

# Percutaneous transluminal angioplasty and stenting in the management of chronic mesenteric angina: A single center experience

Tixon Thomas, Nazar P Kader, Nirmal K Prabhu, Rajesh Kannan, Sreekumar K Pullara, Srikanth Moorthy

Department of Radiology, Amrita Institute of Medical Science, Amrita Vishwavidyapeetam, Kochi, Kerala, India

**Correspondence:** Dr. Tixon Thomas, Department of Radiology, Amrita Institute of Medical Science, Amrita Vishwavidyapeetam, Kochi - 682 041, Kerala, India. E-mail: tixonthomas@gmail.com

## Abstract

**Introduction:** The objective of our study was to review the results of percutaneous angioplasty (PTA)/stenting in the treatment of patients who presented with symptoms and angiographic findings of chronic mesenteric ischemia (CMI). **Materials and Methods:** We performed a retrospective analysis of 13 consecutive patients from a single institution who underwent PTA/stenting for the treatment of symptoms suggestive of CMI. **Results:** All 13 patients in our study were men, and most common presenting symptoms were weight loss and postprandial pain. Atherosclerosis was the most common cause. PTA and stenting was performed in 9 patients and PTA alone was done in 4 patients. Primary technical success rate was 92% with complete resolution of symptoms within 2 weeks in all patients. No statistical difference was noted in primary clinical success rate based on the number of vessels treated or the method of treatment. However, in patients whom SMA was treated had longer duration of symptom-free survival as compared to other vessels. **Conclusion:** PTA and stenting are very effective therapeutic options for patients presenting with CMI symptoms. It should be considered as the first-line of management in such patients.

**Key words:** Angioplasty; chronic mesenteric ischemia; inferior mesenteric artery; stenting; superior mesenteric artery

## Introduction

Chronic mesenteric ischemia (CMI) has been a recognized entity since 1936.<sup>[1]</sup> Among the atherosclerotic ischemic disorders, it accounts for less than 2% of the revascularization procedures.

The disease usually manifests in patients above 60 years of age. It is typically revealed by abdominal pain after consuming food that lasts for 1–4 h. Because of abundant

mesenteric collateral circulation, gradual and progressive stenosis of one or more major mesenteric vessels is generally well tolerated;<sup>[2,3]</sup> however, when residual mesenteric flow is unable to support the physiologic demand of gastrointestinal (GI) tract, mesenteric ischemia occurs, and if left untreated, can lead to mesenteric infarction, which has a grim prognosis. Early treatment of symptomatic CMI is therefore mandatory.

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

**For reprints contact:** reprints@medknow.com

**Cite this article as:** Thomas T, Kader NP, Prabhu NK, Kannan R, Pullara SK, Moorthy S. Percutaneous transluminal angioplasty and stenting in the management of chronic mesenteric angina: A single center experience. *Indian J Radiol Imaging* 2016;26:460-5.

### Access this article online

#### Quick Response Code:



**Website:**  
www.ijri.org

**DOI:**  
10.4103/0971-3026.195794

Conventional treatment options such as open endarterectomy/bypass surgery has high mortality and morbidity rate.<sup>[2,4,5]</sup> Endovascular treatment of CMI has yielded good results<sup>[6-8]</sup> since it was first performed in 1980.<sup>[9]</sup>

The low incidence of CMI explains the small number of patients in published series as well as the difficulties encountered in determining the efficacy and defining the role of endovascular treatment.

The purpose of this article is to review our experience with percutaneous angioplasty (PTA) and stenting in the treatment of patients with symptoms characteristic of CMI.

## Material and Methods

We performed a retrospective analysis of patients diagnosed with symptoms suggestive of CMI who had undergone endovascular treatment in our institute between January 2006 to December 2014.

The electronic medical record (EMR) and picture archiving and communication system (PACS) were used to identify patients with CMI who had undergone percutaneous intervention. Follow up data was obtained from EMR and in some cases from telephonic interviews of patients.

The clinical symptoms of postprandial abdominal angina and weight loss combined with computed tomography (CT) angiogram or digital subtraction angiogram (DSA) findings of critical stenosis of coeliac axis, superior mesenteric artery (SMA) and/or inferior mesenteric artery (IMA), in the absence of any other cause for abdominal pain on CT was used to make a definitive diagnosis of CMI. We considered more than 70% narrowing of an involved vessel in the absence of collaterals from other splanchnic arteries as critical stenosis.

