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## Preventing Bleeding Complications Of Paracentesis Using Point-Of-Care Ultrasound: An n-of-1 Case Study

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## Preventing Bleeding Complications Of Paracentesis Using Point-Of-Care Ultrasound: An n-of-1 Case Study

### Abstract

Abdominal paracentesis is a common bedside procedure, and the advent of point-of-care ultrasound has provided an opportunity to reduce the associated risks. Multiple society guidelines now recommend both site and vascular marking to avoid potential complications. This case illustrates the importance of vascular marking specifically to avoid damage to adjacent blood vessels.

### Keywords

point-of-care ultrasound, POCUS, paracentesis, inferior epigastric artery bleed

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# Preventing Bleeding Complications Using Point-Of-Care-Ultrasound: An n-of-1 Case Study

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## Abstract

Abdominal paracentesis is a common bedside procedure, and the advent of point-of-care ultrasound has provided an opportunity to reduce the associated risks. Multiple society guidelines now recommend both site and vascular marking to avoid potential complications. This case illustrates the importance of vascular marking specifically to avoid damage to adjacent blood vessels.

## Introduction

Abdominal paracentesis is one of the most common procedures performed by general internists. Between 1993 and 2008, the number of paracenteses for medicare beneficiaries more than doubled to 150,000.<sup>1</sup> This number is likely to continue increasing, given the rising incidence of liver disease.<sup>2</sup> Although paracentesis is relatively safe, hemorrhagic complications can be fatal with 30-day mortality rates as high as 42.6%.<sup>3,4,5</sup> Studies have found that ultrasound-guidance can increase the success rate and decrease adverse events for paracentesis.<sup>6,7,8</sup> Furthermore, in recent years there has been a rapid expansion of the use of point-of-care ultrasound, meaning more clinicians are able to perform their own ultrasound-guided site marking, rather than relying on sonographers or radiologist.<sup>9</sup> Despite evidence that ultrasound marking improves outcomes, the American Association for the Study of Liver Disease 2012 practice guidelines do not endorse the standardized use of sonographic marking, stating only that “ultrasonography can be a useful adjunct.”<sup>10</sup> Recently, the Society of Hospital Medicine Point-of-care Ultrasound Task Force released a position statement advocating for the use of ultrasound guidance for paracentesis, but these recommendations may not be widely known among internal medicine providers.<sup>11</sup>

## Case Presentation

A 45-year-old woman with decompensated alcohol cirrhosis with ascites was admitted to the general internal medicine service due to hematemesis requiring variceal banding. During her admission she required abdominal paracentesis for worsening ascites. An ascites pocket was marked by a sonographer in the right lower quadrant using standard anatomic

landmarks and the procedure was completed by the internal medicine team without immediate complication. The following day her hemoglobin dropped from 7.6 to 5.5g/dL. This was initially attributed to the dilutional effects of intravenous fluid administration. However, following blood transfusion, her hemoglobin temporarily stabilized but decreased back to 6.2g/dL the next day suggesting active blood loss. The internal medicine team used point-of-care ultrasound to identify an ascites pocket in the left lower quadrant. The absence of underlying blood vessels was confirmed using the linear probe with color flow doppler. Needle aspiration produced grossly bloody peritoneal fluid concerning for hemoperitoneum. Immediate repeat ultrasound over the previous paracentesis site was notable for blood vessels overlying the peritoneal lining (Fig. 1) with an adherent mass (Fig. 2) concerning for a blood clot overlying the inferior epigastric vessels. Her hemoglobin continued to steadily decrease which prompted a CT abdomen and pelvis with IV contrast. This revealed a marked increase in complex abdominal fluid suggestive of hemoperitoneum. Interventional Radiology performed an arteriogram revealing an actively bleeding right inferior epigastric artery requiring coil embolization with successful hemostasis (Fig. 3). The patient stabilized and was eventually discharged from the hospital.

## Discussion

This case highlights the value of point-of-care ultrasound-guided paracentesis in avoiding complications, including potentially life-threatening hemorrhage. Several blood vessels are at risk for puncture during paracentesis, including the inferior epigastric, superficial epigastric, and superficial circumflex iliac vessels.<sup>4</sup> Of these, the inferior epigastric vessels are particularly worrisome because of their location in the posterior rectus sheath adjacent to the peritoneum. To avoid these vessels, prior authors have suggested paracentesis needle insertion be more than two thirds of the distance laterally from the midline to the lower quadrant. Unfortunately, the inferior epigastric artery’s lateral branches can be highly variable, and laceration can occur even when following these recommendations.<sup>12</sup>

Furthermore, patients with abdominal distension from obesity or ascites can have distorted anatomy with lateral displacement of the inferior epigastric vessels putting them at greater risk for hemorrhage if relying only surface anatomy.<sup>12</sup> A prospective study found that 13/30 of patient with ascites (43%) had vascular structures located at traditional paracentesis landmark sites.<sup>13</sup> The use of high-frequency ultrasound to survey for vasculature can decrease the rate of major bleeding from paracentesis.<sup>14</sup>

