

# Severe Abdominal Complaints after Technical Successful Endovascular Treatment of Chronic Splanchnic Ischemia

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## Abstract

Reperfusion syndrome (RS) after revascularization of an arterial occlusion of the lower leg is a well-known complication. RS after splanchnic revascularization, however, is an infrequent and less-known phenomenon. We present a patient with persisting abdominal complaints after revascularization of the celiac trunk and superior mesenteric artery suggesting reocclusion. Although computed tomography angiography showed patent splanchnic arteries, an impressive hyperperfusion state of liver and spleen was visualized. Complaints diminished steadily with conservative therapy, but RS can cause severe complications such as liver failure and multiple organ failure. Ignorance of RS might interfere with adequate treatment and can contribute to a high in-hospital mortality rate.

**Keywords:** Complication, intestine, reperfusion syndrome, revascularization

## INTRODUCTION

Mesenteric ischemia (MI) is caused by a reduction in intestinal blood flow and can be divided into acute MI (AMI) and chronic MI (CMI) based on the rapidity and degree to which blood flow is comprised.<sup>[1]</sup> The diagnosis of MI demands careful exclusion of more common causes, requiring extensive testing.<sup>[1]</sup> After the diagnosis, revascularization is mandatory. Both endovascular and open revascularization (OR) procedures hold the risk of severe complications.<sup>[2-5]</sup> Postinterventional complaints can be hard to interpret due to a wide differential diagnosis.

This report presents a patient with CMI and persisting complaints after endovascular revascularization (ER) due to reperfusion syndrome (RS). Informed consent for publication was obtained.

## CASE REPORT

Patient A, a 40-year-old female, suffered from episodes of upper abdominal and back pain accompanied by vomiting since a year before presentation. Initially, complaints presented predominantly postprandial but eventually even in the absence of any provocative factors. She had lost 9 kg (15% total body weight). Her medical history mentioned fibromyalgia.

Furthermore, she had been smoking cigarettes for 20 years (ten pack years) but quit 8 months before presentation. Her medication consisted of oral contraceptives and isosorbide mononitrate 50 mg daily on trial during 3 months which appeared to have a positive effect on her complaints.

The diagnosis of chronic splanchnic ischemia was by the exclusion of several other diseases and after numerous other investigations. Computed tomography angiography (CTA) revealed a high-grade stenosis at the ostia of the superior mesenteric artery (SMA), the celiac trunk, and the inferior mesenteric artery [Figure 1].

The patient was presented for splanchnic revascularization. After retrograde duplex-guided puncture of the right femoral artery, a diagnostic angiography confirmed a pinpoint stenosis of the celiac trunk and SMA. Subsequently, the right brachial artery was punctured. The stenosis in the celiac trunk was passed easily, and a 5 mm × 19 mm self-expandable stent

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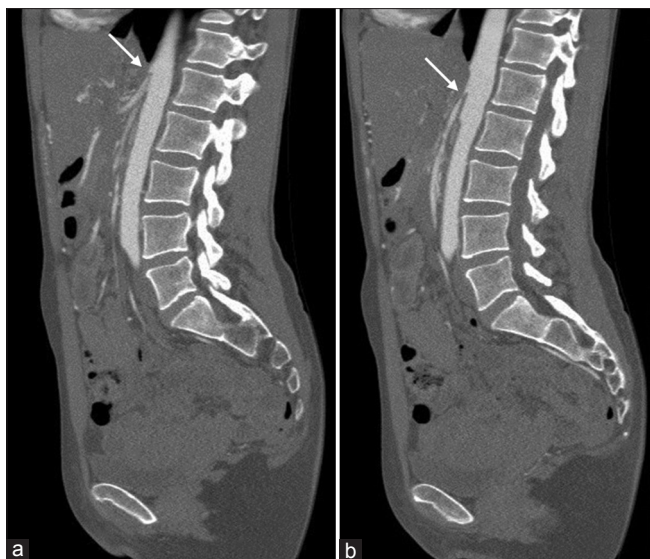
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**Figure 1:** Computed tomography angiography (sagittal plane) showing high-grade stenosis (arrow) at the ostia of the celiac trunk (a) and superior mesenteric artery (b)

was placed. Subsequently, a 5 mm × 15 mm self-expandable stent was placed in the SMA. Postballooning was performed after the stent placements. The procedure was uncomplicated resulting in a technical successful revascularization [Figure 2].

