

An Academic Hospitalist–Run Outpatient Paracentesis Clinic

Lawrence D. Gerber, MD^{a,b}; Gaetan Sgro, MD^{a,b}; Jessica E. Cyr, MD^{a,b}; and Sharon Conlin, BSN, RN^a

Background: Patients needing large-volume paracenteses (LVPs) can occupy inpatient hospital beds and unnecessarily use inpatient resources.

Methods: We describe an outpatient paracentesis clinic that was part of a quality assurance initiative at the Veterans Affairs Pittsburgh Healthcare System in Pennsylvania. A retrospective review was conducted that included patient age, sex, etiology of ascites, amount of ascites removed, time of the procedure, complications, and results of ascites cell count and cultures abstracted from the electronic health record.

Results: Over 74 months, 506 paracenteses were performed

on 82 patients. The mean volume removed was 7.9 L, and the mean time of the procedure was 33.3 minutes. There were 5 episodes of postprocedure hypotension that required admission for 3 patients. One episode of abdominal wall hematoma occurred that required admission. Two patients developed incarceration of an umbilical hernia after the paracentesis; both required surgical repair. Without the clinic, almost all the 506 outpatient LVPs we performed would have resulted in a hospital admission.

Conclusion: An outpatient paracentesis clinic run by academic hospitalists can safely and quickly remove large volumes of ascites and minimize hospitalizations.

Author affiliations can be found at the end of this article.

Correspondence:

Lawrence Gerber
(lawrence.gerber@va.gov)

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Cirrhosis is the most common cause of ascites in the United States. In patients with compensated cirrhosis, the 10-year probability of developing ascites is 47%. Developing ascites portends a poor prognosis. Fifteen percent of patients who receive this diagnosis die within 1 year, and 44% within 5 years.¹ First-line treatment of cirrhotic ascites consists of dietary sodium restriction and diuretic therapy. Refractory ascites is defined as ascites that cannot be easily mobilized despite adhering to a dietary sodium intake of ≤ 2 g daily and daily doses of spironolactone 400 mg and furosemide 160 mg.

Patients who cannot tolerate diuretics because of complications are defined as having diuretic intractable ascites. Diuretic-induced complications include hepatic encephalopathy, renal impairment, hyponatremia, and hypo- or hyperkalemia. Because these patients are either unresponsive to or intolerant of diuretics, second-line treatments, such as regular large-volume paracentesis (LVP) or the insertion of a transjugular intrahepatic portosystemic shunt (TIPS) are needed to manage their ascites. These patients also should be considered for liver transplantation unless there is a contraindication.²

Serial LVP has been shown to be safe and effective in controlling refractory ascites.³ TIPS will decrease the need for repeated LVP in patients with refractory LVP. However,

given the uncertainty as to the effect of TIPS creation on survival and the increased risk of encephalopathy, the American Association for the Study of Liver Diseases (AASLD) recommends that TIPS should be used only in those patients who cannot tolerate repeated LVP.⁴ Repeated LVP also has been shown to be safe and effective in controlling malignant ascites.^{5,6}

LVP can be done in different health care settings. These include the emergency department (ED), interventional radiology suite, inpatient bed, or an outpatient paracentesis clinic. There have been various descriptions of outpatient paracentesis clinics. Reports from the United Kingdom have revealed that paracenteses in these outpatient clinics can be performed safely by nurse practitioners or a liver specialist nurse, that these clinics are highly rated by the patients, and are cost effective.⁷⁻¹⁰ Gashau and colleagues describe a clinic in Great Britain run by gastroenterology (GI) fellows using an endoscopy suite.¹¹ A nurse practitioner outpatient paracentesis clinic in the US has been described as well.¹² Grabau and colleagues present a clinic run by GI endoscopy assistants (licensed practical nurses) using a dedicated paracentesis room in the endoscopy suite.¹³ Cheng and colleagues describe an outpatient paracentesis clinic in a radiology department run by a single advanced practitioner with assistance from an

ultrasound technologist.¹⁴ Wang and colleagues present outpatient paracenteses in an outpatient transitional care program by a physician or an advanced practitioner supervised by a physician.¹⁵ Sehgal and colleagues describe (in abstract) the creation of a hospitalist-run paracentesis clinic.¹⁶

