

Surgical and endovascular treatment for mesenteric ischemia

Huseyin Onur Aydin¹, Ebru Hatice Ayvazoglu Soy¹, Tevfik Avci¹, Tugan Tezcaner¹, Fatih Boyvat², Sedat Yildirim¹

¹Baskent University Faculty of Medicine, Department of General Surgery, Ankara, Turkey

²Baskent University Faculty of Medicine, Department of Radiology, Ankara, Turkey

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Abstract

Aim: Mesenteric ischemia is a rare, highly fatal, surgical emergency. In addition to open surgical (OS) intervention, endovascular treatment (ET) was also recommended for treatment in last years. Surgical resection becomes inevitable in the cases of intestinal ischemia. We aimed to assess patient-related factors and compare treatment outcomes in mesenteric ischemia treated by OS and ET.

Material and Methods: Patients treated for mesenteric vascular occlusion at our hospital between 2013 and 2018 were retrospectively evaluated. Duration of symptoms, time from symptom onset to treatment, treatment used and surgery used, re-laparotomy need, duration of intensive care unit stay, duration of hospital stay, and 30-day and 1-year mortality rates were evaluated.

Results: Twenty patients with mesenteric ischemia were evaluated. The OS group had a significantly higher CCI score than the ET group ($p < 0.05$). The most common comorbidities in the OS and ET groups were coronary artery disease and hypertension, respectively. The duration of symptoms and time from symptom onset to treatment were significantly shorter in the OS group than the ET group ($p < 0.05$). The OS group most commonly had SMA emboli while the ET group most common had chronic SMA occlusion ($p < 0.05$). Thirty-day and 1-year mortality rates were significantly greater in the OS group than the ET group ($p < 0.05$).

Conclusion: Mesenteric ischemia is a highly morbid and fatal condition. ET significantly reduces morbidity and mortality in the face of signs of intestinal ischemia. On the other hand, OS would be inevitable for patients with signs of diffuse peritoneal irritation or those with suspected intestinal necrosis.

Keywords: Mesenteric Vascular Occlusion; Surgery; Endovascular Procedures; Morbidity, Mortality.

INTRODUCTION

Mesenteric ischemia is a rare, highly fatal, surgical emergency. Its annual incidence is reported to be 0.09% - 0.2% (1). Its mortality rate was reported as 30% to 90% in different resources (2,3). In addition to open surgical (OS) intervention, endovascular treatment (ET) options like percutaneous transluminal angioplasty (PTA) or stenting were also recommended for its treatment in last years (4).

Although ET was reported to be performed more rapidly and with less morbidity, surgical resection becomes inevitable in the cases of intestinal ischemia (5,6). However, surgical therapy is reportedly associated with less favorable outcomes due to longer operative times and higher morbidity rates (7). In the case of persistent signs of peritonitis, even after a successful ET, laparotomy may be needed to assess intestinal perfusion (8). Clinical suspicion and early diagnosis are crucial for

treatment success (9). The rare nature of the disease and the emergency presentation limits the performance of prospective studies. Therefore, studies previously reported are limited to case reports and retrospective studies. Herein, we aimed to assess patient-related factors and compare treatment outcomes in mesenteric ischemia treated by OS and ET.

MATERIAL and METHODS

This study approved by Baskent University Institutional Ethical Review Board (Project no: KA18/308) and supported by Baskent University Research Fund. Patients treated for mesenteric vascular occlusion at our hospital between 2013 and 2018 were retrospectively evaluated. Patients with occlusion of the superior mesenteric artery were included. Age, sex, and Charlson Co-morbidity score (CCI) were studied. We also analyzed duration of symptoms, time from symptom onset to treatment, treatment used,

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Corresponding Author: Huseyin Onur Aydin, Baskent University Faculty of Medicine, Department of General Surgery, Ankara, Turkey

E-mail: dronuraydin@hotmail.com

surgery used, re-laparotomy need, duration of intensive care unit stay, duration of hospital stay, and 30-day and 1-year mortality rates. The outcomes of OS and ET were compared.

