

## Acute Embolus Occlusion of the Superior Mesenteric Artery: Report of Two Cases

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Two cases of acute embolus occlusion of the superior mesenteric artery (SMA) are reported herein. Symptoms and physical findings, particularly acute onset of abdominal pain and underlying atrial fibrillation, suggested the possibility of SMA embolism. Furthermore, in case 1, the following findings on abdominal CT led to the suspicion of SMA embolism: bowel dilatation, thickening and thumbprinting of the bowel wall, a high density in the SMA, and a reduction in diameter of the superior mesenteric vein. Finally, an accurate diagnosis was made by selected SMA angiography. Laparotomy was performed twenty hours after hospitalization in case 1 and eight hours after in case 2. Almost all the ileum (cases 1 and 2), the hepatic flexure region of the transverse colon (case 1), and the caecum (case 2) were edematous with ischemic color but no infarction, and the affected segments showed no peristalsis. In cases 1 and 2, embolectomy in the SMA was performed to allow an immediate improvement in color, peristalsis of the regional part, and a bounding pulsation. Resection was not performed on the affected segment, in the small or large intestine. However, in case 2, two days after the operation, the general condition had deteriorated, manifesting low blood pressure, decreased volume of urine, high fever, elevation in levels of serum CPK, CRP, LDH, and metabolic acidosis of the blood gases, which suggested necrosis of the bowel. At reoperation, almost all the small intestine and caecum were necrotic, although pulsation was recognized at the trunk and periphery of the SMA. The necrotic bowel segment was removed with colostomy construction. This condition was interpreted as non occlusive mesenteric ischemia (NOMI) following the initial operation. Early detection of SMA embolism is very important to avoid a dangerous situation. In this paper, we discussed the early diagnosis of SMA embolism.

**Key Words :** acute abdomen, embolism, superior mesenteric artery, mesenteric ischemia

### INTRODUCTION

Occlusion of the superior mesenteric artery (SMA) is a relatively rare but life-threatening disorder of acute abdomen, requiring an emergency treatment<sup>1-4)</sup>. In most studies, SMA embolism is responsible for 70-80% of cases with acute occlusion of SMA<sup>5)</sup>. SMA embolism has been difficult to diagnose preoperatively because most patients present with signs and symptoms indistinguishable from other types of disorders of acute abdomen. Accordingly, most patients had not been diagnosed until laparotomy was performed. In this report, we described two elderly males with SMA embolism, which was diagnosed preoperatively by the clinical course, abdominal CT scan and superior mesenteric angiography.

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### *Clinical Course*

#### *Case 1*

A 69-year-old male was admitted to the Department of Surgery, at Juzen Hospital on an emergency basis. For one day before hospitalization, he had felt suddenly severe pain all over the abdomen, associated with vomiting and diarrhea, which gradually became worse. The symptoms occurred immediately after supper. He had not felt similar attack until then. The patient's personal and medical histories were remarkable. At the age of 57, he had diabetes mellitus to be controlled since then. At the age of 59, he was hospitalized because of angina pectoris to treat with PTCA. Moreover, at the age of 68, he started to take antiarrhythmic drugs.

Physical examination revealed acute distress due to abdominal pain and repeated vomiting or diarrhea. His body temperature was 37.3°C; pulse rate, 78 (arrhythmia); respiratory rate, 17 per minute; body weight, 72 kg; height, 165 cm; blood pressure, 210/100 mmHg, respectively. The physical examination revealed generalized abdominal tenderness without muscular guarding. Bowel sounds were scarce. The following routine laboratory tests on admission were all within normal limits: the hemogram, coagulation studies, and serum levels of electrolytes, albumin, calcium, triglycerides, total bilirubin, alkaline phosphates, amylase and transaminase. On the contrast, the white blood cell count taken on the day of admission was 14,500 cells/mm<sup>3</sup> with 82 per cent neutrophils, indicating a moderate leukocytosis, which continued during the preoperative course. Furthermore, the hematocrit, serum levels of blood sugar and CRP also elevated, with values being 54.6 per cent, 298 mg/dl and 3.7 mg/dl, respectively. The circulation system monitored by electrocardiogram showed atrial fibrillation (Fig. 1-A). The respiratory system as well as arterial blood gases were all unremarkable.