During the procedure, the patient experienced an increased abdominal tension, pain, and nausea. Angiography, however, showed a patent SMA and celiac trunk, without evidence of distal embolization, dissection, or thrombosis of the target vessels.

Approximately 7 h after the procedure, a CTA was performed because of persisting significant abdominal complaints in the epigastric region despite administration of substantial amounts of analgesics. CTA revealed patent stents in the SMA and celiac trunk and adequate peripheral blood flow. No laboratory abnormalities were detected (serum lipase level 16 U/l, C-reactive protein 2 mg/l).

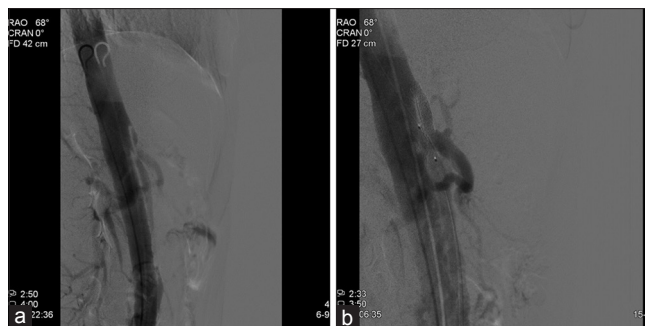
The day after the procedure pain persisted in the epigastric region. No hepatosplenomegaly was observed. A gastroscopy showed no abnormalities. Serum lipase levels as well as liver function tests and infection parameters remained low. Serum lactic acid level was 1.0 mmol/l.

Even more than 50 h after the initial procedure, complaints did not diminish. Once again CTA was repeated, showing patent splanchnic arteries [Figure 3a]. However, an impressive hyperperfusion state of liver and spleen was visualized, accompanied by ascites (Figure 3b).

Symptoms were considered to be due to splanchnic reperfusion and diminished spontaneously after a few days

## DISCUSSION

CMI (also known as intestinal angina) refers to episodic or constant intestinal hypoperfusion, which usually develops

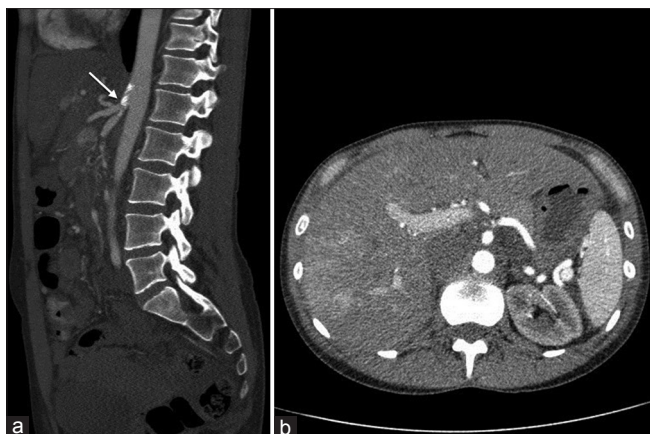


**Figure 2:** Splanchnic arteries before (a) and after (b) recanalization as seen on digital subtraction angiography

in patients with chronic mesenteric atherosclerotic disease. Symptoms are strongly associated with meals provoked by increased metabolic demands associated with digestion.