Patients with discordance between imaging and clinical findings and patients with evidence of acute mesenteric ischemia were excluded from the study.

A high brachial approach was used in most patients to take advantage of the downward angulation of the mesenteric arteries. A 45 cm 6F multipurpose sheath (Cook, Bloomington) was placed in the upper abdominal aorta, and the stenotic vessel was engaged with a 4F vertebral curve Glide (Terumo, Japan) catheter. The stenosis was crossed with an angled 035° Terumo wire. It was then exchanged for an exchange length Rosen wire. In one of the patients, where the stenosis was very tight, we used 014 "Microwire Microcatheter system (Progreat). Balloon expandable stents [Express (Boston scientific)/scuba (Medtronic)] were deployed in all patients who received stents. In 4 patients, the lesions were only angioplastied. The appropriate dimension of the stent or balloon was determined from

the DSA images. Finally, an aortogram was obtained to document the target vessel patency and observe the adequacy of the mesenteric circulation. Angioplasty alone was performed in the early phase of our experience, when balloon expandable stents were expensive and not freely available.

Technical success was defined as a residual stenosis of 30% or less, as estimated on the post-procedure angiogram. Pressure gradient measurements across the lesions were not performed. Technical success was calculated on a per vessel basis. Clinical success was defined as complete reduction or significant improvement in symptoms such that no further invasive treatment was necessary. Clinical success was calculated on a per patient basis.

## Statistics

Binomial proportion test was used to test whether proportions were 0 or 0.5; Kaplan-Meier method was used to estimate the failure/recurrence rate. Log rank test was used to test the difference in time to failure distribution between angiogram results and recurrence. The Statistical Package for the Social Sciences (SPSS) software was used for statistical analysis.

## Results

All the 13 patients in our study were men whose age ranged from 24 to 69 years [Table 1]. Risk factors included tobacco use (55%), hypertension (40%), and diabetes (30%). Common symptoms were weight loss (100%), with a median weight loss of 7 Kg, and postprandial pain (100%). Other comorbidities were coronary artery disease (40%) and peripheral vascular occlusive disease (PVOD)(30%).

Based on the age and imaging findings, atherosclerosis was the most common cause. Arteritis was encountered in 1 patient and 1 patient had a prothrombotic state.

Celiac artery was occluded in 42.2% and stenosed in 53.8%, SMA was occluded in 69.2% and stenosed in 30.8%, IMA was occluded in 46.2% and stenosed in 46.2%.

A single vessel was treated in 10 patients, and 3 patients had treatment for two vessels each. PTA and stenting was performed in 9 patients (10 vessels) and PTA alone was done in 4 patients. Celiac artery was treated in 5 patients [Figure 1A-D], SMA in 3 patients [Figure 2A-D], IMA in 3 patients [Figure 3A-D], SMA and IMA was treated in 1 patient, and left common iliac artery was treated in 1 patient.

Primary technical success rate was 92% with complete resolution of symptoms within 1 week in 8 patients and within 2 weeks in 4 patients.

