with a baseline of 1.1 mg/dL), elevated blood glucose (134 mg/dL), elevated potassium (5.4 mmol/L), elevated alkaline phosphatase (225 U/L), higher end of normal total bilirubin (1.1 mg/dL), low albumin (2.6 g/dL), elevated international normalized ratio (INR) (1.62), and normal aspartate transaminase (AST) and alanine transaminase (ALT) levels. Thyroid-stimulating hormone, troponin, and urine drug screen were also normal. Chest X-ray revealed low lung volumes without infiltrates or other acute pathology. Abdominal ultrasound (US) revealed a cirrhotic liver with no focal lesions alongside large volume ascites. Given laboratory results, the patient was noted to be Child-Pugh class B with an MELD-Na score of 16 (<2% estimated 90-day mortality).

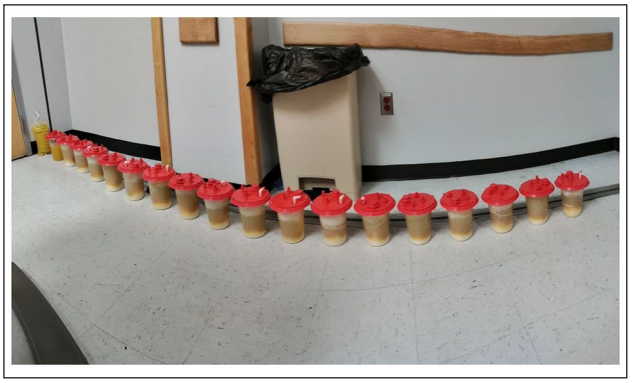

**Figure 1.** Visual representation of one 2-L bag and 18 suction canisters (29 L total) of peritoneal fluid removed from the patient.

## Hospital course

The patient's ascites was concluded to be secondary to cirrhosis given the US findings. Once evaluated, the patient was started on Ceftriaxone (2 g every 24 h), Furosemide (20 mg intravenous [IV] every 24 h), and Lokelma (10 g) for hyperkalemia. Anti-aldosterone agents were not initiated on admission due to elevated potassium. A bedside US-guided paracentesis was initiated on the day of admission. The patient was placed on continuous cardiac monitoring and closely monitored. The area of the right lower abdomen was prepped and draped in a sterile fashion using chlorhexidine scrub. Lidocaine (1%) was used to numb the region. The skin was incised using a 10-blade scalpel. The paracentesis catheter was inserted and advanced with negative pressure until clear yellow fluid was retrieved and collected. Approximately 65 mL of ascitic fluid was collected and sent for laboratory analysis. Fluid removal during the procedure was solely evacuated by the force of the patient's intra-abdominal pressure. No active removal of peritoneal fluid was warranted as fluid continued to drain due to extensive abdominal pressure alone. The procedure ended once the passive fluid output had decreased significantly. A dressing was placed to minimize post-procedure leakage at the site of incision. The patient tolerated the procedure well without any immediate complications.

Procedure time spanned approximately 5 h with a total of one 2-L bag and 18 suction canisters used (1.5 L total volume each) that resulted in a total of 29 L of peritoneal fluid removed, as shown in Figure 1. Vitals during the procedure remained stable with an average systolic blood pressure reading of 90–100 mmHg. Vital signs following the procedure revealed a heart rate of 102 beats per minute, a respiratory rate of 19 breaths per minute, a temperature of 97.2°F (36.2°C), a blood pressure of 110/80 mmHg, and oxygen saturation of 96% on room air. The patient received 100 g total albumin shortly after the procedure. Unfortunately, the amount of albumin provided was limited due to facility shortage. Fluid analysis revealed a negative gram stain,

negative aerobic and anaerobic cultures, a white blood cell count of 56, and albumin of 0.1 g/dL. During rounds the next morning, the patient's abdomen was noted to be soft and without tenderness or tension. The patient was no longer short of breath and his vital signs remained within normal limits. Repeat laboratory assessment revealed normal electrolytes and a creatinine level of 1.2 mg/dL (1.5 mg/dL on admission). During the encounter, he had expressed interest in leaving the hospital. The patient subsequently left the hospital against medical advice. Although he was not formally discharged, appropriate follow-up with a primary care provider and gastroenterologist was provided. Unfortunately, the patient had not followed up with any provider after his discharge. Missed appointments and unanswered phone calls were noted upon chart review following his hospitalization. It is worth noting that the fluid analysis was negative for an infectious etiology as both Gram stain and culture were negative.

