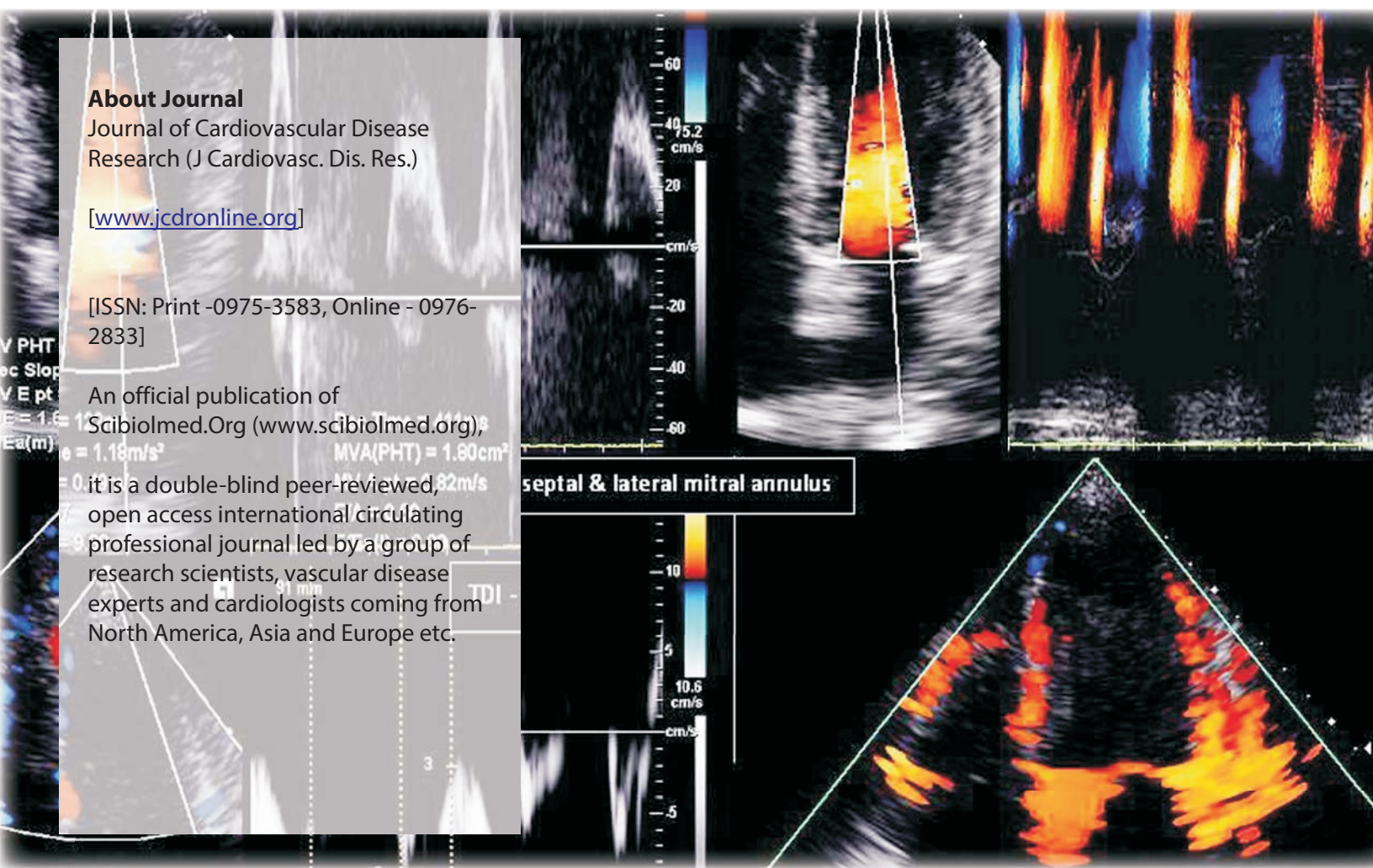


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Severe Abdominal Complaints after Technical Successful Endovascular Treatment of Chronic Splanchnic Ischemia

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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 re-occlusion. CT angiography showed patent splanchnic arteries but a striking hyperperfusion state of liver and spleen. 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.

