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# Enlarging Superior Mesenteric Artery Aneurysm Successfully Treated By Selective Angiography And Embolization With Terumo Hydrocoil: A Case Report And Review Of The Literature

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## Abstract

### “Background”

Aneurysms and pseudo-aneurysms of the superior mesenteric artery are rare and potentially lethal. Such aneurysms may be found incidentally or they may be diagnosed after complications have occurred.

### “Aims”

To report a case of Superior Mesenteric Artery Aneurysm, diagnosed incidentally, and successfully treated by Selective Angiography and Embolization

To review the literature on Superior Mesenteric Artery aneurysms

### “Case Report”

A lady who has been followed up for hepatitis C and cirrhosis of liver had MRI scan of the abdomen which showed a 1.9 cm lesion in her liver which was consistent with hepato-cellular carcinoma. She had previously had ultrasound scan of her liver and liver biopsy which confirmed cirrhosis of liver and no evidence of malignancy. She successfully underwent 3 sections of selective angiography and embolization of the hepatocellular carcinoma with disappearance of the tumour. During the process of the embolization of the hepato-cellular carcinoma the patient's previous MRI scans and CT scans were reviewed and these revealed that the patient had a Superior Mesenteric Artery Aneurysm which had enlarged over a period of 3 years. Selective Superior Mesenteric Artery Angiography and embolization of the aneurysm was successfully carried out using Terumo hydro-coil. Literature review revealed that cases of Superior Mesenteric Artery Aneurysms are rare and they have been treated traditionally by means of open surgery however, some cases of Superior Mesenteric Artery Aneurysms have been treated recently by embolization but coil migration has been reported.

### Conclusions:

With developments in interventional radiology and coil technology selective superior mesenteric artery angiography and embolization of superior mesenteric artery aneurysm has become a safe alternative modality of treatment instead of open surgery.

This technique has the added advantage of: avoiding general anaesthesia and laparotomy; being less invasive; being associated with low morbidity; short period of hospitalization.

The Terumo hydrocoil which is now available for such embolizations has the added advantage of expanding to fill up the aneurismal cavity up to 5.8 times more than conventional coils and it does not dislodge easily.

**Key Words:** Superior Mesenteric Artery Aneurysm; Selective Angiography; Embolization; Azur Terumo Hydrocoil;

## Introduction

Superior Mesenteric Artery Aneurysm (SMAA) is rare; being observed in one in every 12,000 autopsies, only 5.5% of 8% of cases of visceral aneurysms and less than 0.5% of all intra-abdominal aneurysms are Superior Mesenteric Artery Aneurysm (SMAA) [1, 2, 3]. Superior Mesenteric Artery Aneurysm (SMAA) is the third most common splanchnic aneurysm [2, 3]. The first reported case of treatment for Superior Mesenteric Artery Aneurysm (SMAA) was an open surgical treatment but since then interventional radiology has developed to the extent that it is now possible to treat Superior Mesenteric Artery Aneurysm by selective Angiography and Embolization of the aneurysm. We report a case where a patient who previously successfully underwent selective angiography and embolization for a small hepatocellular carcinoma also underwent successful selective angiography and embolization of her expanding Superior Mesenteric Artery Aneurysm. Literature has also been reviewed on Superior Mesenteric Artery Aneurysm.

## Case Report

A 53-years-old lady has been under the care of a gastro-enterologist for about 11 years because of cirrhosis, chronic hepatitis C (genotype 3a,

homozygous for HFE gene, high viral load) and haemochromatosis (homozygous C282Y) which was diagnosed 10 years ago. She has been having resection at regular intervals. Ten years earlier, she also had CT scan guided liver biopsy of her liver which only showed micro-nodular cirrhosis and a lot of siderosis but no evidence of liver malignancy.

She has a history of heavy alcohol drinking, severe mental illness (anxiety, depression and schizophrenia).

She had both ultrasound scan and CT scans at her 7th year follow-up to assess her liver. The ultrasound scan showed: a slightly enlarged liver which had a coarse heterogenous texture; the portal vein was normal; the spleen was normal. The CT scan was reported to show normal liver texture with homogenous contrast enhancement and no mass lesions.

