Acute Hemoperitoneum After Large-Volume Paracentesis

CHRISTIAN ARNOLD, KLAUS HAAG, HUBERT E. BLUM, and MARTIN RÖSSLLE
School of Medicine, Department of Gastroenterology and Hepatology, University of Freiburg, Freiburg, Germany

Hemoperitoneum resulting from rupture of mesenteric varices is a rare complication of portal hypertension with a high mortality of up to 70%. This case report describes the symptoms, clinical course, and treatment of 4 patients with acute hemoperitoneum caused by mesenteric variceal bleeding after large-volume paracentesis. Abdominal pain and/or hemorrhagic shock developed in 4 patients (age, 48–68 years), admitted for refractory ascites, 3 hours to 4 days after 1–4 large-volume paracenteses (>4000 mL). Duplex sonography, performed in 3 of the 4 patients before onset of bleeding, showed retrograde flow in the mesenteric veins, suggesting large-caliber mesenteric collateralization. Treatment consisted of surgical ligation followed by transjugular intrahepatic portosystemic shunt (TIPS) (2 patients) and emergency TIPS with embolization of the bleeding vessel (1 patient). One patient died before any intervention could be initiated. In these 4 patients, the concurrence of large-volume paracentesis and hemoperitoneum suggests their causal relationship. The mechanism may be a sudden reduction in intraperitoneal pressure increasing the pressure gradient across the wall of the mesenteric varices, resulting in rupture and bleeding. The awareness of this complication may accelerate the diagnostic process and treatment.

Intestinal bleeding is a frequent complication in patients with portal hypertension. Esophageal varices are by far the most frequent source of bleeding with a prevalence of 50%–75%1–4 and a bleeding incidence of approximately 30%.5,6 Mortality caused by the first esophageal bleeding has decreased considerably during the last 15 years from approximately 50% to 20%.6–10 Bleeding from gastric varices11 or from varices of the small intestine12–14 is less frequent but may be associated with a higher short-term mortality than esophageal variceal bleeding. In these locations, most bleedings are caused by erosive or ulcerative alterations of the mucosa that are rarely life-threatening and have a low mortality.10,15–23

Bleeding from mesenteric varices into the omentum or the peritoneal cavity is a rare complication of portal hypertension with probably the highest short-term mortality of up to 70%. Only 19 patients with this complication have been reported in the literature reviewed by Ben-Ari et al.,24 all single patient observations. A possible relationship of mesenteric variceal bleeding and large-volume paracentesis was not suggested. A recent report by Webster et al.25 described the follow-up of patients with refractory ascites receiving large-volume paracentesis. Intra-abdominal hemorrhage developed in 4 of 179 patients. The site of bleeding was not identified, but mesenteric varices were discussed as a probable cause in 2 patients.

The present report is, to our knowledge, the first describing patients with refractory ascites in whom acute hemoperitoneum was probably caused by preceding large-volume paracenteses. Special emphasis is placed on risk factors, diagnosis, and treatment with the transjugular intrahepatic portosystemic shunt (TIPS).

Case Report

The clinical characteristics of the patients are summarized in Table 1. All patients had cirrhosis and were admitted for refractory ascites.

Patient 1

In patient 1, second large-volume paracentesis (4000 mL) showed clear ascitic fluid. Microscopic examination of the ascites showed lysed and aggregated erythrocytes compatible with recent bleeding. During the following 4 days, the patient developed hemorrhagic shock with a blood pressure of 80–50 mm Hg and a heart rate of 150 bpm without evidence of overt gastrointestinal bleeding. Six units of packed erythrocytes and catecholamines were given. Ultrasonography showed echogenic ascites. A subsequent diagnostic paracentesis showed hemorrhagic fluid. At emergency laparotomy, 8 L of hemorrhagic fluid was removed and ruptured mesenteric varices of the terminal ileum were identified as the source of bleeding and ligated. The patient was then transferred to our hospital for TIPS implantation to prevent recurrence of bleeding. TIPS was performed as described previously.26 The portography performed during the TIPS procedure showed retrograde filling of the portal and mesenteric veins with opacification of the mesenteric varices (Figure 1A), which were occluded using 2

Abbreviation used in this paper: TIPS, transjugular intrahepatic portosystemic shunt.

