Review

Proposed Clinical Guidelines for Abdominal and Pleural Paracentesis with Emphasis on Large-Volume Paracentesis

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Proposed Clinical Guidelines for Abdominal and Pleural Paracentesis with Emphasis on Large-Volume Paracentesis

Bartal Carmi [1,*], Sikuler Emanuel [1], Tsenter Philip [2], Perski Vitali [1], Dvorkin Valery [1], Pairous Roman [1] and Schwartz Doron [3,4]

[1] Internal Medicine Daycare Unit, The Soroka Medical Center and Ben-Gurion University of the Negev, Beer-Sheva, Israel
[2] Respiratory Diseases Institute, The Soroka Medical Center and Ben-Gurion University of the Negev, Beer-Sheva, Israel
[3] Gastroenterology and Hepatology Institute, The Soroka Medical Center and Ben-Gurion University of the Negev, Beer-Sheva, Israel
[4] Risk Management Unit, The Soroka Medical Center and Ben-Gurion University of the Negev, Beer-Sheva, Israel
* Correspondence: carmibtl@gmail.com; Tel.: 972528891264

Abstract

Large-volume paracentesis (LVP) of the peritoneal and pleural cavities is a common therapeutic and diagnostic intervention in patients with liver cirrhosis or advanced heart failure, which are often complicated by ascites or pleural effusion. Although generally considered low-risk, the potential complications of LVP include intrapleural or abdominal hemorrhage or, more commonly, intraabdominal wall hemorrhage, organ puncture, and infection. Performing paracentesis in patients with coagulopathy or bleeding disorders, whether due to underlying disease or resulting from anticoagulant therapy, presents a major clinical dilemma. The safety thresholds for conducting the procedure in such patients vary, and the strategies for mitigating the bleeding risk remain debated, with no consensus reached across different professional societies. Based on our institutional experience and the current international literature, we herein present comprehensive recommendations for the safe and effective execution of LVP, based on evidence synthesis and expert consensus. This review may serve as a practical guide for clinicians performing LVP in high-risk patients.

Keywords: large-volume paracentesis; ascites; pleural effusion; coagulation management; ultrasound guidance

1. Introduction

Ascites and pleural effusion are common manifestations of decompensated liver cirrhosis and congestive heart failure (CHF). Large-volume paracentesis (LVP) is often required for symptom relief, prevention of complications such as spontaneous bacterial peritonitis (SBP), and diagnostic evaluation. The balance between bleeding risks and thrombosis in patients with cirrhosis and CHF complicates decision-making, particularly when coagulopathy or anticoagulant therapy is required. Various professional societies, including the Gastroenterological Association and the Society of Interventional Radiology, have proposed clinical guidelines, which may create uncertainty in clinical practice. The present study reviewed the existing literature and proposes a set of consolidated recommendations that are relevant and applicable to every healthcare system, aimed at enhancing safety and standardizing clinical care.

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2. Methodology

This work represents a narrative review of the literature, aiming to synthesize available evidence and provide practical recommendations for clinical management. In this study, we conducted a literature search of the PubMed and Open Evidence databases, complemented by a manual review of the relevant society guidelines. The search strategy used terms such as "paracentesis," "coagulopathy," "complications," "bleeding risk," and "guidelines." English-language publications from January 2010 to March 2025 were included. Eligible study types included randomized controlled trials, observational studies, meta-analyses, and professional society guidelines. Case reports and non-peer-reviewed materials were excluded. The quality and relevance of the evidence were qualitatively assessed.

At the conclusion of the review process, an integrative guideline table for each procedure was constructed: Tables 1 and 2 present guidelines for abdominal and pleural paracentesis, respectively.