Traditionally, at Veterans Affairs Pittsburgh Healthcare System (VAPHS) in Pennsylvania, if a patient needed LVP, they were admitted to a medicine bed. LVP is not done in the ED, and interventional radiology cannot accommodate the number of patients requiring LVP because of their caseload. The procedure was done by an attending hospitalist or medical residents under the supervision of an attending hospitalist. To improve patient flow and decrease the number of patients using inpatient beds, we created an outpatient paracentesis clinic in 2014. Here, we present the logistics of the clinic, patient demographics, the amount of ascites removed, and the time required to remove the ascites. As part of ongoing quality assurance, we keep track of any complications and report these as well.

METHODS

The setting of the outpatient paracentesis clinic is a room in the VAPHS endoscopy suite. The clinic operates 1 half-day per week with up to 3 patients receiving a paracentesis. We use the existing logistics in the endoscopy suite. There are 1 or 2 registered nurses (RNs) who assist the physician performing the paracentesis. The proceduralist is an academic hospitalist who at the time is not on service with residents. The patients are referred to the clinic by the ED, hepatology clinic, palliative care, primary care physicians, or at hospital discharge. In the clinic consult, patients are required to have at least an estimated 3 L of ascites and systolic blood pressure (SBP) \geq 90. The patients can eat and take medications the morning of the procedure except diuretics. Patients are checked in to the endoscopy suite and a peripheral IV is placed. Blood tests, such as a complete blood count and coagulation studies, are not checked routinely since the AASLD guidelines state that routine prophylactic use of fresh frozen plasma or platelets before paracentesis is not recommended because bleeding is uncommon.³ The proceduralist can order blood work at their discretion.

TABLE Etiology of Ascites

Types	No. (%)
Cirrhotic	76 (93)
Ethanol	28 (34)
Ethanol + hepatitis C	23 (28)
NASH	8 (10)
Cardiac	5 (6)
Hepatitis C	4 (5)
Cryptogenic	3 (4)
Hepatitis B	1 (1)
Hepatitis C + hemochromatosis	1 (1)
Hepatitis C + NASH	1 (1)
NASH + α -1 antitrypsin deficiency	1 (1)
NASH + primary sclerosing cholangitis	1 (1)
Noncirrhotic	
Metastatic malignancy	6 (7)

Abbreviation: NASH, Non-alcoholic steatohepatitis.

After the procedure, patients are brought to the recovery area of the endoscopy suite and discharged. The patients are discharged usually within 15 to 30 minutes from arriving in the recovery area after it is assured that the SBP is within 10% of their baseline. Patient follow-up in the outpatient paracentesis clinic is determined by the proceduralist. Most patients need regularly scheduled paracenteses depending on how quickly they reaccumulate ascites. If a patient does not need a regularly scheduled paracentesis, the proceduralist ensures that the appropriate outpatient clinic visit has been scheduled or requested.

Procedure

Informed consent is obtained, and a time-out is performed before each paracentesis. The patient is attached to a cardiac monitor and pulse oximetry as per the endoscopy suite protocol. The proceduralist does a point-of-care ultrasound to find the optimal site and marks the site of puncture. The skin around the marked site is prepared with 3 chlorhexidine gluconate 2%/isopropyl alcohol 70% applicators. A fenestrated drape is used to form a sterile field. The Avanos Paracentesis Kit is routinely used for LVP at VAPHS. Local anesthesia with 1% lidocaine is used with a 25-gauge \times 1-inch needle. Deeper anesthesia is obtained with 1% lidocaine, using a 22-gauge \times 1.5-inch needle, injecting and aspirating while advancing the needle until ascites is aspirated.