**Table 1: Patients data list**

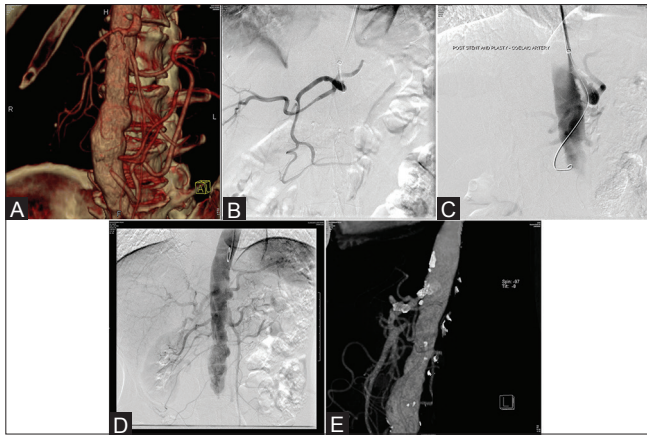
Patient No	Age/sex	Clinical presentations and co morbidities	Angiographic findings	Management	Immediate results	Follow-up
1	45/M	Wt loss (4 kg), post prandial pain, smoker, no other comorbidities	Coeliac and sma short segment occlusion .Ima stenosis	Ima stenting	8 Days hospital admission, symptomatically better within 1 wk	Asymptomatic after 36 months
2	47/M	Wt loss (6 kg), post prandial pain, smoker, no other comorbidities	Coeliac-stenosis, sma long segment occlusion, ima mild stenosis	Coeliac stenting	17 Days stay, better after 3 wks	Asymptomatic after 48 months
3	52/M	Post prandial pain, cad -post ptca	Coeliac occlusion, sma focal non osteal stenosis, imaosteal stenosis	Sma and ima stenting	9 Days stay, better after 1 wk	Asymptomatic after 48 months
4	45/M	Post prandial pain, smoker, pvod b/l lower limb	Coleiac osteal stenosis, sma long segment occlusion, ima occluded	Coleiac angioplasty	7 Days stay better after 1 wks	Totally asymptomatic for 36 months, had a episode of abdominal pain after 3 yrs which was managed conservatively
5	58/M	Wt loss (5 kg) smoker, diabetic	Coeliac and sma occluded, ima stenosis	Ima stented	7 Days stay better after 1 wks	Asymptomatic after 5 yrs
6	63/M	Wt-loss (7 kg) pvod cad	Coleiac osteal stenosis, sma non osteal stenosis, ima occluded	Sma plasty	10 Days stay better after 2 wks	Asymptomatic after 9 yrs, has pvod symptoms
7	65/M	Wt loss (6 kg), post prandial pain, dm , cad	Coleiac ostial stenosis, sma occlusion, ima stenosis	Coeliac stenting, ima failed	8 Days stay, better after 1 wk	Asymptomatic for 12 months had abdominal pain , after one year, which was managed conservatively
8	64/M	Wt loss (4 kg) post prandial pain, cad, dm, smoker	Coeliac stenosis, sma occlusion, ima occlusion (coronary ballon)	Coeliac stented	7 Days stay, better after 1 wk	Asymptomatic after 3 yrs
9	57/M	Wtloss (14 kg) post prandial pain pvod smoker	Coeliac occluded, sma occluded, ima stenosis- scuba stent	Ima stenting	7 Days stay, better after 1 wk	Asymptomatic after 2 yrs
10	63/M	Wt loss (10 kg) pppain, dm ht	Coeliac stenosed sma occluded, ima occluded	Coeliac stented via femoral route	18 Days stay better after 3 wks	Asymptomatic after 14 yrs
11	55/M	Wt loss-(9 kg) renal stenting, dm, ht	Coeliac stenosis, sma occlusion, ima stenosis arch of riolan was reformng from rt iliac with contribution from left	Ima attempted but failed , lt iliac stenosis was stented	9 Days stay better after 2 wks	Asymptomatic for 7 yrs , admitted in june 2015 with abdomainl pain, which was managed conservatively
12	33/M	Ppd, wt loss-(10 kg), known case of takayasu	Coeliac occlusion , sma long segment stenosis, ima and aortic occlusion	Sma plasty	Expired after 1 month	Expired after 2 months of procedure
13	24/M	Ppd, wt loss (5 kg), prothrombotic disorder	Coeliac occlusion , sma stenosis, ima normal	Sma plasty	10 Days stay better after 2 wks	Asymptomatic after 3 yrs , on warfarin

The patient who did not have any clinical improvement had Takayasu arteritis. He had near total occlusion of all three mesenteric vessels as well as significant infrarenal aortic stenosis. SMA angioplasty was successfully performed, however, the patient died of cardiac arrest after 2 weeks. Follow-up data was available in all remaining 12 patients. Mean duration of hospitalization was 10 days. No major procedure-related complication occurred. There was no mortality in the follow-up period. Mean duration of follow up was 20 to 108 months. All these patients experienced marked clinical improvement after revascularization. Four patients had mild recurrent abdominal pain, which could be managed at a local community hospital. None of the patients required re-intervention in the follow-up period.

One patient had occlusion of SMA and celiac axis with a tight stenosis of IMA ostium and a stenosis of the left

common iliac artery. Owing to aortic ectasia, the IMA could not be accessed. The IMA and, in turn, the arcade of Riolan were seen to be filling retrograde from the left internal iliac artery. The left common iliac artery was then stented since it was critically stenosed, with the intention of improving the internal iliac flow. The patient's symptoms resolved and he continues to be asymptomatic.