2. Section I: Abdominal Paracentesis in Patients with Ascites

2.1. Indications [1–4]

a. Diagnostic: Differentiate ascitic fluid based on the serum–ascites albumin gradient (SAAG) into high (> 1.1 g/dL) and low (< 1.1 g/dL) SAAG.
b. Diagnostic evaluation for SBP or suspected hepatocellular carcinoma transformation
c. Symptomatic ascites, such as tense ascites causing respiratory compromise or abdominal discomfort
d. Refractory ascites requiring repeated therapeutic drainage
e. Cornerstone treatment for hepatorenal syndrome [1,4,5]

2.2. Clinical Recommendations for Peritoneal Paracentesis:

Table 1 lists all recommendations for the preproceural preparations, principles of execution of the procedure, and postprocedural care requirements.

Table 1. Clinical recommendations [3–12].

Section	Recommendation
Preprocedural Recommendations	
	Obtain verbal consent and document. Written consent should be obtained only if required by institutional policy.
2. First-Time Paracentesis	Provide a full explanation of the risks in the patient's native language. Document the explanation, clinician's name, and language used.
3. Exclude Acute Infection	Postpone the procedure if active infection is suspected.
4. Management of Anticoagulants	Warfarin: Stop 5 d prior; confirm INR <1.7. DOACs/ Clexane (LMWH): Skip the last dose before the procedure.
5. Laboratory Testing in Suspected Coagulopathy	If no known coagulopathy exists and recent laboratory test results show a platelet count of >20 000/μL and INR <1.7, omit repeat tests. If platelet count is <20 000/μL: Administer 6 units of platelets (~5000/unit) [1]. If INR >1.7: Administer up to 3 units of FFP (~0.3 INR correction per unit) [1].

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6. Aspirin	No need to withhold before procedure.
7. Clopidogrel (Plavix)	Withhold for 72 h before drainage.
8. Baseline Vitals	Record temperature, pulse, BP, and oxygen saturation.
Technique Recommendations	
1. Ultrasound Guidance	Mandatory for all procedures.
2. Needle Placement	Avoid the midline. Insert 8 cm lateral to the midline and 5 cm above the pubic symphysis or 2 cm below the umbilicus.
3. Drainage System	Use either an 8F Seldinger kit or 18G cannula.
4. Volume	No restriction on the amount of peritoneal fluid drained (unlike pleural effusion).
5. Diagnostic Fluid Sampling	Always analyze fluid for cell count. If neutrophil count is >250/mm^3 → suspect SBP. If a catheter is in place → perform culture testing.
6. Device Options	Either an 8F Seldinger set or 18G peripheral catheter is acceptable.
7. Initial/Diagnostic Studies	Analyze fluid for: cell count, culture, albumin, TP, amylase, BNP (optional), cytology.
8. Albumin Administration	Administer 8 g albumin for each 1 L of drainage (only >5 L) (to prevent paracentesis-induced circulatory dysfunction)
Postparacentesis Care	
1. Observation	Monitor patients for 1 h after catheter removal
2. Bed Rest	Keep patient in bed for the first 30 min postremoval.
3. Discharge Criteria	Discharge only after documentation of stable BP and HR. Ensure parameters are recorded.
4. Leakage from Site	If leakage occurs, place a pressure bandage. If leakage does not stop, a single suture may be placed. Remove suture after 1 week.
5. Resuming Anticoagulation	Resume anticoagulants (including clopidogrel) the day after the procedure.
Bleeding Management	
1. Bloody Aspirate	Serosanguinous initial fluid is acceptable. If bloody fluid follows clear drainage → stop immediately. If the initial aspirate is blood → abort and remove the catheter.
2. Bleeding Response	a. Monitor for 4 h with vitals assessed every hour. b. Repeat hemoglobin testing after 1 h. Perform blood type testing.
Admission Criteria Post-Paracentesis	
1. SBP	Confirmed SBP diagnosis.
2. Hemodynamic Instability	Hemodynamic changes or a drop in hemoglobin level >1 g/dL.
3. Severe Pain or Hematoma	VAS ≥ 7 + expanding hematoma → consider urgent abdominal CT angiography.