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Table 1. Characteristics of Patients at Time of Admission

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<th>Patient</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<tbody>
<tr>
<td>Sex</td>
<td>M</td>
<td>M</td>
<td>F</td>
<td>M</td>
</tr>
<tr>
<td>Age (yr)</td>
<td>40</td>
<td>33</td>
<td>67</td>
<td>64</td>
</tr>
<tr>
<td>Etiology of cirrhosis</td>
<td>Alcoholic</td>
<td>Alcoholic</td>
<td>Alcoholic</td>
<td>Hepatitis C</td>
</tr>
<tr>
<td>Upper GI varices (grade)</td>
<td>II</td>
<td>II–III</td>
<td>I–II</td>
<td>I–II</td>
</tr>
<tr>
<td>Child–Pugh class</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>Refractory ascites</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Large-volume paracentesis before diagnosis</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Previous variceal bleeding</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Previous sclerotherapy</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
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GI, gastrointestinal.

mL n-butyl-cyano-acrylate/lipiodol (1:1, vol:vol). Thereafter, a Palmaz stent was implanted, resulting in effective portosystemic shunting with prograde flow in the portal vein and its splanchnic tributaries (Figure 1B). During the following days, the patient lost weight and the ascites disappeared. He was discharged 2 weeks later with a good function of the stent-shunt. During follow-up of >15 months, the patient improved clinically without recurrence of ascites or bleeding.

**Patient 2**

In patient 2, TIPS was implanted 2 years ago because of massive recurrent esophageal variceal bleeding. During follow-up, shunt function decreased gradually. Shunt revision was not performed because of several episodes of hepatic encephalopathy stage II and III after placement of TIPS. Within the last 6 months, refractory ascites developed and large-volume paracenteses (4000–6000 mL) were therefore performed. One hour after the second paracentesis, the patient developed diffuse right-sided abdominal pain without signs of gastrointestinal bleeding. A diagnostic puncture showed hemorrhagic ascites, and the volume substitution was performed together with 4 U of packed erythrocytes. Because the patient’s circulation remained unstable (blood pressure, 80–60 mm Hg; heart rate, 160 bpm), emergency laparotomy was performed. Ten liters

**Figure 1.** Direct transjugular portography 1 week after surgical ligation of mesenteric varices in patient 1. (A) Injection of contrast medium into the portal vein results in retrograde opacification of the mesenteric veins and varices (arrowheads). (B) After embolization and TIPS implantation, the superior mesenteric vein and the varices are not opacified, showing effective decompression. VMS, superior mesenteric vein; VMI, inferior mesenteric vein; PV, portal vein; SS, stent-shunt.
of hemorrhagic fluid was removed. The splanchnic veins were extended, and actively bleeding varices were identified along the colon transversum. Right hemicolectomy was performed to stop the bleeding. To prevent rebleeding, revision of the occluded TIPS was performed the following day. Angiography showed retrograde flow in the mesenteric veins and large collaterals in the mesentery. A Memotherm (Angiomed, Karlsruhe, Germany) stent (diameter, 12 mm; length, 8 cm) was implanted into the former Wallstent TIPS. This led to a marked reduction of the portosystemic pressure gradient (i.e., difference of the pressure in the portal vein and the right atrium) and change of the direction of the splanchnic blood flow. Unfortunately, disseminated intravascular coagulopathy developed 1 day later, and the patient died of diffuse intra-abdominal bleeding.

**Patient 3**

Patient 3 received several large-volume paracenteses (5000 mL) before the ascites turned slightly hemorrhagic, which was considered to be a result of previous punctures. Two more large-volume paracenteses (6000 mL) were performed during the following 6 days, yielding increasingly hemorrhagic ascites accompanied by a decrease in serum hemoglobin level from 7.5 to 5.6 mg/dL. The patient was transferred to our hospital where she arrived in advanced shock with a heart rate of 160 bpm and a blood pressure of 50–30 mm Hg. Blood transfusions and high-dose catecholamines could not prevent death before surgical or interventional measures could be instituted. At autopsy, hemorrhagic ascites was found and collapsed perforated varices as the source of bleeding were seen throughout the small bowel and mesentery.