There was no statistical difference in the primary clinical success rate based on the number of vessels treated. Though the cohort is very small, clinical success appeared to be independent of the method of treatment (PTA vs Stent). Whether the SMA was treated or not, also did not seem to make a difference in the primary clinical success rate. One of the patients who developed recurrent symptoms had fracture of the stent demonstrated on CTA. However,



**Figure 1 (A-E):** (A) CTA showing coeliac origin stenosis, long segment SMA occlusion and osteal stenosis of IMA arising from ectatic segment of Aorta (B) DSA obtained after crossing the coeliac stenosis from brachial approach (C) Post stent angiogram showing good filling of coeliac axis and SMA (D) Final Aortogram post stenting showing good filling of coeliac axis (E) Follow up CTA performed after 13 months shows fracture of the stent with a distally migrated portion, Residual stenosis is seen

the stent was patent and the patient could be managed conservatively [Figure 1E].

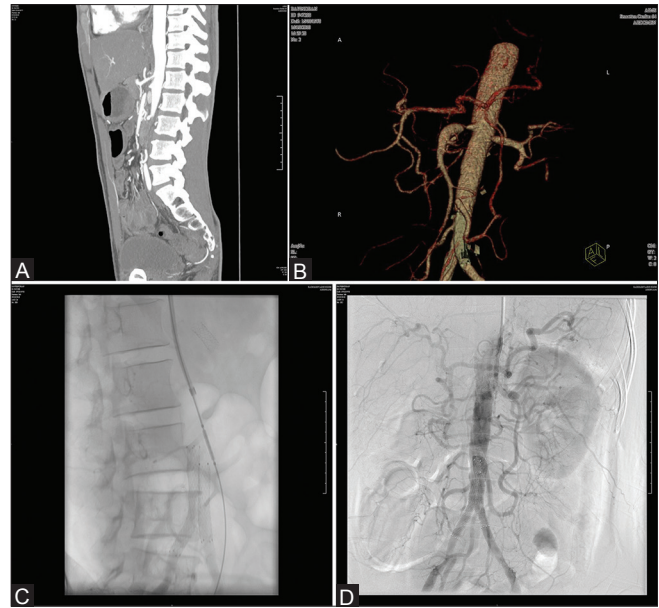
## Discussion

Re-establishment of adequate mesenteric perfusion should be done as early as possible in patients with CMI. Otherwise, it can progress to intestinal infarction which has a very grim prognosis. The primary goal of mesenteric revascularization is relief of abdominal pain, improvement of nutritional status, and prevention of intestinal infarction.<sup>[9]</sup> In our series, we were able to achieve these objectives in 12 out of 13 patients. Only 4 patients had recurrent mild abdominal pain which could be managed conservatively.

Conventional surgical revascularization including open endarterectomy and bypass surgery have shown very good long-term results in several published series. A 9-year assisted primary graft patency rate of 79% has been reported. However, surgery has a 15–47% morbidity and up to 17% mortality rate.<sup>[9–11]</sup>

Since it was first reported in 1980,<sup>[4]</sup> many studies have confirmed the utility and effectiveness of PTA and stenting in treating symptomatic patients with CMI. The reported technical success rate ranges from 82% to 10%. Primary clinical success rate was approximately 95% and primary patency rates observed were 75–85%. Adverse event rate ranges 0–29% in various studies, with puncture site complications being the most common.<sup>[12–15]</sup>

The technical and clinical success rates observed in our series are comparable to previous studies. We did not