Abbreviations: BNP, brain natriuretic peptide; BP, blood pressure; Clexane, brand name for low molecular weight heparin (LMWH); CT, computed tomography; DOACs, direct oral anticoagulants; FFP, fresh frozen plasma; INR, international normalized ratio; LMWH, low molecular weight heparin; SBP, spontaneous bacterial peritonitis; TP, total protein; VAS, visual analog scale.

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2.3. Major Complications [2,3,5,6]

a. Hemorrhage (0.3%–1%) [3,6]: The incidence of hemorrhage is reduced by 50% with ultrasound (US) guidance [13]. Bleeding during paracentesis typically results from an injury to a branch of the inferior epigastric artery of the abdominal wall. Bleeding can occur in two ways.

1. Immediate return of blood through the catheter. This usually indicates direct injury to the artery, resulting in immediate blood reflux. This complication generally leads to the development of abdominal wall hematoma [9,10].

2. Gradual increase in bleeding during the procedure. In such instances, the drainage initially appears serous and progressively becomes hemorrhagic. This suggests arterial bleeding into the peritoneal cavity surrounding the catheter, which leads to increasingly bloody fluid.

b. Bowel perforation: This recognized but rare complication occurred in <1% of patients in a large series of diagnostic paracenteses. The risk is higher in patients with intra-abdominal adhesions, prior abdominal surgery, or distorted anatomy due to underlying disease [14,15]. Clinically, bowel perforation may present acutely with the return of fecal material; gas through the paracentesis catheter; or more insidiously with signs of peritonitis, sepsis, or polymicrobial peritoneal infection. Immediate recognition is critical as delayed diagnosis increases peritonitis and sepsis risks. Management depends on the clinical scenario. Stable patients without peritonitis may be managed conservatively with bowel rest and broad-spectrum antibiotics; however, surgical intervention is indicated for patients with generalized peritonitis or clinical deterioration [15,16]. To minimize risk, the needle should be inserted at sites with the lowest likelihood of underlying bowel, such as the left lower quadrant lateral to the rectus abdominis or the midline 2 cm below the umbilicus, and never through surgical scars or areas with suspected adhesions [14].

c. SBP during peritoneal paracentesis refers to a peritoneal infection that arises from a direct, identifiable intraabdominal source that disrupts the integrity of the gastrointestinal or genitourinary tracts. Secondary peritonitis is typically polymicrobial, involving both aerobic and anaerobic organisms, most commonly gram-negative rods (such as *Escherichia coli* and *Klebsiella* spp.), anaerobes (such as *Bacteroides* spp. and *Clostridium* spp.), and gram-positive cocci (such as *Enterococcus* spp.). The Infectious Diseases Society of America and the American Society for Microbiology emphasize that, in contrast to SBP, secondary peritonitis is usually polymicrobial and may include anaerobic microbiota, and that peritoneal fluid should be sent for both aerobic and anaerobic cultures in an anaerobic transport system [16]. Diagnosis during paracentesis is suggested by the presence of multiple organisms on Gram staining or culture, elevated ascitic fluid neutrophil count, and biochemical features such as low glucose, high lactate dehydrogenase, and low protein levels. Clinical suspicion should be high in patients with severe abdominal symptoms or evidence of sepsis. Imaging (e.g., computed tomography) is often required to identify the source [11]. Management requires the prompt administration of broad-spectrum antibiotics covering both aerobic and anaerobic organisms and urgent surgical or interventional radiology evaluation to control the infection source, as medical therapy alone is insufficient. Without timely intervention, mortality is high [11,17].

d. Postparacentesis circulatory dysfunction (PICD) manifests as effective hypovolemia and renal impairment, usually after the removal of >5 L. The American College of Radiology states that PICD can develop in up to 80% of patients with cirrhosis if volume expansion (typically using albumin) is not performed at the time of paracentesis. The pathophysiology involves a rapid drop in intraabdominal pressure, leading to increased venous return, transiently increased cardiac output, and subsequent activation of the renin-angiotensin-aldosterone and sympathetic nervous systems, resulting in decreased effective arterial blood volume and free water retention [18].