At the time of admission white blood cell counts, blood lactate levels, ECG and abdominal computed tomography were evaluated. Among the physical examination findings, generalized peritonitis was accepted as the patients with generalized tenderness, defensive and reactive findings, and fever values of 38.0 degrees or more. In these patients, intrathoracic air, wall thinning, and wall blood supply deterioration were accepted as intestinal necrosis. Emergency laparotomy was performed in these patients. Interventional radiology was evaluated and selective SMA catheterization was performed in patients without these

findings. Endovascular treatment was performed with the technique previously described (10).

Statistical analyses were performed using the SPSS 25.0 software package (SPSS, Chicago, IL, United States). Mann-Whitney U and Chi square tests were used for statistical analysis. Statistical significance was set at $p < 0.05$.

RESULTS

This study included a total of 24 patients. The most common admission complaints, in descending order, were abdominal pain, nausea-vomiting, and weight loss. The demographic properties of the patients were summarized on Table 1.

Table 1. Demographic findings. (R/A: resection and anastomosis, R/I: resection and ileostomy, TPA: tissue plasminogen activator, Trom: thrombectomy, St: stenting)

Age	Gender	Diagnosis	CCI	ICU Stay	Total Stay	Treatment	Re-Laparotomy	Short Bowel	30-Day	1 - Year	Result
79	M	Thrombosis	3	3	3	R/I	N	Y	Y	Y	Exitus
32	F	Embolism	2	4	7	R/A	Y	N	N	N	Recovery
74	M	Thrombosis	3	3	3	R/I	N	Y	Y	Y	Exitus
62	M	Thrombosis	1	5	10	R/A	N	N	N	N	Recovery
78	M	Embolism	3	1	1	R/I	N	Y	Y	Y	Exitus
75	F	Embolism	2	36	36	R/I	Y	Y	N	Y	Exitus
58	M	Embolism	3	28	28	R/I	Y	Y	Y	Y	Exitus
61	M	Embolism	3	12	12	R/I	Y	Y	Y	Y	Exitus
57	M	Thrombosis	1	4	16	R/I	Y	Y	N	N	Recovery
49	F	Thrombosis	2	16	26	R/A	Y	N	N	N	Recovery
84	F	Thrombosis	3	2	7	R/I	N	N	N	N	Exitus
87	F	Embolism	1	4	4	R/I	N	Y	Y	Y	Exitus
72	M	Embolism	3	4	7	R/I	N	N	N	N	Recovery
87	M	Thrombosis	1	6	6	R/A	Y	N	Y	Y	Exitus
73	M	Thrombosis	2	0	2	R/A	N	N	N	N	Recovery
50	M	Occlusion	2	3	6	TPA/St	N	N	N	N	Recovery
78	F	Occlusion	2	0	2	TPA/St	N	N	N	N	Recovery
58	M	Occlusion	2	0	3	TPA/St	N	N	N	N	Recovery
58	M	Occlusion	2	2	5	TPA/St	N	N	N	N	Recovery
64	F	Occlusion	1	0	3	TPA/St	N	N	N	N	Recovery
79	F	Occlusion	1	0	2	TPA/St	N	N	N	N	Recovery
50	M	Occlusion	1	0	3	TPA/St	N	N	N	N	Recovery
60	M	Thrombosis	1	0	3	Trom/St	N	N	N	N	Recovery
35	M	Embolism	1	0	3	Trom/St	N	N	N	N	Recovery

