بسم الله الرحمن الرحيم

تم رفع هذه الرسالة بواسطة / سلوي محمود عقل

بقسم التوثيق الإلكتروني بمركز الشبكات وتكنولوجيا المعلومات دون أدنى مسئولية عن محتوى هذه الرسالة.

ملاحظات:
.....
.....
.....
.....
.....

Risk Factors and Outcomes for Colonic Ischemia after Abdominal Aortic Aneurism Repair

Thesis
Submitted for Partial Fulfillment of Master Degree in **General Surgery**

By

Mahmoud Mohamed Meshref
M.B.B.Ch.,
Faculty of Medicine-Ain Shams University

Supervised by

Prof. Dr. Tarek Youssef Ahmed
Professor of General Surgery
Faculty of Medicine, Ain Shams University

Prof. Dr. Mohamed Abdelmoneam Rezk
Professor of Vascular Surgery
Faculty of Medicine, Ain Shams University

Dr. Amr Abdelghaffar Mahmoud
Lecturer of Vascular Surgery
Faculty of Medicine, Ain Shams University

Faculty of Medicine
Ain Shams University
2021

سورة البقرة الآية: ٣٢

Acknowledgments

First and foremost, I feel always indebted to **Allah** the Most Beneficent and Merciful.

I wish to express my deepest thanks, gratitude and appreciation to ***Prof. Dr. Tarek Youssef Ahmed****, Professor of General Surgery, Faculty of Medicine, Ain Shams University, for his meticulous supervision, kind guidance, valuable instructions and generous help.*

Special thanks are due to ***Prof. Dr. Mohamed Abdelmoneam Rezk****, Professor of Vascular Surgery, Faculty of Medicine, Ain Shams University, for his sincere efforts, fruitful encouragement.*

I am deeply thankful to ***Dr. Amr Abdelghaffar Mahmoud****, Lecturer of Vascular Surgery, Faculty of Medicine, Ain Shams University, for his great help, outstanding support, active participation and guidance.*

I would like to express my hearty thanks to all my family for their support till this work was completed.

Mahmoud Mohamed Meshref

List of Contents

Title	Page No.
List of Tables	i
List of Figures	ii
List of Abbreviations	v
Introduction	1
Aim of the Work	3
Review of Literature	4
Anatomy	4
Pathophysiology of mesenteric ischemia	10
Causes of intestinal ischemia	14
Clinical evaluation of the patients with postoperative ischemic colitis after AAA repair	23
Patients and Methods	40
Results	70
Discussion	85
Summary	89
Conclusion	90
Recommendations	91
References	92
Arabic Summary	

List of Tables

Table No.	Title	Page No.
Table 1:	Progression of pathologic changes in the intestinal wall	12
Table 2:	Causes of mesenteric ischemia during AAA repair	17
Table 3:	Indications of surgical intervention	38
Table 4:	Intra-Operative Complications after AAA repair	53
Table 5:	Early Complications after AAA repair	54
Table 6:	Late Complications after AAA repair	55
Table 7:	Demographic description of initial data	70
Table 8:	Preoperative risk factors	72
Table 9:	Comparison between patients developed mesenteric ischemia and no mesenteric ischemia regarding preoperative risk factors	74
Table 10:	Comparison between patients developed mesenteric ischemia and no mesenteric ischemia regarding intra operative risk factors	54

List of Figures

Fig. No.	Title	Page No.
Figure 1:	Mesenteric blood supply	5
Figure 2:	Mesenteric collateral circulation	6
Figure 3:	Watershed areas of colon	8
Figure 4:	Reimplantation of the IMA open repair vs EVAR	21
Figure 5:	Classification of mesenteric ischemia	23
Figure 6:	Stages of mesenteric ischemia under colonoscope	48
Figure 7:	Deployment of main trunk of the stent graft below the renal arteries	59
Figure 8:	IVUS evaluation of proximal landing zone demonestrates complete patent renal arteries	60
Figure 9:	Deployment of contralateral limb. Angiogram reveals the location of internal iliac artery	62
Figure 10:	The stent graft is completely deployed and ballooned. angiogram revealed patent bilateral renal and internal iliac arteries.	62
Figure 11:	Demographic description of gender	71
Figure 12:	Preoperative risk factors	73
Figure 13:	Comparison between patients developed mesenteric ischemia and no mesenteric ischemia regarding preoperative risk factors	75
Figure 14:	Comparison between patients developed mesenteric ischemia and no mesenteric ischemia regarding duration of surgery	76

List of Figures cont...