Key words: Intestine, Revascularization, Complication, Reperfusion syndrome, Splanchnic ischemia.

Key messages: Post procedural complaints in splanchnic revasculariza-

tion necessitate alertness and if in doubt immediate diagnostic imaging. If imaging shows patent splanchnic arteries, Reperfusion syndrome (RS) should be considered. Ignorance of RS might interfere with adequate treatment and can contribute to a high in-hospital mortality rate.

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INTRODUCTION

Mesenteric ischemia (MI) is caused by a reduction in intestinal blood flow and can be divided into Acute mesenteric ischemia (AMI) and Chronic mesenteric ischemia (CMI) based upon the rapidity and degree to which blood flow is comprised. The diagnosis of MI demands careful exclusion of more common causes, requiring extensive testing. After the diagnosis, revascularization is mandatory. Both endovascular and open revascularization procedures hold the risk of severe complications. Post interventional 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 History

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 absence of any provocative factors. She had lost nine kilograms (15% total body weight). Her medical history mentioned fibromyalgia. Furthermore she had been smoking cigarettes for 20 years (ten pack years), but quit eight months before presentation. Her medication consisted of oral contraceptives and isosorbide mononitrate 50 mg daily on trial during a period of three months which appeared to have a positive effect on her complaints.

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

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 5×19 mm selfexpandable stent was placed. Subsequently a 5×15 mm selfexpandable stent was placed in the SMA. Post-balloon was performed after the stent placements. The procedure was uncomplicated resulting in a technical successful revascularization (Figure 2).

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

Approximately seven hours after the procedure a CTA was performed because of persisting significant abdominal complaints in 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 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 hours after the initial procedure complaints did not diminish. Once again CTA was repeated, showing patent splanchnic arteries (Figure 3A). However, a striking hyperperfusion of liver and spleen was visualised, as well as ascites (Figure 3 B).

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

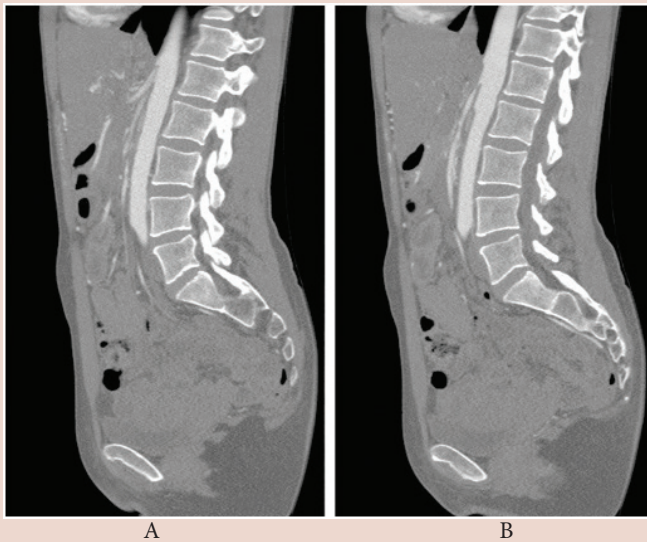


Figure 1: CTA showing high grade stenosis at the ostia of the celiac trunk (A) and SMA (B)

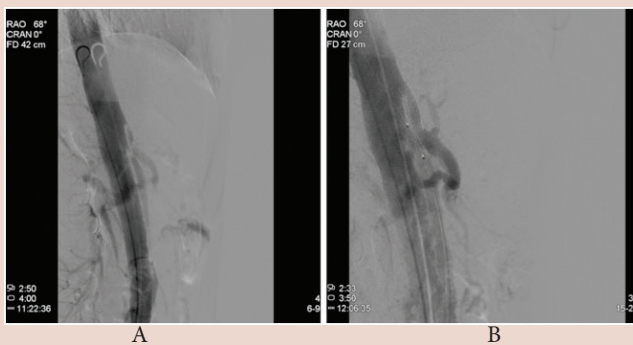


Figure 2: Splanchnic arteries before (A) and after (B) recanalization as seen on digital subtraction angiography