**Patient 4**

Patient 4 was admitted to our hospital with a diagnosis of acute intra-abdominal bleeding after receiving two large-volume paracenteses (6000–8000 mL) within 5 days before hospitalization. He experienced diffuse abdominal pain and shock (heart rate, 170 bpm; blood pressure, 70–40 mm Hg), which were reversed by 4 U of erythrocytes and volume substitution. TIPS was implanted on emergency, and, at the same time, large mesenteric varices were identified as the bleeding site and embolized. The patient was discharged 7 days later in good clinical condition. No recurrence of ascites or bleeding occurred during a follow-up of 11 months.

Table 2 shows that all patients had hemorrhagic shock without evidence of gastrointestinal bleeding. Two patients had severe acute abdominal pain before developing shock, probably caused by bleeding into the mesentery. In the patients with no acute pain, diagnosis was delayed because of misinterpretation of the findings, which were believed to be related to traumatic punctures during paracenteses.

Table 3 shows the hemodynamic data before and shortly after TIPS implantation (3 patients) obtained by duplex sonography, angiographically and by direct catheter measurement in the portal vein during the TIPS procedure. All patients had retrograde flow in the portal and mesenteric veins, an unusual

| Table 2. Clinical Parameters of Patients at Time of Intra-abdominal Bleeding |
|---------------------------------|-----------|-----------|-----------|-----------|
| Patient | 1 | 2 | 3 | 4 |
| First symptoms indicating hemorrhage | Shock | Abdominal pain, shock | Shock | Abdominal pain, shock |
| Blood transfusions (U) | 6 | 4 | 12 | 4 |
| Time between first symptoms and diagnosis | 4 days | 3 hours | 3 days | 2 days |
| Time between first symptoms and treatment | 4 days | 12 hours | 3 days | 3 days |
| Treatment | Surgical ligation, TIPS | Surgical ligation, TIPS | None | TIPS |
| Outcome | Survived | Died | Died | Survived |

<table>
<thead>
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<th>Table 3. Portal Hemodynamics Before and After TIPS Implantation</th>
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<tr>
<td>Patient</td>
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<tr>
<td>Portal blood flow velocity (cm/s)*</td>
</tr>
<tr>
<td>After</td>
</tr>
<tr>
<td>Direction of portal and mesenteric vein flow†</td>
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<tr>
<td>After</td>
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<tr>
<td>Portal pressure (cm H$_2$O)‡</td>
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<tr>
<td>After</td>
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<tr>
<td>Portal venous pressure gradient (cm H$_2$O)§</td>
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ND, not done.
*Assessed by duplex sonography.
†Assessed by duplex sonography and/or angiography.
‡Assessed by direct measurements during the TIPS procedure.
Discussion

The predominant findings in the patients were advanced cirrhosis with refractory ascites, retrograde flow in the mesenteric veins (3 patients were examined), previous large-volume paracenteses, and hemorrhagic shock without apparent gastrointestinal bleeding. The existence of these four main findings should immediately initiate peritoneal puncture to verify or exclude hemoperitoneum. The duplex sonographic finding of retrograde flow in the mesenteric veins indicates the existence of large mesenteric collaterals. Large-volume paracenteses, performed in this situation, may cause an increase in the variceal/peritoneal pressure gradient, resulting in mild but progressive bleeding (patients 1, 3, and 4) or fulminant intra-abdominal bleeding (patient 2). Kravetz et al.\textsuperscript{27} showed recently that paracentesis produced a greater pressure reduction in the abdominal cavity than in the inferior caval vein and abdominal varices, respectively. Therefore, in patients receiving large-volume paracentesis, an increasing erythrocyte count or even overt intra-abdominal bleeding warrants careful monitoring. Additional large-volume paracenteses should be avoided, but diagnostic punctures are indicated in short intervals. It seems to be reasonable to interpret moderate bleeding as being related to the puncture. However, even in patients with severe coagulopathy, intra-abdominal bleeding from the puncture site is very rare.\textsuperscript{25,28}