A total of 15 patients with signs of diffuse peritonitis, of which 5 (33.3%) were females, were treated with OS. These patients had a mean age of 68.5 ± 3.9 years. The most common comorbidity was coronary artery disease and the mean CCI score was 2.2 ± 0.2 . The mean duration of symptoms was 26.4 ± 4.8 days and the time from symptom onset to treatment was 32.8 ± 5.1 days among the patients treated with OS. Eight (53.4%) patients had SMA embolism and 7 (46.6%) had SMA thrombosis. Five (33.3%) patients were operated with segmentary small

intestinal resection and anastomosis due to intestinal necrosis. Three patients who were operated with resection and anastomosis underwent re-laparotomy; a patient developed anastomosis leak due to progressive necrosis, which was treated by re-resection and ileostomy opening. Four of patients who underwent segmentary resection and ileostomy opening underwent re-laparotomy, of whom 2 patients underwent re-resection for progressive ischemia. Eight patients developed short bowel syndrome as a result of the surgical interventions performed. These patients

had a mean duration of intensive care unit and hospital stays of 8.7±2.6 days and 11.4±2.7 days, respectively. Seven patients died within 30 days after surgery, and another patient died within one year (Table 2).

	OS	ET	p
Age	68.5±3.9	59.1±4.6	>0.05
Gender			>0.05
Female	5 (33%)	3 (33%)	
Male	10 (67%)	6 (67%)	
CCI	2.2±0.2	1.4±0.1	<0.05
Coronary artery disease	10	3	
Hypertension	4	6	
Chronic renal failure	4	2	
Chronic obstructive pulmonary disease	2	1	

Nine patients, of whom 3 were females, were treated with endovascular therapy as they had no signs of intestinal necrosis. These patients had a mean age of 59.1±4.6 years, a mean CCI score of 1.4±0.1, a mean duration of

symptoms of 74.4±5.1 hours, and a mean time from symptom onset to treatment of 91.5±6.7 hours. One of these patients had SMA thrombosis; one had SMA emboli; and 7 patients had chronic SMA occlusions. All patients underwent endovascular intervention with previously described technique. The mean durations of intensive care unit and hospital stay were 0.2±0.1 days and 2.89±0.3 days, respectively. No patient needed surgical treatment at follow-up. No 30-day or 1-year mortality developed after the procedure.

The comparisons between the OS and ET groups revealed no significant differences with regard to age and sex distribution. The OS group had a significantly higher CCI score than the ET group ($p<0.05$). The most common comorbidities in the OS and ET groups were coronary artery disease and hypertension, respectively. Six of 8 patients with SMA emboli in the OS group had atrial fibrillation. The duration of symptoms and time from symptom onset to treatment were significantly shorter in the OS group than the ET group ($p<0.05$). The OS group most commonly had SMA emboli while the ET group most commonly had chronic SMA occlusion ($p<0.05$). Thirty-day and 1-year mortality rates were significantly greater in the OS group than the ET group ($p<0.05$). The results of the study groups were summarized on Table 3.

Diagnosis	OS	ET	p
Embolism	8 (53.3%)	8 (88.8%)	
Thrombosis	7 (46.7%)	1 (11.2%)	
Duration of complaint (hour)	26.4 ± 4.8	74.4 ± 5.1	<0.01
Duration to treatment start (hour)	32.8 ± 5.1	91.5 ± 6.7	<0.05
Treatment	5 R/A 10 R/I	7 TPA/St 2 Trom/St	
Re-laparotomy	7	None	<0.05
Morbidity	2	None	<0.05
Mortality	8	None	<0.05

DISCUSSION

Acute mesenteric occlusion is a surgical emergency associated with a high mortality and morbidity rates. In addition to surgical treatment, endovascular treatment options were introduced for its treatment in last years (11). Surgical treatment, however, is inevitable in patients with signs of intestinal ischemia. Herein, we observed that patients with mesenteric occlusion undergoing surgery for signs of intestinal necrosis had a high mortality rate even though they were operated early. We also observed that the patients undergoing endovascular therapy frequently had signs of chronic mesenteric ischemia; they developed acute thrombosis on the basis of atherosclerosis; and they suffered no mortality or morbidity despite a long time-to-treatment time. Abdominal pain was the most common symptom in our patients, which was expected as more than half of patients with abdominal pain, had local

