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Superior mesenteric artery stenosis treated with percutaneous transluminal angioplasty and stent placement

A narrowing of the Superior Mesenteric Artery (SMA) is usually asymptomatic since blood supply to the bowel is from three independent mesenteric arteries: SMA, Inferior Mesenteric Artery (IMA) and Celiac Trunk. Clinical symptoms of abdominal pain and weight loss occur usually when at least two out of three arteries are significantly narrowed or occluded. Less frequently, patients may also develop nausea, vomiting and diarrhea. There are also previously described cases of even asymptomatic patients with all three mesenteric arteries occluded (2). The regulation of blood supply to the bowel is influenced by many physiologic systems including hormonal, nervous and vascular with its numerous arteriole–venules connections. They all combine into a complex autoregulation system (5). The clinical status of afflicted patients depends on a capability of forming collateral blood supply to the bowel (13). The narrowing of SMA is usually suspected clinically when the above described symptoms occur. One of the first diagnostic imaging evaluations performed in these patients is color Doppler sonography (15). It may visualize the narrowing of the affected artery, although the sensitivity and specificity of the sonographic examination is often limited and depends on many variables. The gold standard for diagnosis of mesenteric arteries narrowing is angiography, both anterior-posterior and lateral projections, as well as during inspiration and expiration. The critical stenosis is considered to be greater than 70% of diameter narrowing. The significant stenosis involves the range of 50–70% of diameter narrowing, and greater than 10mmHg of pressure gradient across the site of narrowing. The narrowing of less than 50% is believed not to cause hemodynamically significant changes in blood flow across the arterial narrowing.

The SMA stenosis is usually caused by atherosclerotic disease, although fibromuscular dysplasia, Takayasu arteritis, aortic dissection and Sneddon's syndrome have all been previously described as alternative etiologies (12).

The technique of percutaneous treatment of SMA stenosis depends on anatomical consideration in a given patient, the experience of the radiologist performing the procedure, as well as equipment capabilities and local hospital policies. The first description of Percutaneous Transluminal Angioplasty (PTA) of SMA dates back to 1980 (4). The femoral artery is a preferred access site for the procedure, however, in case of a very acute angle of SMA with the aorta other approaches have been used including brachial or axillary arteries. The initial angiographic evaluation allows one to confirm the degree of stenosis and to establish its exact location. The stenosis is then crossed with a hydrophilic wire over which a balloon catheter is introduced. The appropriate size balloon is chosen, usually 5–8 mm in diameter. The successful angioplasty is

defined by a residual stenosis of less than 30% of lumen diameter. The results of PTA of SMA are very good. The technical success rate reaches 84%. The clinical improvement is seen in approximately 92% of technically successful procedures. The long-term clinical benefits are seen in approximately 75% of initially successful procedures (9,14). The results of treating ostial lesions (stenosis located within 5 mm from the aorta) are comparable to more distal narrowings within the superior mesenteric artery. These results are rather surprising, since in case of somewhat comparable in location and anatomy renal arteries, the difference in technical and clinical results is significantly in favor of distal lesions. One of the possible explanations for this phenomenon is the fact that stenosis of more distal SMA is occasionally caused by an external compression, for example by the median arcuate ligament. There is a general lack of data about a possible prophylactic angioplasty of asymptomatic narrowings of SMA. There is also lack of published data about endovascular treatment for an occlusion of SMA (8). In last few years there have appeared publications describing the use of stents in treating stenosis of SMA. These are, however, only case reports, rather than prospective studies, describing using either Palmaz or Wallstent devices.

CASE REPORT

A 62-year-old patient presented typical symptoms of postprandial abdominal pain and weight loss over last two years. The color Doppler sonography did not allow visualizing the SMA enough to evaluate it for patency and stenosis. The color Doppler sonography with the use of an intravenous contrast agent (Levovist, Schering) did not allow the evaluation of SMA or celiac trunk narrowings. Abdominal aortogram from a femoral approach, in anterior-posterior and lateral projections, during inspiration and expiration showed two concentric significant stenoses (Fig.1,Fig.2).One was in the SMA, 7 mm away from the ostium, and the other an ostial lesion in the celiac trunk. Both of these narrowings did not change in degree during different phases of respiration. Inferior mesenteric

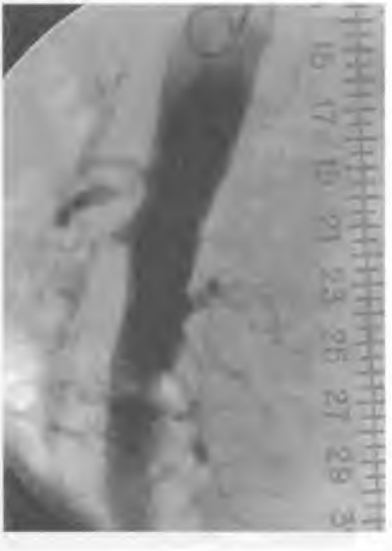

Fig.1. Abdominal aortogram showing two concentric significant stenoses

Fig.2. Abdominal aortogram with calibration catheter

artery was correct. The PTA was then performed at both lesions using a long introducing sheath, hydrophilic wire and a 6 mm balloon catheter. The patient received 3,000 units of an intravenous Heparin. The angioplasty resulted in a minimal widening of both stenoses. We were attacking both lesions at the same time, because the first artery (SMA) did not respond to PTA.