At her 8th year follow-up (about 3 years ago) she had an MRI scan of her abdomen which showed a 1.9 cm focal lesion in the postero-superior segment of the right lobe of her liver with low signal intensity on T1W imaging and high signal intensity on T2W image and showing arterial phase enhancement and early wash-out. The portal vein was patent and normal. The spleen which measured 13.5 cm was normal, there was no ascitis, and other abdominal viscera were normal. The 1.9 cm focal lesion was diagnosed as being consistent with a hepato-cellular carcinoma.

The MRI scan was reviewed at a Multi-Disciplinary Team meeting and the diagnosis of Hepatocellular carcinoma was confirmed. Management options for the lesion were discussed and these included chemo-embolization and ablation.

She had one session of selective angiography and chemo-embolization as treatment for her hepatocellular carcinoma. A subsequent follow-up CT scan showed other small lesions in the liver consistent with multiple hepato-cellular carcinomas and because of this she under-went two more sessions of chemo-embolization for the lesions. She had regular follow-up CT scans which revealed that her liver lesions had all disappeared and there was no evidence of any residual or recurrent hepato-cellular carcinoma. However, during the process of her follow-up CT scans it was noted that she had all along had an aneurysm of the superior mesenteric artery which had not been commented upon earlier and further more the aneurysm had gradually enlarge (see illustrations 1 to 3). Considering the fact that the superior mesenteric artery aneurysms was noted to be enlarging it was felt that its surgical treatment was necessary. The aneurysm was successfully treated by selective superior mesenteric artery angiography and embolization with pushable Terumo hydrocoils with

obliteration of the aneurismal dilatation (see illustrations 4 and 5) and no post-embolization problem of bowel ischaemia or coil dislodgement. The patient has remained well 3 months after her embolization procedure.

## Discussion

Superior Mesenteric Artery Aneurysm (SMAA) is extremely rare and this has been observed in one in every 12,000 autopsies; only 5.5% to 8% of cases of visceral aneurysm are Superior Mesenteric Artery Aneurysm [1].

Superior Mesenteric Artery Aneurysm (SMAA) is the third most common splanchnic aneurysm, accounting for splanchnic aneurysms and Mycotic aneurysm was first described by Osler in 1885 [4]. The classical description was that of infective aneurysms secondary to rheumatic endocarditis and this did not imply a fungal aetiology; in view of this the term "Mycotic" has been regarded a misnomer. The terminology of infective aneurysm has been recommended [5].

Aneurysms affecting the proximal 5 cm of the superior mesenteric artery are usually mycotic (inflammatory) and inflammatory process accounts for 58 to 63% of cases [6]. Infection has been reported to be caused by non-hemolytic streptococcus, pursuant to left-sided endocarditis. Staphylococcal organisms ensuing non-cardiac septicaemia have been reported [2].

Syphilitic aneurysms have not been noted in recent reports. In patients with infective endocarditis and mycotic aneurysm, there is a 4% to 6% risk of superior mesenteric artery involvement [7].

Dissecting aneurysms with medial defects are rare and they have been reported to occur in 5% of cases [2, 6]. Atherosclerosis accounts for 20% of superior mesenteric artery aneurysms. Trauma is a rare cause of superior mesenteric artery aneurysm, and this accounts for 1% to 2% of cases.

Most Superior mesenteric artery aneurysms are symptomatic. The most common presenting symptom of superior mesenteric artery aneurysm is intermittent abdominal discomfort which eventually leads to persistent severe epigastric pain [2]. The mechanism of the epigastric pain has been based upon the following postulates:

\* It has been stated that expansion of the aneurysm with dissection or propagation of an intra-luminal thrombus beyond the middle colic and pancreatico-duodenal branches of the Superior mesenteric artery results in occlusion of collateral flow from the celiac and inferior mesenteric arteries.

\* Mobilization of the thrombus and further intermittent

thrombus formation as result of flow stasis beyond the main thrombus occludes the collateral circulation and causes intestinal angina [2, 3].

Nausea, vomiting, jaundice, hemobilia and gastro-intestinal bleeding may occasionally occur. In 50% of cases a pulsatile mass is palpable.

Clinical findings, haematological investigations, echocardiography and ultra-sound scan may be helpful in the diagnosis of the entity, however, CT scan, and Angiogram would confirm the diagnosis [8]. MRI scan would also confirm the diagnosis.