e. Puncture site leakage following large-volume peritoneal paracentesis is a recognized complication, with reported rates varying from 0% to 23% [15]. The primary cause is persistent ascitic fluid flow through the needle tract, which may be exacerbated by high intraabdominal pressure, large-volume removal, or technical failure of sealing the skin and subcutaneous tissues after catheter removal. The initial management options include conservative measures [15]. The first-line approach involves the application of a pressure dressing directly over the puncture site, which is effective in

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most cases. The use of the Z-tract technique during the procedure, in which the skin is displaced before needle insertion to create a zigzag tract, may help prevent leakage, although evidence for its efficacy is limited. If leakage persists, additional options include continued pressure dressings, use of ostomy appliances to collect fluid, or, rarely, placement of a suture at the site [15]. Rarely, persistent or high-volume leaks may require further intervention such as peritoneal drains or surgical closure. Infection should be ruled out if the leak is prolonged or is associated with local erythema.

3. Section II: Thoracocentesis in Patients with Pleural Effusion

3.1. Indications [13,19–21]

a. New or unexplained pleural effusion, to differentiate between transudate and exudate based on Light's criteria

b. Suspected infection (empyema or parapneumonic effusion), especially if the effusion is loculated or shows signs of sepsis

c. Suspected malignancy, particularly in patients with cancer history or unilateral/bloody effusions

d. Suspected tuberculous pleuritis based on the regional epidemiology and clinical presentation

e. Symptomatic relief of dyspnea, especially in patients with large pleural effusions causing lung compression and impaired ventilation. This indication is common in malignant effusion, heart failure, or hepatic hydrothorax

f. Large effusion with signs of respiratory compromise such as tachypnea, hypoxemia, or use of accessory muscles

g. Effusion refractory to medical management; for example: diuretic-resistant pleural effusions in CHF

h. Recurrent pleural effusion requiring repeated drainage as a bridge to pleurodesis or indwelling pleural catheter placement in patients with malignancy.

3.2. Clinical Recommendations for Thoracocentesis

Table 2 lists all recommendations for the preproceural preparations, principles of execution of the procedure, and postprocedural care requirements.

Table 2. Clinical recommendations for pleural drainage [12,19,21–25].

Section	Recommendation
Preprocedural Requirements and Recommendations	
1. Imaging	Localize effusion using POCUS.
2. Access Point	Two intercostal spaces below the fluid peak in the posterior mid-clavicular line with the patient seated, arms forward. Above the rib.
3. Needle/Drainage Kit	20–21G cannula or 6–8F Seldinger catheter.
4. Coagulation Guidelines	No repeat tests if no coagulopathy history and normal test results in the past month. a. DOACs: Stop 48 h prior. b. Warfarin: Stop 5 d prior; confirm INR <1.7. c. Clexane (LMWH): Hold 24 h (2 doses). d. Aspirin: Continue [25]. e. Plavix: Stop 72 h prior [22,25]. f. Platelet count of <50 000/μL: Administer 6 units. g. INR >1.7: Administer ≤3 FFP units. h. TEG: Optional if available.

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Procedure Guidelines	
1. Bilateral Drainage	Do not perform on the same day.
2. Volume Limit	Do not exceed 1.5 L drainage per session [19].
3. Drainage Method	Use gravity drainage. Avoid vacuum suction [2].
4. Anesthesia	Use 1% lidocaine for local anesthesia [19].
5. Diagnostic Testing	Send pleural fluid for pH, LDH, glucose, protein, cytology, and BNP assessments.
Postprocedure Care	
1. Vital Signs	Monitor hourly for 2 h.
2. Imaging	Chest radiography (AP + LAT) 1 h postprocedure [19].
3. Anticoagulation	Restart the next day.
Documentation Checklist	
1. Indication	Document the indication for the procedure.
2. Consent	Obtain and document verbal or written consent.
3. Physical/POCUS Findings	Record the physical exam and POCUS findings.
4. Technique	Document the insertion technique.
5. Vital Signs	Record pre- and postprocedure vital signs.
6. Anticoagulation	Document anticoagulation status and last dose timing.
7. Laboratory test results	Include relevant laboratory test results and hemostasis assessment.

