

Bedside USG-guided Paracentesis – A Technical Note for Beginners

Karamvir Chandel, Shaleen Rana, Ranjan Kumar Patel, Tara Prasad Tripathy, Amar Mukund*

Department of Intervention Radiology, Institute of Liver and Biliary Sciences, New Delhi, India

Abstract

Paracentesis is a routinely performed low-risk daycare procedure most commonly performed in patients with cirrhosis. Although uncommon, devastating bleeding complications may occur, particularly in patients with coagulopathy. Hence to avoid any such complication, it is important for the intervention radiologists, as well as clinicians, particularly beginners, to have basic knowledge of the major anterior abdominal wall arteries, their course, and their sonographic appearance. Here, we briefly describe the relevant abdominal wall anatomy and sonographic planes to use for paracentesis.

Keywords: Abdominal wall, avascular plane, paracentesis, ultrasound

INTRODUCTION

Paracentesis is a very common and routinely performed procedure for ascites drainage which can be either diagnostic or therapeutic. Large-volume paracentesis (LVP) is routinely used in patients with chronic liver disease.^[1] Usually, paracentesis is a safe procedure; however, serious complications even death has been reported.^[2] Leakage, infection, bleeding, and bowel perforation are known complications.^[2,3] However, the most dreaded serious complication is hemorrhage, which might be early or late in presentation. This becomes more significant in cases of cirrhosis as we expect deranged coagulation in such patients. Prothrombin time (PT)/international normalized ratio (INR) may not be representative of coagulation state in patients with cirrhosis. Society of intervention radiology consensus guidelines has categorized abdominal paracentesis as low-risk procedures which do not require preprocedure INR, minimum platelet count of $>20 \times 10^3/L$, and fibrinogen levels above 100 mg/dl.^[4] SIR recommends the use of appropriate blood products. Ultrasound is commonly used nowadays to avoid any major vessels puncture and its utility has been described in various previous studies.^[1,5] In this technical note, we discuss the vascular anatomy to consider and two specific planes to avoid major vessels.

ANATOMY

The anterior abdominal wall is supplied by a deep and superficial arterial system, which runs craniocaudally connecting the subclavian and the external iliac arteries and also anastomosing with the lateral subcostal and intercostal arteries.^[5,6] The deep system consists of the deep inferior epigastric artery (DIEA), a branch of the external iliac artery, and the deep superior epigastric artery, a terminal branch of the internal thoracic artery. Laterally, these arteries anastomose with the subcostal, intercostal, and deep circumflex iliac artery, a branch of the external iliac artery.^[6] Similarly, a superficial arterial system network is present between superficial inferior epigastric artery, superficial superior epigastric artery, lateral superficial branches of subcostal and intercostal, and superficial circumflex iliac artery [Figure 1a and b].^[6]

ULTRASOUND

On ultrasound, relatively avascular zones are noted along the midline in the subumbilical region and lateral border of rectus abdominis (Linea semilunaris), which represents aponeurosis of the lateral abdominal wall muscles (Obliques and the

Address for correspondence: Dr. Amar Mukund,

Department of Intervention Radiology, Institute of Liver and Biliary Sciences,
Vasant Kunj, New Delhi - 110 070, India.
E-mail: dramarmukund@gmail.com

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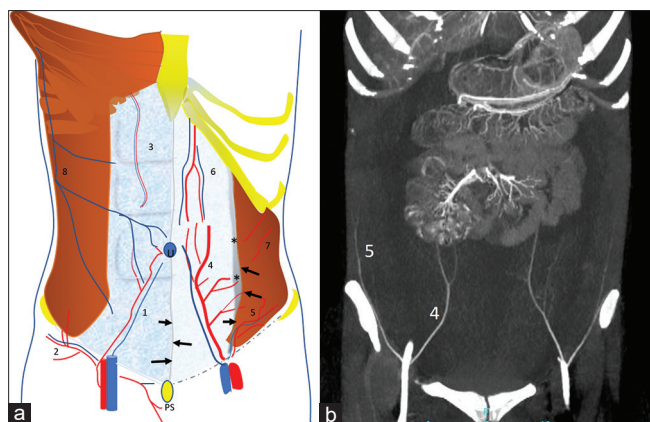