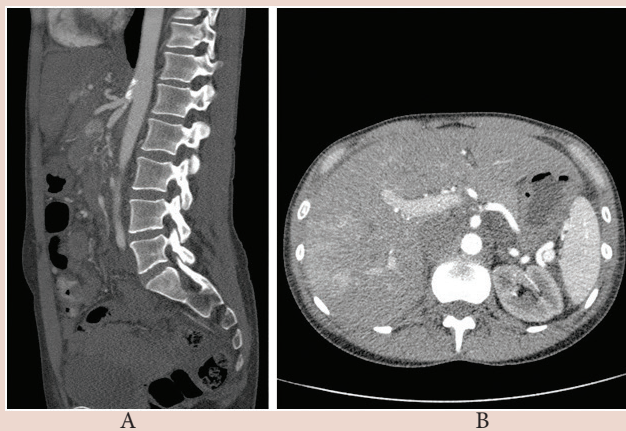


Figure 3: Patent splanchnic arteries on CTA (A) and hyperperfusion state of liver and spleen as evinced by strong portal venous enhancement in this arterial phase scan (B)

DISCUSSION

CMI (also known as intestinal angina) refers to episodic or constant intestinal hypoperfusion, which usually develops 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 prior to intervention.¹ CT is preferred over MR because of its lower costs and wide availability.^{2,3} Furthermore, MRA is limited in identification of more peripheral occlusions and non-occlusive mesenteric ischemia (NOMI).⁴ However, mesenteric angiography is currently considered to be the gold standard diagnostic test for suspected arterial embolism or thrombosis.⁵⁻⁷ Nevertheless CT and MR arteriography are preferred initial tests since they can identify stenosis and determine the preferred approach for intervention.^{8,9}

The two main treatment modalities for (chronic) MI are classical Open revascularization (OR) and Endovascular revascularization (ER) performed through Percutaneous transluminal angioplasty (PTA) 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 RCT's. The decision for conventional surgery or ER is based upon 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.^{10,11} In CMI, OR is associated with superior long-term vessel patency and fewer reinterventions.^{10,12,13} 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.¹² Moreover, patients can even experience an aggravation of abdominal complaints.¹⁴ 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.

When during reperfusion 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 towards the circulation which can result in a subsequent severe inflammatory response.¹⁵ This phenomenon is also known as 'the oxygen paradox'.¹⁶

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.^{17,18} Clinical symptoms can be difficult to interpret, creating a challenge to distinguish between the reperfusion syndrome (RS) and feared complications such as ischemia which need to be excluded. Besides clinical examination, laboratory testing and imaging are often warranted. Mesenteric hyperaemia 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 CTA's, hyperperfusion of the liver and spleen became more evident over time, with ascites as well. No distal embolisation 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.

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None.

CONFLICT OF INTEREST

The author declare no conflict of interest.

ABBREVIATION USED

AMI: Acute mesenteric ischemia; **CMI:** Chronic mesenteric ischemia; **CTA:** Computed tomography angiography; **ER:** Endovascular revascularization; **IMA:** Inferior mesenteric artery; **mg/l:** milligrams per litre; **MI:** Mesenteric ischemia; **mmol/l:** Millimoles per litre; **MOF:** Multiple organ failure; **MRA:** Magnetic resonance angiography; **NOMI:** Non-occlusive mesenteric ischemia; **OR:** Open revascularization; **PTA:** Percutaneous transluminal angioplasty; **RCT:** Randomized controlled trial; **RS:** Reperfusion syndrome; **SMA:** Superior mesenteric artery; **U/l:** Units per litre.

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