Abbreviations: AP: anteroposterior; BNP: B-type natriuretic peptide; Clexane: brand name for enoxaparin, a low-molecular-weight heparin; DOACs: direct oral anticoagulants; FFP: fresh frozen plasma; INR: international normalized ratio; LAT: lateral; LDH: lactate dehydrogenase; LMWH: low-molecular-weight heparin; Plavix: brand name for clopidogrel; POCUS: point-of-care ultrasound; TEG: thromboelastography.

3.2. Complications

a. Pneumothorax: Pneumothorax, including tension pneumothorax, is the most frequent complication, occurring in approximately 3–6% of cases; However, pneumothorax requiring intervention is rare (<0.5%), especially when ultrasound guidance is used [2,22,23].
b. Hemothorax: Bleeding complications, such as chest wall hematoma or hemothorax, are uncommon and are not significantly increased in patients with mild to moderate coagulopathy or thrombocytopenia, particularly when ultrasound guidance is employed [20,24,25].
c. Reexpansion pulmonary edema: This is a rare but potentially serious complication, with an incidence of <0.1%, and is associated with rapid or large-volume fluid removal, especially if pleural pressures fall below −20 cm H_2O or if >1.5 L is removed quickly. Symptom-limited drainage is recommended to mitigate this risk [4].
d. Secondary infections: Complications following thoracentesis include empyema (pus in the pleural space), parapneumonic effusion (infected pleural fluid associated with pneumonia), and, less commonly, cellulitis or soft tissue infection at the puncture site. These complications are rare when sterile technique is used. Empyema and complicated parapneumonic effusion are clinically significant and often require antimicrobial therapy and drainage. According to the Infectious Diseases Society of America and the American Society for Microbiology, the most common pathogens in pleural space infections are *Streptococcus anginosus*, *Staphylococcus aureus* (including methicillin-resistant *S. aureus* in hospital-acquired cases), anaerobes, and Enterobacterales. Hospital-acquired infections are more likely to involve resistant gram-negative bacteria [13].
e. Hemorrhage: Hemorrhage is a recognized but rare complication of pleural effusion paracentesis (thoracentesis) with a risk of significant bleeding (including hemothorax or puncture site

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bleeding) of approximately ≤1%, as indicated in large meta-analyses and cohort studies. The primary mechanism is misplaced needle or catheter insertion, resulting in laceration of the intercostal artery or its branches, which can lead to chest wall hematoma or hemothorax. Injury to other vascular structures or inadvertent puncture of abdominal organs (e.g., the liver and spleen) is rare but possible, especially for low-lying effusions or with improper techniques. Lack of ultrasound guidance, poor knowledge of the local anatomy, and multiple needle passes increase the risk. Vascular ultrasonography with color Doppler can help avoid vessel injury [22,24].

Although this was a narrative review, its primary limitation notably lies in the fact that the examined literature underpinning the recommendations predominantly comprised retrospective studies and case series. This is likely one of the main reasons for the current absence of consensus in the guidelines. A meta-analysis of the literature may serve as an important tool for evaluating the cumulative data therein and for validating our recommendations.

4. Conclusions

Although both abdominal and pleural LVP are considered low-risk interventions, meticulous attention to coagulation status, imaging guidance, and postprocedural monitoring are essential for reducing complications. The guidelines proposed here align with the current literature and have been adapted to high-risk populations. The emphasis on detailed documentation ensures accountability and safety. Adherence to these recommendations can reduce procedural complications and optimize patient outcomes, especially in complex cases involving coagulopathies or anticoagulant therapy.

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Abbreviations

The following abbreviations are used in this manuscript:

CHF	congestive heart failure
LVP	large-volume paracentesis
PICD	post-paracentesis circulatory dysfunction
SBP	spontaneous bacterial peritonitis
SAAG	serum–ascites albumin gradient

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