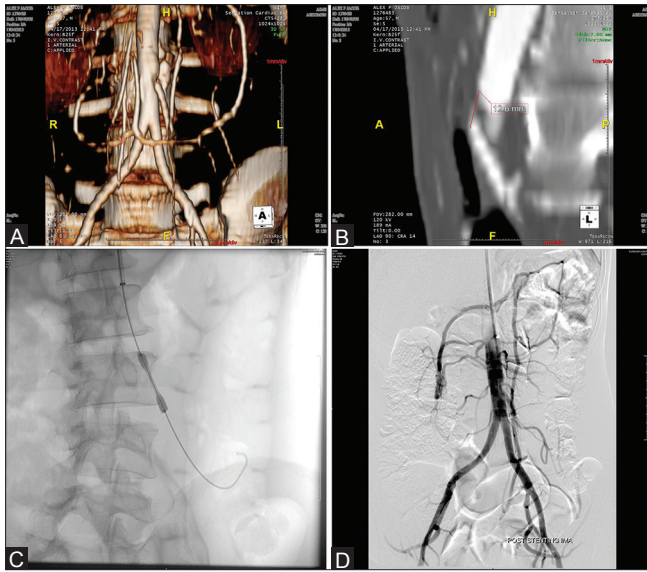
**Figure 2 (A-D):** (A) Sagittal MIP showing short segment occlusion of SMA beyond ostium. Tight stenosis of coeliac Axis also seen. (B) CTA VRT image showing tight IMA stenosis. coeliac also stenosed (C) Lateral view showing Balloon Expandable stent in place across lesion. Bilateral Iliac stents and a renal stent from a previous procedure are also seen. (D) Post stent angio showing good filling of mesenteric circulation

encounter any significant complication, and re-intervention was not required in any patient.

Compared to surgical series,<sup>[9,10]</sup> the mortality/morbidity, days spent in hospital, and recurrence rates were lower in our series. Both the retrospective nature of our study and the reliance on patient symptoms as a surrogate marker for vessel patency on follow-up, limit the reliability of our results. On the other hand, symptomatic CMI is a relatively rare entity and all reported series have these limitations.

In many studies,<sup>[13,14]</sup> use of stents was restricted to instances where results of angioplasty were unsatisfactory. We preferred to primarily deploy stents in all patients with osteal stenosis and used stents in patients with significant residual stenosis post angioplasty. Post-angioplasty arterial dissection in a patient with a single patent mesenteric vessel can have disastrous consequences while primary deployment of a balloon expandable stent, we feel, is a safer option. In our series, stents were used in 10 vessels. There was no difference between the stent and angioplasty alone groups in terms of both short and long-term clinical success. However, the total number of patients is not sufficiently large to derive any definite conclusions, which can influence treatment decisions in the future.

Majority of patients had occlusion of two vessels and critical stenosis of the third vessel at the time of presentation. It appears that, in many patients, symptoms arise only when



**Figure 3 (A-D):** (A) CTA showing stenosis of origin of IMA ,Note the hypertrophied arcade of Riolan, Coeliac axis and SMA were occluded (B) MIP images showing the focal osteal stenosis (C) 4mm x 3.7 cm Balloon expandable stent being delivered from brachial approach (D) Post stent angiogram showing restoration of lumen and good distal run-off

there is significant flow reduction in the last remaining vessel. In this scenario, we simply chose the stenosed vessel for treatment because it is easier to access than an occluded vessel. The IMA was the target vessel in 4 patients. In these patients, the IMA was large and was found to connect to a hypertrophied arcade of Riolan which sustained the entire mesenteric circulation. Our results suggest that adequate revascularization of any one of the three vessels is sufficient to achieve clinical success provided the distal circulation fills via this major collateral.

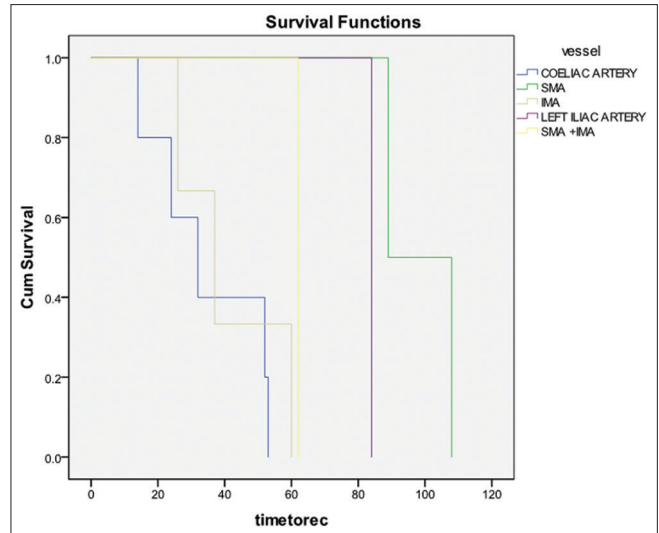
Treatment of the superior mesenteric artery stenosis or occlusion has been emphasized as essential for clinical success in some studies.<sup>[9]</sup> In our study, although the vessel treated did not affect the primary clinical success rate, on follow-up, it was found that patients who had undergone SMA plasty/stenting had longer duration of symptom-free survival [Figure 4].