Plane X-ray films of the abdomen showed slight gaseous distension of the small and large bowel, without fluid level or free air. Gaseous distension on the films became greater more and more (Fig. 2-A). Abdominal CT scans showed the gas-distended colon in the anterior abdomen (Fig. 3-A), and thickened or thumbprinting of the bowel wall (Fig. 3-B, C). Extraluminal gas was not shown on CT, which was obtained with the patient supine. Furthermore, a high density in SMA and a reduction in diameter of the superior mesenteric vein were observed (Fig. 3-D). Acute embolus occlusion of the SMA was strongly suggested because of both the clinical course and CT

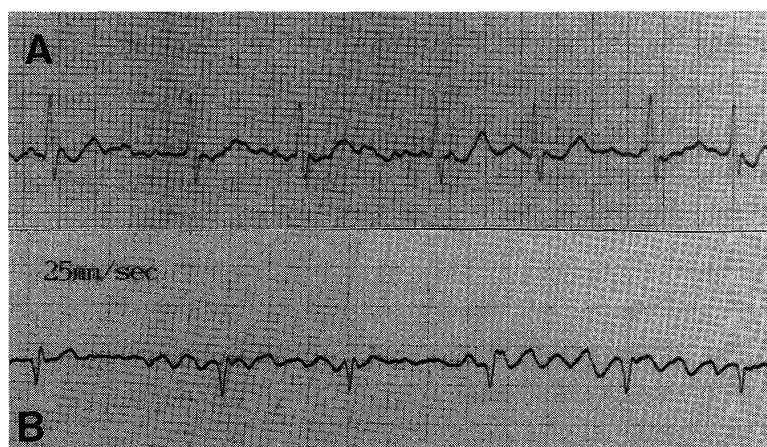


Fig. 1 Atrial fibrillation in cases 1 (A) and 2(B).

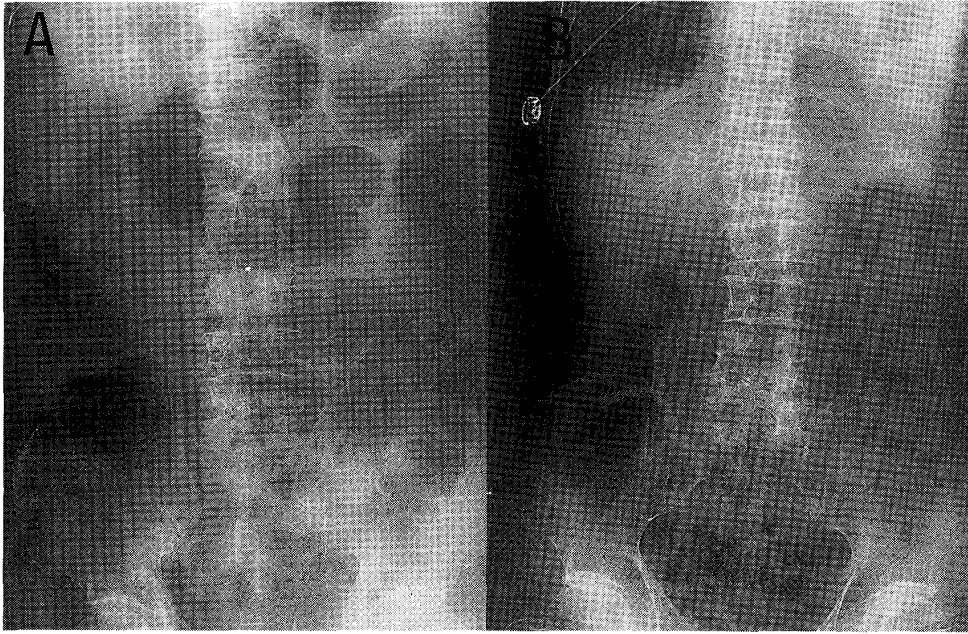


Fig. 2 Plane X-ray films of the abdomen in cases 1 (A) and 2(B) show gaseous distension of the small and large bowel.