peritoneal and systemic inflammatory response (12). In our study CCI scores of the patients who underwent OS were significantly higher than those of patients who underwent ET. Those who underwent OS had SMA embolism as the most common pathology, while thrombosis due to chronic SMA occlusion was more common in the ET group. Former studies showed that atherosclerosis causes chronic mesenteric stenosis (13). Diseases like atrial fibrillation, myocardial infarction, and congestive heart failure cause acute embolism and intestinal necrosis (14). We believe that etiological differences cause the difference between the CCI scores of both groups. As expected, time from symptom onset was also significantly longer in the ET group. In the latter, long-term postprandial pain was noted to be suddenly exacerbated. Long-term atherosclerosis is known to cause acute thrombosis (15). Thrombosis causes acute intensification of long-term abdominal pain

and intestinal ischemia as a result of partial or complete SMA occlusion. Since intestinal necrosis develops slowly after ischemia, patients were assessed and operated with ET before necrosis completely settled. ET is known to require an experienced staff, specific equipment, and detailed patient assessment. It is preferable when no abnormal SMA angulation or tortuosity exists or there is no suspected intestinal necrosis (16). Peritoneal irritation, suspected intestinal necrosis, or unexplained signs of acute abdomen require urgent exploratory laparotomy. Thus, OS group had a shorter time to treatment.

Patients undergoing laparotomy for suspected necrosis may need intensive care due to sepsis, acidosis, and renal dysfunction. Our ET patients had a short-term need for intensive care due to the absence of factors like peritonitis or sepsis deteriorating a patient's overall condition. Additionally, their hospital stay is shorter as they are free of complications such as short bowel syndrome, second-look laparotomy, ileostomy, and ileostomy complications. As in our group of patients, heparin infusion, thrombectomy, or stenting are preferred methods after SMA catheterization. These patients reportedly have shorter treatment duration than patients undergoing surgery (17).

In the OS group 30-day mortality and 1-year mortality rates were higher than those of the ET group. This was caused by factors increasing mortality like a higher CCI score sepsis, poor condition, or prolonged intensive care unit stay. Mortality is above 50% in mesenteric ischemia (18). It is debatable that ET can replace abdominal exploration for assessing intestinal perfusion despite lower mortality and morbidity rates. OS sometimes becomes inevitable especially for patients with suspected intestinal necrosis. ET is associated with less mortality and morbidity because patients treated this way are free of comorbidities like sepsis or acidosis and selected carefully.

The major limitations of our study include its retrospective design, a small sample volume due to a low disease incidence, and the inability to establish a standard treatment algorithm due to management of patients under urgent conditions. On the other hand, comparison of surgical approach and endovascular approach, and evaluation of long-term patient outcomes are its main advantages.

CONCLUSION

In conclusion, mesenteric ischemia is a highly morbid and fatal condition. Morbidity and mortality, however, can be reduced by early diagnosis and appropriate treatment. ET significantly reduces morbidity and mortality in the face of signs of intestinal ischemia. On the other hand, OS would be inevitable for patients with signs of diffuse peritoneal irritation or those with suspected intestinal necrosis. In the case of intestinal necrosis, surgical therapy is believed to be associated with a prolonged intensive care and hospital stay, repeated laparotomies, development of short bowel syndrome, and high morbidity and mortality rates.

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Huseyin Onur Aydin ORCID: 0000-0003-3795-5794

Ebru Hatice Ayvazoglu Soy ORCID: 0000-0002-0993-9917

Tevfik Avci ORCID: 0000-0001-5225-959X

Tugan Tezcaner ORCID: 0000-0002-3641-8674

Fatih Boyvat ORCID: 0000-0002-0076-9034

Sedat Yildirim ORCID: 0000-0002-5735-4315

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