Abstract
We describe here the case of a 75-year-old woman who underwent emergency laparoscopic surgery for recurrent hemorrhages caused by diverticulosis of the right colon with subsequent anemia. At admission, physical examination revealed stable vital signs, and the abdomen was soft, non-tender, and non-distended. The hemoglobin level was 10.6 g/dL. No fresh blood clots were observed in the right colon lumen on colonoscopy. Ileocecal resection was planned; however, at 10 days after hospital admission, the patient presented with severe gastrointestinal bleeding; the hemoglobin level decreased to 7.2 g/dL, with the subsequent development of hemorrhagic shock. Blood transfusion (4 U of blood) was immediately performed; however, a second episode of massive hematochezia occurred after emergency angiography. Therefore, an emergency laparoscopic right colectomy was performed for resection of the diverticulosis of the right colon, followed by reconstruction with end-to-end anastomosis. The patient remained asymptomatic at 8 months of follow-up.

Key words: diverticulitis, laparoscopic right colectomy, massive hematochezia

Introduction
Diverticulosis of the colon has been reported to be a common disease among Caucasians, including Australians, but is infrequent among Asians and Africans. It was formerly believed that diverticulosis of the colon was relatively rare in Japanese populations; however, the incidence of diverticular hemorrhage—which is a common cause of lower gastrointestinal bleeding—has been increasing in Japan.

We report here the surgical management of a case of grave hemorrhagic shock occurring due to diverticulitis of the right colon.

Case Report
A 75-year-old woman presented with diverticular hemorrhage with diverticulitis twice, the first event occurring 2 years before the current hospital admission. Abdominal computed tomography (CT) showed luminal extravasation of contrast material (Fig. 1A) with cecal wall thickening (Fig. 1B). Colonoscopy revealed fresh bleeding in the right colon lumen (Fig. 2A). The active diverticular bleeding was treated with a few clips (Fig. 2B).

Surgical treatment was planned for treating the recurrent hemorrhages and anemia. The patient was not receiving any specific medication, and no history of major diseases was noted. She did not smoke or drink alcohol. At admission, the abdomen was soft, non-tender, and non-distended. The vital signs were as follows: temperature, 36.6°C; pulse rate, 76 beats/min; and blood pressure, 120/84 mmHg. The hemoglobin level was 10.6 g/dL, and her liver, renal, and coagulation function tests and electrolytes levels were all within the normal range. No fresh blood clots or bleeding spots were noted in the colon lumen on colonoscopy. Barium enema revealed some diverticulae of the right colon (Fig. 3). Subsequently, ileocecal resection was planned. However, at 10 days after admission, the patient presented with severe acute gastrointestinal bleed-
ing, which manifested as passage of bloody watery stools 6 times without pain, with a decrease in the hemoglobin level to 7.2 g/dL, and the subsequent development of hemorrhagic shock. The pulse had increased to 98 beats/min, and the blood pressure was 78/40 mmHg. Blood transfusion with 4 U of blood was administered for treating the blood loss. Since an urgent colonoscopy was considered a high-risk procedure considering the patient’s unstable hemodynamic status, an emergency angiography of the superior mesenteric artery was performed concurrently with the blood transfusion. However, no abnormal vasculature or extravasation focus was observed (Fig. 4). Following the emergency angiography, a second episode of massive hematochezia occurred. Therefore, after explaining the operative risks under the state of hemorrhagic shock and obtaining informed consent for surgical removal of the bleeding colon, the patient underwent emergency laparoscopic surgery under pneumoperitoneum.

The patient was placed in the supine position with an endotracheal tube, and a 30-mm vertical transumbilical incision and an assist 5-mm port were made. We performed a right colectomy for treating diverticulosis of the right colon. The resected specimen was delivered through the umbilical incision by extending the incision for 1.5 cm on either side, and the right colonic pedicles were ligated extracorporeally. Reconstruction was performed via a functional end-to-end anastomosis using the gastrointestinal anastomosis (GIA) stapler (3.5-mm thickness Autosuture, Covidien, Mansfield, Mass). The total operating time was 185 min, and the blood loss was 100 mL. No intraoperative or postoperative complications occurred. The resected specimen

![Fig. 1 Computed tomography. Abdominal CT showing luminal extravasation of contrast material (A) with cecal wall thickening (B).](image1)

![Fig. 2 Colonoscopy. Colonoscopy showing fresh bleeding in the right colon lumen (A). The active diverticular bleeding for a few clips (B).](image2)
showed the presence of some diverticulae at the right colon (Fig. 5A). Pathological examination revealed diverticulitis (Fig. 5B). There was no evidence of any thick abnormal vessel that might have possibly triggered local haemodynamic/pressure changes. The postoperative course was satisfactory. The patient passed flatus on postoperative day (POD) 1 and began receiving oral fluids on POD 3. At 8 months of follow-up, the patient has remained asymptomatic, and is now in good health.

**Discussion**

Lower gastrointestinal bleeding typically occurs due to the presence of hemorrhoids, diverticulosis, or colorectal cancer. Although the hemorrhage often resolves spontaneously, some patients may require massive transfusions and emergency surgery. In the present case, sudden severe gastrointestinal bleeding resulted in a sharp decrease in the haemoglobin level to 7.2 g/dL, with the subsequent development of hemorrhagic shock that required significant blood transfusion (4 U).

Generally, diverticular hemorrhage begins suddenly and stops spontaneously in most instances; however, re-bleeding occurs in some patients. Diverticular hemorrhage is detected only in 3.9% patients. Active bleeding or stigmata of hemorrhage (visible vessel or pigmented protuberance) are identified in only 10–20% of colonoscopies for diverticular bleeding. The diagnostic rate of angiography for gastrointestinal hemorrhage reportedly ranges from 40% to 78%.

A diagnosis of hemorrhage is confirmed when ex-
travasation of the contrast medium occurs into the bowel lumen.

In the present case, we performed an emergency angiography along with the blood transfusion, but no abnormal vasculature or extravasation focus was observed. Kusumoto et al. have reported that it is difficult to identify the hemorrhagic point when the rate of bleeding is less than 0.5 mL/min\textsuperscript{8}. Our patient had suffered repeated hemorrhage of more than 200 mL; this recurrent hemorrhage was refractory or not amenable to therapy. Indications for surgical intervention included large transfusion requirements and hemodynamic instability that did not respond to medical therapy. We chose to perform bowel resection and right colectomy in consideration of the high risk of bowel perforation. In patients with uncontrolled bleeding requiring emergency surgery, the mortality is high (10–20%), often because of hypotension and comorbid conditions\textsuperscript{9-11}. The surgical procedure of choice is directed segmental resection, which requires preoperative localization of hemorrhage.

Two multicenter studies have demonstrated that laparoscopic sigmoidectomy with primary anastomosis for diverticular disease is feasible and safe as an elective procedure, whereas in cases of complicated diverticulitis and/or fistula, this procedure is more likely to be associated with complications\textsuperscript{12,13}. This case report provides an opportunity to recommend the intensive use of laparoscopic exploration and evaluation in the emergency surgical setting. Potential advantages of laparoscopy include decreased postoperative pain, quicker return of bowel function as compared to laparotomy, and lesser adhesion formation. This approach can also minimize the required length of bowel resection in cases with high-risk hemorrhagic complications.

References