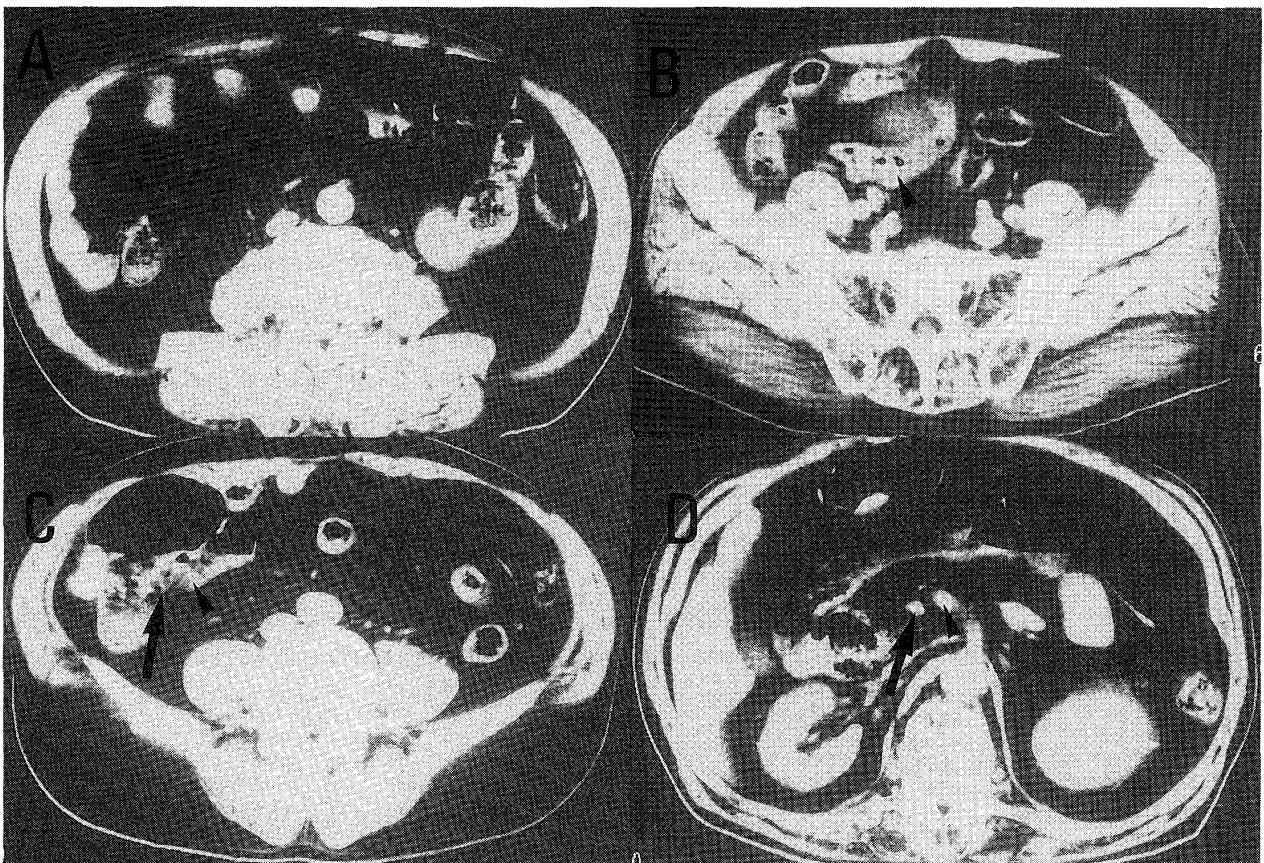


Fig. 3 CT scans in case 1. (A) Gas-distended bowel in the anterior abdomen. (B) (C) Thumbprinting (arrow) and thickened (arrowhead) of the bowel wall. (D) A high density in the SMA (arrowhead) and a reduction in diameter of the superior mesenteric vein (arrow).