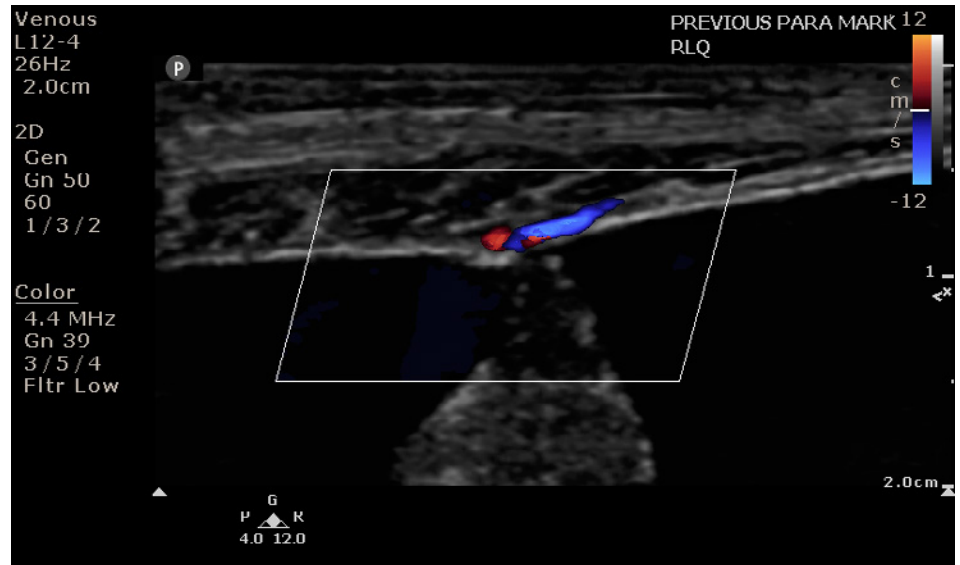
Based on this information, in 2019 the Society of Hospital Medicine recommended the use of color flow Doppler prior to paracentesis to avoid blood vessels along the anticipated needle path. Power Doppler sonography is another option for vasculature screening. Compared to color Doppler, power Doppler is more sensitive for detecting low-velocity blood flow and is angle independent.<sup>15</sup> While there is not a single agreed upon method for performing vascular survey, one suggested technique is scanning over the site mark in 4 planes using a high-frequency linear probe with both standard 2-dimensional gray scale and color flow Doppler modalities.<sup>16</sup> The rationale for looking in multiple planes is that blood vessels may run in any direction and looking in a single ultrasound plane may miss relevant vasculature.<sup>11</sup>

## Conclusion

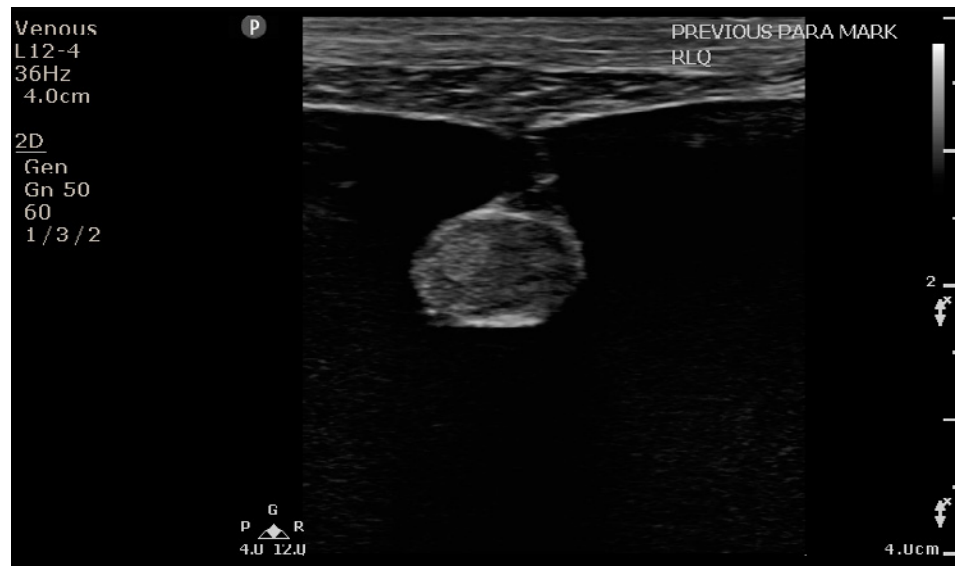
In conclusion, this case illustrates the value of using point-of-care ultrasound to perform a vascular survey prior to performing paracentesis. In our experience, this adds only minimally to the procedure duration and can help avoid potentially life-threatening hemorrhagic complications. Clinicians who perform paracentesis should undergo training to integrate point-of-care ultrasound into their practice, including evaluating for vasculature over the intended path of needle entry using color flow or Doppler.<sup>11</sup> ■

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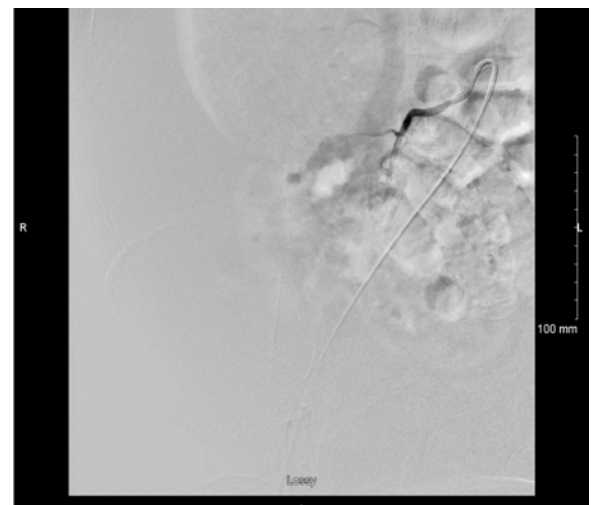
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**Figure 1.** The inferior epigastric artery overlying the peritoneal lining, visible by color flow Doppler.



**Figure 2.** An adherent mass concerning for a blood clot.



**Figure 3.** An arteriogram with contrast extravasation suggesting actively bleeding inferior epigastric artery.