## Discussion

A bedside paracentesis is a vital process that can help diagnose and symptomatically treat ascites or new-onset peritoneal fluid accumulation. It is a commonly performed procedure with a low complication rate when executed under the right conditions.[4] Although care must be taken, paracentesis has been proven to be a safe procedure in patients with thrombocytopenia or an elevated INR.[5] The utility of performing a paracentesis can vary between diagnostic, therapeutic, or both. Therapeutic paracentesis should predominantly be utilized if a patient has moderate to large volume of ascites, if the patient is experiencing respiratory compromise, if the patient exhibits a tense/distended abdomen, or if the patient has failed initial diuretic therapy.[6]

Caution with LVP needs to be exercised due to potential adverse events post-procedure. Studies have demonstrated a markedly elevated renin level in patients following an LVP, an indicator of hypovolemia.[2] Post-paracentesis circulatory dysfunction can be encountered and lead to renal impairment, hyponatremia, or hepatic encephalopathy.[6] An effective method to reduce such complications is to provide post-procedure volume expansion. Expert opinion suggests that if greater than 5 L of fluid is removed, 6–8 g/L of albumin should be given for every liter thereafter.[7]

The above case presents a patient with an overwhelming amount of ascites who had 29 L removed from the peritoneal cavity via bedside paracentesis. The indication of such large volume removal included his tense/distended abdomen, respiratory complaints, and recurrent ascites. In patients with a tense abdomen due to ascites, the initial outflow of fluid is often brisk. Due to possible time restraints, connecting the paracentesis tubing to vacuum canisters can aid in faster removal of the fluid. In patients who require an LVP, removal of as much fluid as possible is warranted to minimize the interval between repeat paracentesis.[8] In clinically stable patients, cautious removal of large volumes of fluid is often well tolerated. A 2011 study demonstrated safety with a single-tap paracentesis removing an astonishing 38.8 L of fluid.[9]

Prematurely stopping a paracentesis while the abdomen remains under stress or due to time restraints may result in a persistent leak at the insertion/incision site. Such leaks can be uncomfortable for both the patient and the nurse and potentially creates a nidus for infection. If applicable, patients who are at risk of hemodynamic compromise, post-procedure complications or have a large volume of refractory ascites, passive drainage should be considered. This can ensure slow but comfortable drainage initiated simply by the patients' elevated intra-abdominal pressure. Providers are encouraged to monitor the patient's overall clinical status as this method may allow for an uncomfortably large amount of fluid to be removed/drained. Although immediate medical optimization is warranted, evaluation for liver transplant should be considered. Patients who suffer from decompensated cirrhosis with refractory ascites have an approximate 1-year survival of 50%.[10]

In addition, we must consider abdominal compartment syndrome (ACS) in patients with significant/severe abdominal distention (such as the patient discussed). ACS is defined as elevated abdominal pressure associated with at least one end-organ dysfunction.[10] Although prevalence in cirrhotic patients is low given the chronicity of fluid build-up, one should consider ACS on the differential in the presence of a tense/distended abdomen. Treatment is often surgical (abdominal decompression) but a less invasive procedure such as a paracentesis is considered an alternative option in select patients.[11]

## Conclusion

Paracentesis is a safe and common bedside procedure that can be both diagnostic and therapeutic. Patients who have recurrent or large volume ascites should have as much fluid removed as possible to minimize repeat paracentesis and control-related symptoms. Passive drainage during an LVP can ensure slow but comfortable removal of fluid in patients deemed high risk for hemodynamic compromise or post-procedure complications.

### Declaration of conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### Ethical approval

Our institution does not require ethical approval for reporting individual cases or case series

### Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

## Informed consent

Written informed consent was obtained from the patient(s) for their anonymized information to be published in this article.

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