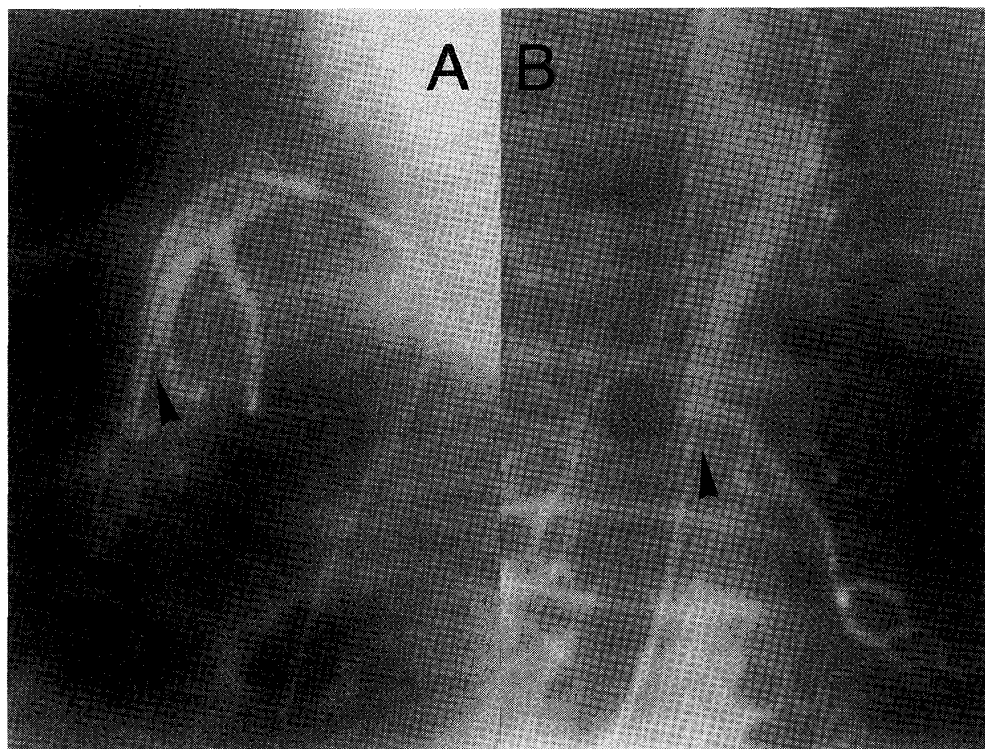


Fig. 4 SMA angiography in cases 1 (A) and 2 (B) show the occlusion in the trunk of the SMA (arrow).

findings described above, then, selective superior mesenteric angiography was performed. The angiography disclosed occlusion in the trunk of the SMA (Fig. 4-A).

Therefore, laparotomy was performed 20 hours after hospitalization. At surgery, there were no ascites or blood in the abdominal cavity. Almost all the ileum and the hepatic flexure region of the transverse colon were edematous with ischemic color but no infarction; and these affected ileum and colon showed no peristalsis. The SMA was isolated and traced proximally. Occluding lesion was a bounding pulse. Then, an arteriotomy incision was made just over the occlusion of the SMA, to remove the embolus in the main trunk of the SMA with the 4-F Fogarty's balloon catheter (Fig. 5-A). Blood flow from the main trunk of the SMA and back-flow from the distal of the SMA was recognized. After flushing with heparin, the arterial incision was carefully closed so as not to cause a thrombus. Removing embolus allowed an immediate improvement in color and peristalsis of the diseased region, and did not require the resection of the small intestine or colon.

#### **Postoperative clinical course**

Angiography performed on the 18th postoperative day did not show the recurrent occlusion of the SMA. So far, in his two-year's postoperative history, recurrence of occlusion of the SMA has been successfully controlled with administration of antiarrhythmic drugs and oral antidiabetics.

#### **Case 2**

An 86-year-old male was admitted to the Department of Surgery, at Juzen Hospital on an emergency basis. He was found breaking down in a toilet for abdominal pain. The patient's personal and medical histories were unremarkable except cerebral thrombosis before seven months.