### Conclusion

In summary, our results show that PTA with or without stent are very effective therapeutic options for patients with symptomatic CMI. The high success rates and the absence of major morbidity compared to surgical techniques makes percutaneous intervention the best first-line therapeutic option in these patients.

### Acknowledgement

We thank Dr Teena Mary Joy for assisting in the statistical analysis and all our patients who were part of our study for whole-hearted cooperation.



**Figure 4:** Kaplan Meir Curve Showing Survival Functions In Relation To Type Of Vessel Treated

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

### References

- Dunphy J. Abdominal Pain of vascular origin. *Am J Med Sci* 1936;192:109-12.
- Allen RC, Martin GH, Rees CR. Mesenteric Angioplasty in the treatment of Chronic Intestinal ischemia. *J Vasc Surg* 1996;24:415-23.
- Mikkelsen WP. Intestinal Angina: Its surgical significance. *Am J Surg* 1957;94:262-9.
- Kasirajan K, Dhara PJ, Gray BH. Chronic mesenteric Ischemia: Open surgery Versus Percutaneous Angioplasty and stenting. *J Vasc Surg* 2001;33:63-71.
- Rose SC, Quigley TM, Raker EJ. Revascularization for chronic mesenteric Ischemia: Comparison of operative arterial bypass grafting and percutaneous transitional angioplasty. *J Vasc Interv Radiol* 1995;6:339-49.
- Van Wanroji J, Van Peterson AS, Huisman AB. Endovascular treatment of chronic splanchnic syndrome. *Eur J Vasc Endovasc Surg* 2004;28:193-200.
- Sarac TP, Altinel O, Kashyap V, Bena J, Lyden S, Srivastava S, *et al.* Endovascular treatment of stenotic and occluded visceral arteries for chronic mesenteric Ischemia. *J Vasc Surg* 2008;47:485-91.
- Foley MI, Moneta GL, Abou-Zamzam AM Jr, Edwards JM, Taylor LM Jr, Yeager RA, *et al.* Revascularization of the superior mesenteric artery alone for treatment of intestinal ischemia *J Vasc Surg*. 2000;32:37-47.
- Furrer J, Gruntig A, Kugelmeier J, Goebel N. Treatment of abdominal Angina with percutaneous dilatation of an arteria mesenterica stenosis. Preliminary communication. *Cardiovascular Interv Radio* 1980;3:43-4.
- Hollier LH, Bernatz PE, Pairolero PC, Payne WS, Osmundson PJ. Surgical management of chronic mesenteric Ischemia: A reappraisal. *Surgery* 1981;90:940-6.
- Calderon M, Reul GJ, Gregoric ID, Jacobs MJ, Duncan JM, Ott DA, *et al.* Long term results of the surgical management of symptomatic chronic intestinal ischemia. *J Cardiovasc Surg* 1992;33:723-28.

12. Hallisey MJ, Deschaine J, Illescas FF, Sussman SK, Vine HS, Ohki SK, *et al.* Angioplasty for treatment of visceral Ischemia. *J Vasc Interv Radiol* 1995;6:785-91.
13. Matsumoto AH, Tegtmeier CJ, Fitzcharles EK, Selby JB Jr, Tribble CG, Angle JF, *et al.* Percutaneous transluminal angioplasty of Visceral arterial stenosis: Results and long term clinical follow-up. *J Vasc Interv Radiol* 1995;6:165-74.
14. Matsumoto AH, Angle JF, Spinosa DJ, Hagspiel KD, Cage DL, Leung DA, *et al.* Percutaneous transluminal Angioplasty and stenting in the treatment of Chronic mesenteric ischemia. *J Am Coll Surg* 2002;194:21-31.
15. Sheeran SR, Murphy TP, Khwaya A. Stent placement for treatment of mesenteric artery stenosis or occlusion. *J Vasc Interv Radiol* 1999;10:861-7.