Fig.3. Balloon catheter (Ø7mm)

A stent was then deployed across the narrowing. We used a 35 mm long balloon expandable Perflex stent mounted on a 7 mm balloon catheter (Fig.3). The follow up angiography showed no residual stenosis across the stented lesion, with full expansion of the balloon, nor any evidence for occlusion of any SMA branches (Fig.4). This time, the color Doppler sonography with an intravenous contrast agent allowed to sufficiently visualize the dilated SMA. The next day the patient reported resolution of the postprandial pain. The clinical follow-up of the patient consisted of history and physical examination, targeted abdominal radiographs in anterior-posterior and lateral projections, as well as color Doppler sonography imaging every six months. On the three-year follow-up patient remained asymptomatic and color Doppler sonography examination was normal.

Fig. 4. Angiograhpy after implantation of a Perflex stent
A. A-P; B. Lateral view

DISCUSSION

The standard treatment for SMA stenosis had been a surgical repair, since it was first described in 1958 (11). This method carries 3–20% mortality rate and 15% rate of occlusion of the treated artery after 38 months of follow-up (1,10). In 1980, there was a first described treatment of SMA stenosis with a PTA. This expanded option for treatment of SMA stenosis is advised especially in patients who may be poor surgical candidates (4). The development of endovascular methods with stent placement adds is another option in patients who may not respond sufficiently to angioplasty alone (3,6,7,11,12). This method is not, however, well established and the results are not forthcoming yet, because the prospective studies are not available, and they may not be easily so since this disorder is not that common. In order to obtain any meaningful data one needs a significant number of patients randomized to at least two methods of treatment and a significant period of follow-up. This would be almost impossible with this rare entity, unless a global, multi-center study is designed. The preliminary results of angioplasty and stent placement are encouraging, however, and one should certainly apply this method of treatment in appropriately

selected patients. The described case of treatment for SMA and celiac trunk stenosis is to add to an overall experience with endovascular repair of mesenteric arteries narrowing.

The color Doppler sonography used in this case did not help in assessment of mesenteric arteries stenoses even with use of intravenous contrast agent. We believe that the reason for this failure may have been in an insufficient preparation of the patient for this examination. Prior to the examination, the patient was 24 hr NPO, and we also used dimeticone, and it still was not sufficient for a good sonographic examination. We believe it may have been caused by functional disturbances of the digestive system with poor arterial supply. Sonography of mesenteric arteries is not a gold standard and sometimes carries many errors and is depended on several factors.

The angiographic evaluation during the angioplasty was also not unequivocal. The narrowing of SMA had some characteristic of the median arcuate ligament compression since it easily dilated with balloon angioplasty, however, it returned to its original stenosis immediately after deflation of the balloon. Yet, it lacked other characteristics of an asymmetric narrowing and significant change with respirations. Placement of a stent in case of the median arcuate ligament extrinsic compression may lead to damage of the stent integrity and a subsequent occlusion of artery. In the following 3 months of radiographic follow-up we did not notice any change in the stent structure.

Using color Doppler sonography as a follow-up method to assess stent patency is also somewhat limited. The examination is difficult due to motion artifacts as well as distortions caused by a metallic structure of the stent.

Summing up, we would like to emphasize that the endovascular treatment of a chronic bowel ischemia described in this report was clinically successful and minimally invasive. However, lack of long-term results and a small number of patients is a significant limitation of the described treatment method, and at the same time it opens a discussion for further possible studies.

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SUMMARY

We present a case of a man with concentric significant stenoses in the superior mesenteric artery and the celiac trunk, in whom percutaneous transluminal angioplasty did not provide sufficient technical result. We report the successful use of balloon expandable Perflex stent to treat superior mesenteric artery stenosis.

Zwężenie tętnicy krezkowej górnej, leczone przy użyciu angioplastyki balonowej i stentu

Praca zawiera opis przypadku mężczyzny z krytycznym zwężeniem tętnicy krezkowej górnej oraz pnia trzewnego, u którego leczenie metodą angioplastyki balonowej nie przyniosło zadowalającego wyniku. Zastosowana proteza wewnątrznaczyniowa (stent) rozprężalna balonem pozwoliła na uzy-skanie poszerzenia tętnicy krezkowej górnej i poprawę stanu klinicznego chorego.