Physical examination revealed abdominal pain without Blumberg's sign or muscular guarding, and vomiting. Bowel sounds were normal. His body temperature was 36.3°C; pulse rate, 88

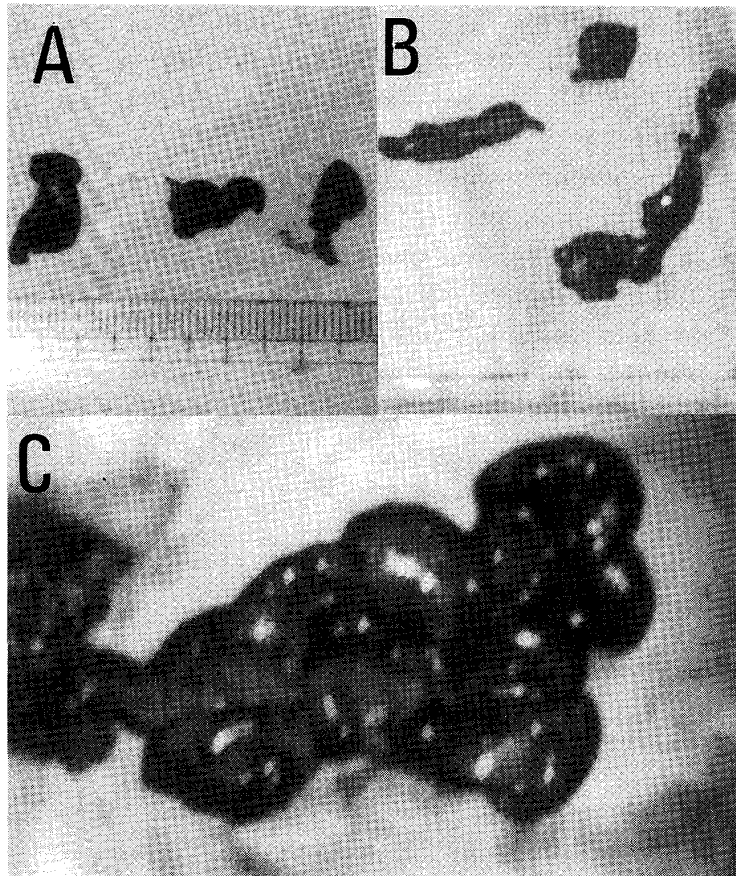


Fig. 5 Removed embolus in cases 1 (A) and 2 (B). Removed necrotic small and large bowel in case 2 (C).

(arrhythmia); respiratory rate, 18 per minute; body weight, 53 kg; height, 153 cm; blood pressure, 152/96 mmHg, respectively.

The following routine laboratory tests on admission were all within normal limits: the hemogram, coagulation studies as well as serum levels of electrolytes, albumin, calcium, triglycerides, total bilirubin, alkaline phosphates, amylase and transaminase except a serum LDH (668 IU/L). The circulation system monitored by electrocardiogram showed atrial fibrillation (Fig. 1-B). The respiratory system and blood gases were all unremarkable.

Plane X-ray films of the abdomen showed slight gaseous distension of the small and large intestines, without fluid level or free air (Fig. 2-B). Acute embolus occlusion of the SMA was strongly suggested because of a similar clinical course to that of case 1. Therefore, superior mesenteric angiography was done immediately, which revealed the occlusion in the trunk of the SMA (Fig. 4-B).

Thus, laparotomy was performed eight hours after hospitalization. At surgery, there were no ascites or blood in the abdominal cavity. Most of the ileum and the part of the caecum were edematous with ischemic color but no infarction; and the small intestine showed no peristalsis. The SMA was isolated and traced proximally. Occluding lesion was a bounding pulse. As in the case 1, an arteriotomy incision was made just over the occlusion of the SMA, to remove the embolus in the main trunk of the SMA with the 4-F Fogarty's balloon catheter (Fig. 5-B). Flow from the main trunk of the SMA and back-flow from the distal of the SMA was recognized. After flushing



with heparin, the arterial incision was carefully closed so as not to cause a thrombus. Thus, a resultant immediate improvement in circulation of the affected segment avoided the resection of the small intestine or colon.