The clinical symptoms in most patients reported in the literature were abdominal pain, abdominal distention, and shock.\textsuperscript{24,29} In our patients, abdominal distention was not of diagnostic relevance because of preexisting massive ascites. This is also the reason why the hematocrit in the ascitic fluid does not seem to be an accurate measure in estimating the amount of blood loss because of dilution effects. In contrast to previous findings,\textsuperscript{29} abdominal pain was not reliably found in our patients, possibly because of the location of the bleeding site, presence of ascites, and gradual onset of bleeding in the 2 patients without abdominal pain.

In terms of short-term mortality of mesenteric variceal bleeding, it is difficult to compare our findings with those of previous reports. In a study by Webster et al.,\textsuperscript{25} 4 of 179 patients had hemorrhagic complications after large-volume paracenteses. Two bleedings were ascribed to the puncture; in 2 patients, rupture of mesenteric varices was suggested. One of the latter patients underwent TIPS treatment for control of the ascites 1 week after the onset of the bleeding. The other patient survived without further therapy. The time of follow-up is not mentioned. Ben-Ari et al.\textsuperscript{24} reviewed 19 patients with portal hypertension and acute hemoperitoneum of unknown origin. The patients were treated by either surgical ligation or portocaval shunting. Despite surgery, 14 patients died, most of them postoperatively. Among the 5 survivors, 4 were treated by surgical ligation only and 1 by ligation and portocaval shunting. A possible relationship among ascites, paracentesis, and bleeding was not considered. In most of the reports summarized by Ben-Ari, the (non)existence of ascites was not mentioned at all.\textsuperscript{24,29–31}

One of our 2 patients (patient 2) who underwent laparotomy died of continued bleeding caused by disseminated intravascular coagulopathy. This may have been induced by the surgical procedure and aggravated by the subsequent TIPS reestablishment. Unfortunately, a TIPS expert was not involved in the primary treatment decision. TIPS correction with embolization of the varices without prior surgical ligation would probably have been better tolerated.

On the other hand, only 1 of our 4 patients received TIPS as primary emergency treatment. Therefore, it is not known whether this intervention would improve survival. This seems reasonable considering that TIPS is less invasive than surgical interventions. In experienced centers, TIPS implantation can be performed in a short time (1 hour) with only minimal procedural mortality even in emergency situations.\textsuperscript{32} Compared with surgical ligation, TIPS seems to be preferable because it does not only stop the acute bleeding but also prevents rebleeding and recurrence of ascites.\textsuperscript{33} Of course, the decision for the one or the other treatment also depends on the availability of the TIPS procedure and an experienced team.

No information exists regarding recurrence of hemoperitoneum after treatment. The question whether patients with refractory ascites receiving large-volume paracentesis and with the finding of retrograde blood flow in the mesenteric veins should undergo prophylactic treatment (e.g., TIPS) cannot be answered at present. Retrograde flow in mesenteric veins may, however, influence the treatment decision in such patients in favor for TIPS implantation. Given the extremely high mortality rate of hemoperitoneum, we agree with Webster et al.\textsuperscript{25} that close surveillance is justified in patients receiving large-volume paracentesis, in particular those with retrograde mesenteric blood flow indicating large-caliber collaterals. Diagnostic paracentesis should be performed in any patient with ascites and blood loss of unknown origin, and, if erythrocytes are detectable in the ascites, duplex sonographic and/or angiographic procedures should be initiated for diagnosis of mesenteric and/or lower gastro-
intestinal varices. In patients with progressive shock and the need of transfusions (>4 U within 24 hours), invasive treatment seems to be indicated and should be performed without delay. This approach would accelerate treatment and possibly improve survival.

References