The diagnosis of MI requires careful exclusion of more common causes and a high degree of clinical suspicion, especially in patients with known risk factors. However, early signs are nonspecific, and definitive diagnosis often requires extensive testing. Duplex ultrasonography can be used to identify high-grade stenoses in the SMA and celiac artery. A positive study requires confirmation with an additional imaging study before intervention.<sup>[6]</sup> CT is preferred over magnetic resonance (MR) because of its lower costs and wide availability.<sup>[7,8]</sup> Furthermore, magnetic resonance angiography (MRA) is limited in identification of more peripheral occlusions and non-occlusive mesenteric ischemia (NOMI).<sup>[9]</sup> However, mesenteric angiography is currently considered to be the gold standard diagnostic test for suspected arterial embolism or thrombosis.<sup>[10-12]</sup> Nevertheless, CT and MR arteriography are preferred initial tests since they can identify stenosis and determine the preferred approach for intervention.<sup>[13,14]</sup>

The two main treatment modalities for (chronic) MI are classical OR and ER performed through percutaneous transluminal angioplasty either with or without stent-graft placement. Direct comparison between OR and ER is challenging because of inherent differences in patient characteristics and lack of large randomized controlled trials. The decision for conventional surgery or ER is based on the surgeon's experience, patient's age, comorbidity, the number and severity of occluded vessels, and the ease of vascular access to the occluded vessels.<sup>[2,3]</sup> In CMI, OR is associated with superior long-term vessel patency and fewer reinterventions.<sup>[2,4,5]</sup> However, OR is also accompanied by significant higher postoperative mortality and morbidity and longer intensive care unit and hospital stay. ER is increasingly regarded first choice in treatment of MI. Nevertheless, these less invasive procedures can lead to severe complications. After ER, early postoperative symptom relief is not always experienced.<sup>[4]</sup> Moreover, patients can even experience an aggravation of abdominal complaints.<sup>[15]</sup> Distal embolization and dissection and/or occlusion of the target vessel are dreaded events and can lead to necrosis of the target organs. However, it is noteworthy that even after technical successful revascularization, severe complications can occur.



**Figure 3:** Patent splanchnic arteries (arrow) on computed tomography angiography (sagittal plane) (a) and hyperperfusion state of liver and spleen as evinced by strong portal venous enhancement in this arterial phase scan (axial plane) (b)

When during the reperfusion phase oxygen is reintroduced to tissue after a prolonged period of hypoxia by (splanchnic) ischemia, massive mucosal damage to the epithelial lining occurs. This causes intestinal barrier integrity loss which is accompanied by significant translocation of intraluminal pathogens and endotoxins toward the circulation which can result in a subsequent severe inflammatory response.<sup>[16]</sup> This phenomenon is also known as “the oxygen paradox.”<sup>[17]</sup>

Although restoration of the blood flow is imperative to improve patient outcome, reperfusion can paradoxically result in deleterious effects and can potentially even lead to multiple organ failure (MOF) and death.<sup>[18,19]</sup>

Clinical symptoms can be difficult to interpret, creating a challenge to distinguish between the RS and feared complications such as ischemia which need to be excluded. Besides clinical examination, laboratory testing and imaging are often warranted. Mesenteric hyperemia shown as strong portal venous enhancement (in an arterial phase scan) with associated ascites, enlarged pancreatic vessels, or even pancreatitis can be indicative for RS. In our case, during the subsequent CTAs, hyperperfusion of the liver and spleen became more evident over time, with ascites as well. No distal embolization could be detected. The patient recovered spontaneously from her complaints after a few days. Normally RS is self-limiting within several days, without need for additional measures. However, in more severe situations, it might also cause pancreatitis, liver failure, and even MOF with associated considerable mortality rates. It is therefore that recognition of the splanchnic RS is so essential; not only renewed ischemia has to be ruled out, understanding of the process of reperfusion and adequate treatment of (systemic) complications is of utmost importance.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other

clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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### Conflicts of interest

There are no conflicts of interest.

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