A 15-gauge 3.3-inch Caldwell cannula with an inner needle is inserted into the

peritoneal cavity and ascites is aspirated into a syringe. The inner needle is then removed, and the Caldwell cannula is left in the peritoneal cavity and tubing with a roller clamp is attached to the cannula. The tubing is then attached to a 1-L vacuum suction bottle by the RN. We use the CareFusion PleurX drainage bottle. The proceduralist maintains sterility and assures the cannula remains in place. The RN changes the drainage bottles after being filled with 1 L of ascites.

We drain as much ascites as possible until drainage stops on its own. The cannula is then removed, and pressure is held with a gauze pad. An adhesive bandage is then placed over the site. Consistent with AASLD guideline, 25 g of IV albumin 25% is infused for every 3 L of albumin removed provided > 5 L of ascites is removed.³ The albumin is infused during the procedure and not after to limit the time of the procedure. A sample of ascites is sent for cell count with differential and culture.

RESULTS

Between March 2014 and May 2020, 506 paracenteses were performed on 82 patients. The mean age was 66.4 years, and 80 of 82 patients were male. The etiology of the ascites is presented in the Table. Twelve percent of the patients had concomitant hepatocellular carcinoma. Data on the amount of ascites removed were available for all patients, but data on the amount of time it took to do the LVP were available for 392 of 506 paracenteses. The mean volume removed was 7.9 L (range, 0.2-22.9 L), and the mean time of the procedure was 33.3 minutes. The time of the procedure was the time difference between entering and leaving the procedure room. This does not include IV placement or the recovery area time.

There were 5 episodes of postprocedure hypotension that required IV fluid or admission. In all these events, the patients had received the appropriate amount of IV albumin. Three patients required admission, and 1 patient required IV fluid postparacentesis on 2 occasions and then was discharged home. One abdominal wall hematoma occurred. Two patients with umbilical hernias developed incarceration after the paracentesis; both required surgical repair. There were 3 episodes of leakage at the paracentesis site;

a skin adhesive was used in 2 cases, and sutures were applied in the other. There were no deaths.

Possible Infections

Ascitic fluid infection is a risk for patients needing paracentesis. Spontaneous bacterial peritonitis (SBP) is a bacterial infection of ascites in the absence of a focal contiguous source. The polymorphonuclear leukocyte (PMN) count in the ascites is ≥ 250 cells/mm³ in the presence of a single organism on culture. Culture-negative neutrocytic ascites (CNNA) is an ascitic fluid PMN count ≥ 250 cells/mm³ in the absence of culture growth obtained before the administration of antibiotics. Monomicrobial nonneutrocytic bacterascites (MNB) is an ascitic fluid PMN count < 250 cells/mm³ with growth of a single organism on culture.¹⁷ There was one occasion where a patient developed symptomatic CNNA 3 days after having a therapeutic paracentesis in the clinic at which time his ascites had a normal neutrophil count and a negative culture. He presented with abdominal pain and fever 3 days later, and a diagnostic paracentesis was done in the ED. He was treated as though he had SBP and did well.

Ascites cell count and culture are routinely sent in the clinic, and 1 case of asymptomatic SBP and 3 cases of asymptomatic ascitic fluid infection variants were diagnosed. The patient with SBP grew vancomycin-resistant *Enterococcus faecium* in his ascites. Two cases were CNNA. These patients were admitted to the hospital and treated with IV antibiotics. One case of MNB occurred that grew *Escherichia coli*. The patient refused to return to the hospital for IV antibiotics and was treated with a 5-day course of oral ciprofloxacin.