Superior mesenteric artery aneurysms must be treated surgically in the absence of complicating factors because of the high risk of spontaneous rupture and thrombosis which occur in up to 50% of cases and intra-operative death rate amounts to 30% [2, 3, 9, 10, 11].

The type of treatment depends on the aetiology of the aneurysm and upon intestinal viability. DeBakey and Cooley [12] in 1953 reported the first surgical treatment for superior mesenteric artery aneurysm.

The surgical correction consisted of proximal and distal ligation with resection of the area affected by the aneurysm. Simple ligation proximally and distally to the aneurysm with intra-operative assessment of intestinal viability is the treatment of choice in the absence of infection.

The following general approach to the management of SMAA has been recommended:

- \* Mycotic aneurysm should be treated by aneurysm resection, debridement of the infected area and with broad spectrum antibiotics [1]

- \* Aneurysmorrhaphy can be used for saccular aneurysm and disease free arteries, thus preserving the lumen

- \* Revascularization is indicated if there is visceral ischemic involvement after arterial ligation

- \* The use of prosthesis is prohibited in the presence of infection. In such cases saphenous vein graft is recommended.

- \* Aorto-mesenteric bypasses are less frequently used [13].

Surgery may be performed via a trans-mesenteric approach however proximal aneurysms require either a left retro-peritoneal approach with medial reflection of the colon, pancreas, and spleen, or trans-scleral approach [2, 3].

The common treatment methods that have been used are aneurysmorrhaphy and ligation. Collateral flow of blood from the inferior pancreatico-duodenal and middle colic arteries help to improve the outcome, hence temporary superior mesenteric artery occlusion and observation of the small bowel for viability has been recommended by Zelenock and Stanley [2].

Zelenock and Stanley [2] as well as Zimmerman-Klima and associates [3] stated that aneurysmectomy may be hazardous in view of the close proximity of the superior mesenteric vein and pancreas, and serious risk of bleeding from such a high-flow system with good collaterals.

Zimmerman-Klima and associates [3] as well as Komori and associates [11] stated that in view of the fact that superior mesenteric artery remains critical in chronic mesenteric ischemia, and subsequent procedures may threaten collateral circulation, arterial reconstruction with inter-position graft or aorto-mesenteric by-pass has been preferred. Zelenock and Stanley [2] suggested that after the operation, if a mycotic aneurysm is suspected, a long-term antibiotic therapy must be given. Despite the fact that prosthetic grafts used to be recommended in order to avoid potential kinking of saphenous vein grafts, taking into consideration the high risk of mycotic aetiology increases the risk of graft infection, Zelenock and Stanley [2] as well as Zimmerman-Klima and associates [3] favoured saphenous vein by-pass with preservation of graft configuration. Zimmerman-Klima and associates [3] demonstrated that passing the saphenous- vein-graft superiorly behind the left renal vein before angling anteriorly to anastomose with the superior mesenteric artery was a satisfactory way to avoid kinking. Resection of the aneurysm and reconstruction of the superior mesenteric artery by means of direct anastomosis to the aorta has also been performed as an alternative treatment modality [11].

Yuksel and associates [14] reported a 38-years-old woman with mid-epigastric pain, diarrhoea, weight loss who was found to have superior mesenteric artery aneurysm. She underwent resection of the superior mesenteric artery aneurysm and primary repair of the artery. Pathological examination showed degenerative atherosclerotic changes, marked medial and intimal thickening, and vegetations. Microbiological studies demonstrated *Streptococcus viridians* as the infecting organism of the mycotic aneurysm. The patient made a good recovery and remained alive and well after 3 years [14].

Zimmerman-Klima and associates [3] as well as Baker and associates [15] stated that trans-catheter occlusion has proven useful in patients with medial degenerative disease who have substantially higher risks of bleeding and death, and in some saccular aneurysms or pseudo-aneurysms with discrete neck connected to the superior mesenteric artery.

Ishii and associates [16] performed embolization in four cases of aneurysm of branches of the superior mesenteric artery successfully in three cases without

the need for surgical treatment. In the first case, the aneurysm was excised because of migration of a microcoil into the left hepatic artery. It was not retrieved because sufficient blood flow to the liver was shown on angiography after migration and no ischaemic change of liver was detected at laparotomy. In the second case, the aneurysm arose from the anterior pancreaticoduodenal artery. In the third case, the patient had two SMA aneurysms, one had been resected and the second revealed on follow-up angiography and embolized with microcoils. The fourth patient had jejunal artery aneurysm with extravasation, haemostasis was achieved by packing it. In all four cases, no major complications were seen after embolization. They recommended that embolization should be the treatment of choice for superior mesenteric artery aneurysms, because it is less invasive than surgical treatment.