#### *Postoperative clinical course*

Two days after the operation, postoperative condition was eventful, including a low blood pressure, decreased volume of urine and high fever, which gradually became worse in spite of intensive treatment. On laboratory tests, serum levels of CPK (401 U), CRP (10.0 mg/dl) and LDH (924 IU/L) elevated, and blood gases showed metabolic acidosis (BE: -8.1 mEq/L). Necrosis of the bowel was diagnosed from both the clinical and laboratory findings. Immediately, reoperation was performed while urokinase was administered. At surgery, all of the small intestine and caecum lapsed into necrosis (Fig. 5-C). However, pulsation was recognized at the trunk and periphery of the SMA. Consequently, the necrotic segment of the bowel was removed, with a construction of colostomy. However, he died on eight hours after reoperation. This case was diagnosed as SMA embolism, complicated with non-occlusive mesenteric ischemia (NOMI)<sup>6)</sup> following the initial operation.

### **DISCUSSION**

Mesenteric ischemia is a dangerous situation that requires an emergency treatment, and the overall mortality rate due to the disease is as high as 70–90%<sup>7,8)</sup>. SMA embolism is the most frequent cause of mesenteric ischemia. Surgery has been the common treatment for acute SMA embolism<sup>9)</sup>. Moreover, recently, local fibrolitic treatment has been performed in selected cases. In most recent studies, however, there has not been a remarkable improvement in the mortality rate<sup>10,11)</sup>.

Patients with SMA embolism present sudden onset of severe abdominal pain, making early diagnosis difficult. In addition, the disease manifests unspecified symptoms including fever, repeating vomiting and diarrhea, muscular guarding, abdominal distension and bloody stool. When the condition of the disease, however, makes bad progress gradually, it is difficult to differentiate SMA embolism from other types of diseases in acute abdomen. It is reported that almost all the cases of SMA embolism are associated with previous heart disease and/or atrial fibrillation<sup>1)</sup>. Therefore, it seems to be useful for early diagnosis of SMA embolism that the patient showed sudden onset of a severe abdominal pain and the complication with heart disease, especially, atrial fibrillation. In fact, our two cases conformed to this pattern.

The final diagnosis of SMA embolism is usually established only after laparotomy, in most cases. However, recently, preoperative accurate diagnosis has been made increasingly with the aid of image diagnosis using ultrasonography, CT and finally angiography. Abdominal CT does not enable specific diagnosis of ischemic or infarcted bowel in many instances. On the other hand, it is reported abdominal CT is useful to check for focal diffuse bowel dilatation, thickened bowel wall, intramural gas, thumbprinting of the bowel wall, pneumatosis intestinalis, embolus or thrombus of the SMA, and portal venous gas, due to SMA embolism<sup>12–16)</sup>. In our case 1, abdominal CT findings strongly suggest ischemic bowel, including diffuse bowel dilatation, thickened and thumbprinting of the bowel wall and high density of the SMA. While it is no doubt that these findings on CT are much reliable to make a preoperative diagnosis of ischemic bowel, there must be considerable doubt as to a reduction in diameter of the superior mesenteric vein as in case 1. The most likely explanation is that venous flow decreases owing to occlusion of the SMA,

although, it needs further investigation.

Mesenteric angiography is the diagnostic method of choice. It can be used to distinguish acute none-occlusive mesenteric ischemia from occlusive ischemia such as thrombo-embolic ischemia, whose therapies are quite different each other. In our cases, SMA embolism was recognized finally by angiography, although it is strongly suspected by CT findings in case 1 and by clinical course in case 2.

It is essential to recognize SMA embolism as an acute abdominal emergency that requires prompt treatment. The treatment consists of surgery and fibrolytic method, although, fibrolytic treatment appears to be a therapeutic alternative to surgical treatment in selected cases. In our case 1, despite 20 hours had elapsed since the initial symptom, the bowel was only ischemic without infarction, and the patient did not collapsed in a severe condition. In case 2, eight hours had elapsed since the initial symptom. In case 2, despite the time until the operation was much shorter than that of case 1, the patient collapsed in a severe condition finally. At the final surgery, all of the small intestine and caecum was necrotic while the pulsation of the trunk and periphery of the SMA were recognized. This case was diagnosed as SMA embolism with complication of non occlusive mesenteric ischemia (NOMI) following the first operation. It is reported that NOMI causes low cardiac output or thrill of mesenteric microcirculation owing to worsened general condition, but not occlusion of the trunk or peripheral artery of the SMA<sup>6)</sup>. NOMI probably occurs in a rate of 50% of all ischemic bowel diseases, often resulting in a severe condition<sup>6)</sup>. It is reported that, in almost all the NOMI cases, it is important to improve low cardiac output for a patient in worse condition<sup>6)</sup>.