Figure 1: Anatomic illustration (a) and computed tomography (b) demonstrating the anterior abdominal wall vessels. The right – superficial arterial arcade, left – deep arterial arcade. 1-superficial inferior epigastric vessels, 2-superficial circumflex iliac vessels, 3-superficial superior epigastric vessels, 4-deep inferior epigastric vessels, 5-deep circumflex iliac vessels, 6-deep superior epigastric vessels, 7-lateral abdominal wall vessels (intercostal and subcostal), 8-thoracoepigastric veins, *-lateral abdominal wall muscles aponeurosis (relatively avascular zone), U-umbilicus, and PS; Pubic symphysis. Relative avascular zones safe for large-volume paracentesis (Solid Black Arrows)

transverse abdominis). Midline avascular plane is seen as echogenic structure in subumbilical region between the two rectus abdominis muscles [Figure 2a]. Lateral avascular plane is seen as an echogenic structure lateral to the lateral border of the rectus abdominis [Figure 2b]. DIEA lies medial to it in the posterior rectus sheath [Figure 2c] and lateral abdominal wall vessels, mainly the deep circumflex iliac artery [Figure 2d] lies lateral to the lateral avascular zone [Figure 2d]. At the level of the umbilicus and midway between the umbilicus and the symphysis pubis, the epigastric vessels lie within 6 cm from the midline.^[7,8] The epigastric vessels are farthest from the midline at the symphysis public level for both the right and left sides. These described anatomical landmarks correspond to the avascular zone as seen on ultrasound and may be helpful during nonimage-guided paracentesis. Ultrasound can be used to target the area with maximum fluid while avoiding main vessels in mild-to-moderate ascites. Patients can be placed in dependent positions to collect fluid in one location and make paracentesis easier. Transarterial management is the treatment of choice in patients with arterial bleeds. In the case of early recognition of arterial bleeds on ultrasound, percutaneous glue has also been used with good success rates.^[9]

CONCLUSION

Basic understanding of the anterior abdominal wall vessels and sonographic identification of the avascular planes are important to avoid any major bleeding complications, particularly in patients with cirrhosis. Following steps are followed at our institute for LVP-patient is placed supine (Head end may be raised to collect the fluid in the pelvis), lower abdomen wall is cleaned and draped, avascular plane is selected on ultrasound as discussed, cannula or needle placement is done under ultrasound guidance avoiding major vessels.

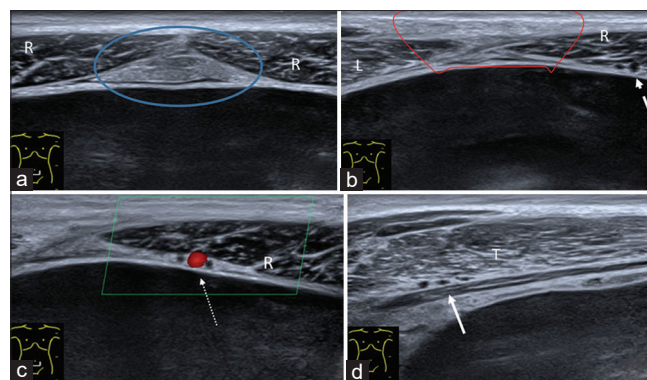


Figure 2: Ultrasound illustration demonstrating the anterior abdominal wall anatomy in a patient with ascites. (a) midline subumbilical aponeurotic plane between rectus abdominis muscles (Blue outline). (b) lateral aponeurotic plane between rectus abdominis and lateral abdominal wall muscles (Redline). (c) color Doppler image showing inferior epigastric artery (Dotted arrow) along with veins in the posterior rectus sheath. (d) grayscale image showing deep circumflex iliac artery in the transverse abdominis muscle. R-Rectus abdominis, L-Lateral abdominal wall muscles, and T-Transverse abdominis

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Conflicts of interest

There are no conflicts of interest.

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