Developments in interventional radiology have made it possible for interventional radiologists to safely treat superior mesenteric aneurysms by selective angiography and embolization. With the development of coil technology, coils have been developed to reduce the problem of coil dislodgement and coil migration. The Terumo hydro-coil is a newly developed coil that can expand and fill up to 5.8 times more volume than conventional coils. The Terumo hydro-coil is a platinum coil with expandable hydrogen polymer which provides mechanical occlusion. The Terumo Axur pushable peripheral hydrocoil is designed to be pushed with a Terumo guide wire. The design of the Azur detachable peripheral hydrocoil is such that it can be retracted and repositioned easily thanks to its' over coil. The patient had selective angiography and embolization in the radiology department under analgesia and sedation (thus avoiding general anaesthesia) and was discharged home safely the next day after observation to ensure there was no evidence of any complication.

The patient was noted to have a number of co-morbidities including: hepatitis C, haemochromatosis, anxiety, depression (for which she has continued to be on two antidepressants), micronodular cirrhosis of liver. The patient has had to cope with the psychological trauma of being followed-up after chemo-embolization to see if she would develop recurrent hepato-cellular carcinoma. It was realised in the case of the patient that the alternative treatment modality of open surgical repair of the superior mesenteric aneurysm by laparotomy and aneurysmorrhaphy / ligation did not appeal to her in view of the general anaesthesia involved, the post-operative pain / analgesia required and a longer period of hospitalization, the possible laparotomy

wound complications as well as possible postoperative adhesions. She opted to have embolization of the Superior Mesenteric Aneurysm due to the fact that she had earlier on undergone three chemo-embolizations for her hepato-cellular carcinoma without any complications.

## Conclusions

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With developments in interventional radiology and coil technology selective superior mesenteric artery angiography and embolization of superior mesenteric artery aneurysm has become an alternative safe modality of treatment instead of open surgery. This technique has the added advantage of avoiding general anaesthesia and laparotomy; it is less invasive; it is associated with low morbidity, short period of hospitalization. The Terumo hydrocoil which is now available for such embolizations has the added advantage of expanding to fill up the aneurysmal cavity up to 5.8 times more than conventional coils and it does not dislodge easily.

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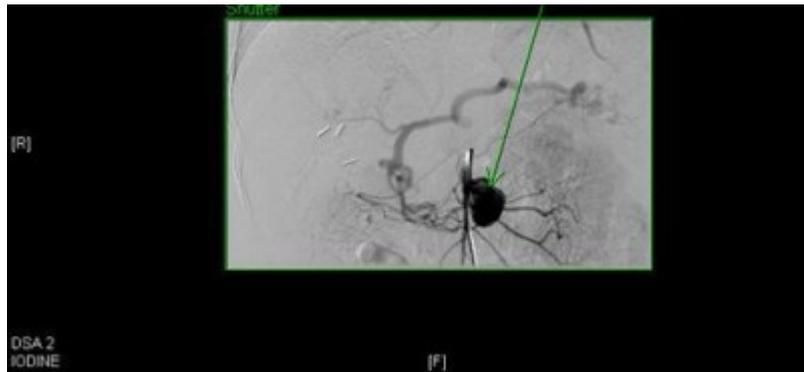
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To Jason Howard, PACS Manager of North Manchester General Hospital Radiology Department in United Kingdom