Occlusion of the SMA is a dangerous situation which requires an emergency treatment. Accordingly, early diagnosis of the disease is of great importance. As our cases suggest, it is key to making the diagnosis to evaluate carefully the clinical course and the underlying diseases such as heart failure. Furthermore, image diagnosis using abdominal CT and finally angiography allows accurate preoperative diagnosis of occlusion of the SMA. Especially, a patient with sudden onset of severe abdominal pain and atrial fibrillation should undertake an abdominal CT and angiography as quick as possible, if necessary. Moreover, as infarction bowel shows high serum levels of CPK, LDH and CRP, and metabolic acidosis, these should be monitored during pre- and post treatment courses. Finally, it is important to keep enough circulation continually in the case of SMA occlusion, to avoid the occurrence of NOMI.

## REFERENCES

1. OTTINGER LW: The surgical management acute occlusion of the superior mesenteric artery. *Ann Surg*, 188: 721-731, 1978.
2. GIULINI S, BONARDELLI S, CANGIOTTI L: Factors affecting prognosis in acute intestinal ischemia. *Int Angiol*, 6: 411-422, 1987.
3. GOREY T, O'SULLIVAN M: Prognostic factors in extensive mesenteric ischemia. *Ann R Coll Surg Engl*, 70: 191-194, 1988.
4. WILLIAMS FL: Mesenteric ischemia. *Surg Clin North Am*, 68: 331-353, 1988.
5. SCHNEIDER TA, LONGO WE, URE T, VERNAVA AM: Mesenteric ischemia. Acute arterial syndromes. *Dis Colon Rectum*, 37: 1163-1174, 1994.
6. THOMAS JH, LORA AP, ERIC AW, et al.: Nonocclusive mesenteric ischemia remains a diagnostic dilemma. *Am J Surg*, 171: 405-408, 1996.

7. HUNTER GC, GUERNSEY JM: Mesenteric ischemia. *Med Clin North Am*, 72: 1091-1115, 1988.
8. STONEY RJ, CUNNINGHAM CG: Acute mesenteric ischemia. *Surgery*, 114: 489-490, 1993.
9. MORANO JU, HARRISON RB: Mesenteric ischemia: angiographic diagnosis and intervention. *Clin Imaging*, 15: 91-98, 1991.
10. SHOUENBAUM SW, PENA C, KOENISBERG P, KATZEN BT: Superior mesenteric artery embolism: treatment with intraarterial urokinase. *JVIR*, 3: 485-490, 1992.
11. TUREGANO F, SIMO G, ECHENAGUSIA AJ, FIUZA C DE, TOMAS J, PEREZ D: Successful intraarterial fragmentation and urokinase therapy in superior mesenteric artery embolism. *Surgery*, 117: 712-714, 1995.
12. JONES B, FISHMAN EK, SIEGELMAN SS: Ischemic colitis demonstrated by computed tomography. *J Comput Assist Tomogr*, 61: 1120-1123, 1982.
13. HUTCHINS WW, GORE RM, FOLEY MJ: CT demonstration of pneumatosis intestinalis from bowel infarction. *Comput Radiol*, 7: 283-285, 1983.
14. FEDERLE MP, CHUN G, JEFFREY RB: Computed tomographic findings in bowel infarction. *AJR*, 142: 91-95, 1984.
15. MATHIS JM, ZELENIK ME, STAAB EV: CT detection of bowel infarction. *Comput Radiol*, 9: 177-179, 1985.
16. ALPERN MB, GLAZER GM, FRANCIS IR: Ischemic or infarcted bowel: CT findings. *Radiology*, 166: 149-152, 1988.