DISCUSSION

We describe an academic hospitalist-run outpatient LVP clinic where large volumes of ascites are removed efficiently and safely. The only other description of a hospitalist-run paracentesis clinic was in abstract form.¹⁶ Without the clinic, the patients would have been admitted to the hospital to get an LVP. Based on VAPHS data from fiscal year 2021, the average cost per day of a nontelemedicine admission was \$3394. Over 74 months, 506 admissions

were prevented, which averages to 82 admissions prevented per year, an approximate annual cost savings of \$278,308 in the last fiscal year alone.

Possible Complications

The complications we report are congruent with those reported in the literature. Runyon reported that the rate of an abdominal wall hematoma requiring blood transfusion was 0.9%, and the rate of an abdominal wall hematoma not requiring blood transfusion was also 0.9%.¹⁸ We had 1 patient who developed an abdominal wall hematoma (0.2% of paracenteses). This patient required 4 units of packed red blood cells. The incidence of ascitic fluid leakage after paracentesis has been reported to be between 0.4% and 2.4%.¹² We had 3 episodes of leakage (0.6% of paracenteses). The Z-track technique has been purported to decrease postparacentesis leakage.² This involves creating a pathway that is non-linear when anesthetizing the soft tissues and inserting the paracentesis needle. The Z-track technique was not used in any of the paracenteses in our clinic.

Postparacentesis hypotension has been reported to be 0.4% to 1.8%.^{12,14} We report 5 episodes of hypotension (0.1% of paracenteses) of which 3 patients were admitted to the hospital. Interestingly, 4 of the 5 patients were on β -blockers. Serste and colleagues reported in a crossover trial that paracentesis-induced circulatory dysfunction (PICD) decreased from 80 to 10% when propranolol was discontinued.¹⁹ PICD is characterized by reduction of effective arterial blood volume with subsequent activation of vasoconstrictor and antinatriuretic factors that can cause rapid ascites recurrence rate, development of dilutional hyponatremia, hepatorenal syndrome, and increased mortality. IV albumin is given during LVP to prevent PICD. Discontinuing unnecessary antihypertensive medications, especially β -blockers, may mitigate postparacentesis hypotension. In a study of 515 paracenteses, De Gottardi and colleagues reported a 0.2% rate of iatrogenic percutaneous infection of ascites.²⁰ We had 1 patient return 3 days after LVP with fever, abdominal pain, and neutrocytic ascites. His blood and ascites cultures were negative. The eti-

ology of his infected ascites could have been either a spontaneously developed CNNA infection or an iatrogenic percutaneous infection of ascites.

Two cases of incarceration and strangulation of umbilical hernias postparacentesis that required emergent surgical intervention were unanticipated complications. Incarceration of an existing umbilical hernia postparacentesis is an uncommon but serious complication of LVP described in the past in numerous case reports but whose incidence is otherwise unknown.²¹⁻²⁶ The fluid and pressure shifts before and after LVP are likely responsible for the hernia incarceration. When ascites is present, the umbilical hernia ring is kept patent by the pressure of the ascitic fluid, and the decrease in tension after removal of ascites may lead to decreased size of the hernia ring and trapping of contents in the hernia sac.²⁵⁻²⁷ In most reported cases, symptoms and recognition of the incarcerated hernia have occurred within 2 days of the index paracentesis procedure. Most cases were in patients who required serial paracenteses for management of ascites and had relatively regular LVPs.

In both cases, the patients had regular visits for paracentesis, and incarceration occurred 0.5 hours postprocedure, in 1 case and 6 hours in the other. Umbilical hernias are common in patients with cirrhosis, with the prevalence approaching 20%.²⁸ The management of umbilical hernias in patients with ascites is complex and optimal guideline-based management involves elective repair when ascites is adequately controlled to prevent recurrence, with consideration of TIPS at the time of repair.³ However, patients enrolled in outpatient paracentesis clinics are unlikely to have adequate ascites control to be considered optimized for an elective repair. In addition, given the number of serial procedures that they require, it is not surprising that they may be at risk for complications that are otherwise thought to be rare. Although incarceration and strangulation of umbilical hernia is thought to be a rare complication of LVP, patients should be informed of this potential complication so that they are aware to seek medical attention should they develop signs or symptoms.