## Illustrations

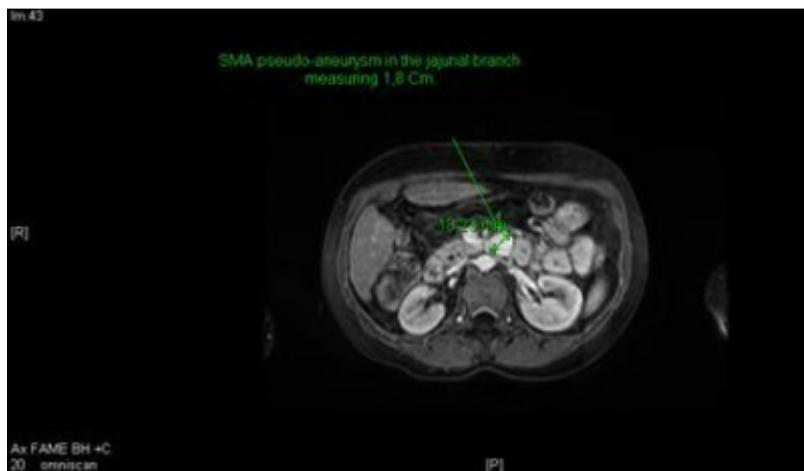
### Illustration 1

illustration 1 Selective Angiography at start of chemo-embolization of hepato-cellular carcinoma showing Aneurysm of jejunal branch of Superior Mesenteric Artery about three years prior to embolization of the aneurysm



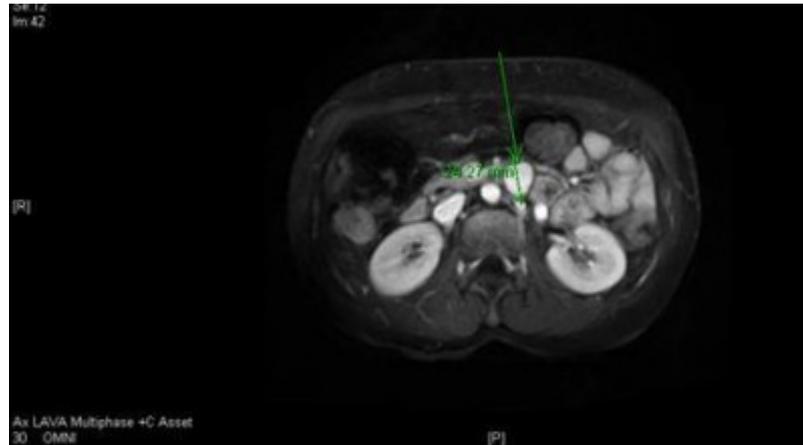
### Illustration 2

Illustration 2: MRI Scan before chemo-embolization of the hepatocellular carcinoma showing 18.23 mm aneurysm of the jejunal branch of the Superior Mesenteric Artery about three years prior to embolization of the aneurysm



### Illustration 3

MRI Scan about three years post chemo-embolization of the hepato-cellular carcinoma showing that the aneurysm of the jejunal branch of the Superior Mesenteric Artery had increased in size to 24.37 mm (Green Arrow Shows the aneurysm)



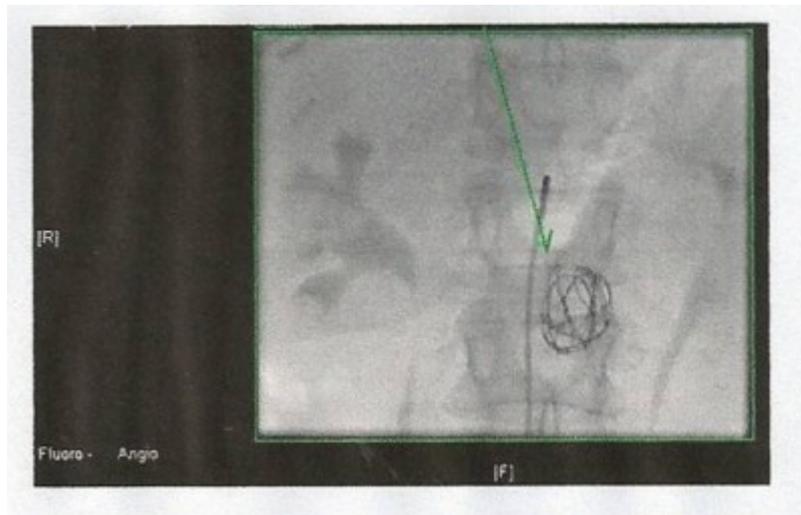
### Illustration 4

Illustration 4: Selective Angiography at the beginning of the embolization showing the aneurismal sac of the jejunal branch of the Superior Mesenteric Artery (Green Arrow pointing to wall of the aneurysm)



## Illustration 5

Illustration 5: Showing Terumo hydro-coil succssfully placed and providing scaffolding for the aneurysmal sac



## Illustration 6

Illustration 6: All Terumo Hydro-coils have been correctly placed within the aneurysm



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