Guidelines

There are no guidelines on how much ascites can be removed and how quickly the ascites can be removed during LVP. The goal of a therapeutic paracentesis is to remove as much fluid as possible, and there are no limits on the amount that can be removed safely.¹ Concerning paracentesis flow rates, Elsabaawy and colleagues showed that ascites flow rate does not correlate with PICD. They looked at 3 groups with ascites flow rates of 80 mL/min, 180 mL/min and 270 mL/min.²⁹ We had data on the time in the procedure room in 77% of our procedures. Given our average amount of ascites removed (7.9 L) and average time in the procedure room (33.3 minutes), the average flow rate from our clinic was at least 237 mL/min (although the flow rate was likely higher because the average time from needle inserted to needle removed was < 33.3 minutes). Both the mean duration of LVP and the mean volume of ascites removed in an outpatient paracentesis clinic were reported in only 1 other study. In a study of 1100 patients, Grabau and colleagues reported the mean duration, defined as the time between when the patient entered and exited the procedure room (the same time period we reported) as 97 minutes and the mean volume of ascites removed as 8.7 L.¹³

The AASLD guidelines state that patients undergoing serial outpatient LVP should be tested only for cell count and differential without sending a bacterial culture. The reason given is that false positives may exceed true positives from ascites bacterial culture results in asymptomatic patients.³ Mohan and Venkataraman reported a 0.4% rate of SBP, 1.4% rate of CNNA, and 0.7% rate of MNB in asymptomatic patients undergoing LVP in an outpatient clinic.³⁰ We had a 0.2% rate of SBP, 0.4% rate of CNNA, and 0.2% rate of MNB. Given the low rates of SBP in outpatient paracentesis clinics, we will adopt the AASLD suggestions to only send an ascites cell count and not a culture in asymptomatic patients. Noteworthy, our patient with asymptomatic SBP grew vancomycin-resistant *Enterococcus faecium*, which was resistant to standard SBP antibiotic therapy. However, if ascites culture was not sent, he would have been treated with antibiotics for CNNA, and if he developed symptoms,

he would have had a repeat paracentesis with cell count and culture sent.

Training

In 2015, faculty at VAPHS and the University of Pittsburgh School of Medicine designed a Mastering Paracentesis for Medical Residents course based on current guidelines on the management of ascites and published procedural guides. The course is mandatory for all postgraduate year-1 internal medicine residents and begins with 2 hours of didactic and simulation-based training with an ultrasound-compatible paracentesis mannequin. In the 3 weeks following simulation-based training, residents rotate through our outpatient paracentesis clinic and perform between 1 and 3 abdominal paracentesis procedures, receiving as-needed coaching and postprocedure feedback from faculty. Since the course's inception, more than 150 internal medicine residents have been trained in paracentesis through our clinic.

CONCLUSIONS

We present a description of a successful outpatient paracentesis clinic at our hospital run by academic hospitalists. The clinic was created to decrease the number of admissions for LVP. We were fortunate to be able to use the GI endoscopy suite and their resources as the clinic setting. To create outpatient LVP clinics at other institutions, administrative support is essential. In conclusion, we have shown that an outpatient paracentesis clinic run by academic hospitalists can safely and quickly remove large volumes of ascites.

Author affiliations

^aVeterans Affairs Pittsburgh Healthcare System, Pennsylvania
^bUniversity of Pittsburgh School of Medicine, Pennsylvania

Author disclosures

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Ethics and consent

The creation of the outpatient paracentesis clinic at the VA Pittsburgh Healthcare System and the data obtained for in-

ternal quality assurance purposes were deemed nonresearch activities by the executive leadership of the VA Pittsburgh Healthcare System and therefore exempt from review of the VA Pittsburgh Healthcare System Institutional Review Board.

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