Fig. No.	Title	Page No.
Figure 15:	Comparison between patients developed mesenteric ischemia and no mesenteric ischemia regarding blood loss	77
Figure 16:	Comparison between patients developed mesenteric ischemia and no mesenteric ischemia regarding no HA embolization or coverage and hypogasteric artery embilization or coverage.	77
Figure 17:	Comparison between patients developed mesenteric ischemia and no mesenteric ischemia regarding ICU stay	79
Figure 18:	Comparison between patients developed mesenteric ischemia and no mesenteric ischemia regarding type of surgery	80
Figure 19:	Comparison between patients developed mesenteric ischemia and no mesenteric ischemia regarding renal deterioration after AAA	80
Figure 20:	Comparison between patients developed mesenteric ischemia and no mesenteric ischemia regarding postoperative acute lower limb ischemic	81
Figure 21:	Comparison between patients developed mesenteric ischemia and no mesenteric ischemia regarding renal deterioration and limb ischemia	81
Figure 22:	Comparison between patients developed mesenteric ischemia and no mesenteric ischemia regarding site of distal anastomosis	82

List of Figures cont...

Fig. No.	Title	Page No.
Figure 23:	Comparison between patients developed mesenteric ischemia and no mesenteric ischemia regarding time of diagnosis of postoperative IC	83
Figure 24:	Comparison between patients developed mesenteric ischemia and no mesenteric ischemia regarding management of IC	83
Figure 25:	Comparison between patients developed mesenteric ischemia and no mesenteric ischemia regarding 30 day mortality rate	57

List of Abbreviations

Abb.	Full term
AAA	Abdominal Aortic Aneurysm
EVAR	Endovascular aneurysm repair
IC	ischemic colitis
MI	mesenteric ischemia
CI	colonic ischemia
HA	hypogastric artery
IMA	inferior mesenteric artery
SMA	superior mesenteric artery
i-FABP	intestinal fatty acid binding protein
L-FABP	liver fatty acid binding protein
CAD	coronary artery disease
CKD	chronic kidney disease
ELISA	enzyme-linked immunosorbent assay
IL-6	interleukin-6
PCT	Procalcitonin
PADs	peripheral arterial disease
COPD	chronic obstructive pulmonary disease
PAUS	pelvi-abdominal ultrasound

CT	Computed tomography
DM	diabetes mellitus
HTN	hypertention
ISHD	ischemic heart disease
CIA	common iliac artery
EIA	external iliac artery
CFA	common femoral artery
OR	open repair

INTRODUCTION

Mesenteric ischemia remains a major adverse event following abdominal aortic aneurysm (AAA) repair associated with a high mortality ***(Saskia et al., 2019).***

The incidence of clinically significant Mesenteric ischemia is in the range of 1 to 3% after elective surgery and 10% in case of rupture. When routine postoperative colonoscopy is performed, the incidence is higher ***(Djavani et al., 2009).***

Mesenteric ischemia after AAA repair has a multifactorial origin leading to hypo perfusion of the intestines. Patient-dependent variables are age, renal impairment, and smoking. These variables are also associated with the development of atherosclerosis leading to a higher risk of mesenteric ischemia ***(Neary et al., 2007).***

Perioperative variables including indication for surgery (ruptured vs elective), type of treatment (EVAR vs open), and operative details (duration of surgery, blood loss, inferior mesenteric artery reconstruction, site of distal anastomosis, hypo gastric artery embolization or coverage). These factors could lead to intraoperative hemodynamic disturbances, making the patient more prone to develop mesenteric ischemia ***(Becquemin et al., 2008).***

In the last decades the treatment modalities for AAA have expanded. Besides open repair (OR) endovascular aneurysm repair (EVAR) was introduced as a less invasive treatment option. It has been suggested that endovascular repair leads to a lower incidence of mesenteric ischemia, although

similar incidences have also been reported ***(Maldonado et al., 2007).***

A relatively new innovative tool in AAA management is fenestrated EVAR (FEVAR), designed to treat patients with short neck infrarenal, juxtarenal, and suprarenal AAA, and type IV thoraco abdominal aneurysms. With this technique the proximal sealing zone of the stent graft is extended beyond the renal arteries by incorporation of fenestrations into the graft for the visceral vessels. It is speculated that (FEVAR) may lead to a better perfusion of the intestines through the created branches and therefore may lead to a lower incidence of mesenteric ischemia after AAA repair ***(Mastracci et al., 2010).***

FEVAR is associated with lower perioperative mortality, complication rates compared with elective open repair of AAAs ***(O'Donnell et al., 2020).***

AIM OF THE WORK

It aims to review the clinical spectrum of mesenteric ischemia (CI) following abdominal aortic aneurysm (AAA) repair and to assess the incidence, overall mortality, and associated factors of occurrence.

REVIEW OF LITERATURE

Anatomy

Prior to discussing the causes of intestinal ischemia following AAA repair, a review of mesenteric arterial anatomy is in order.

Three major vessels serve the abdominal contents: (**AdamCloud et al;2019)**

- Celiac trunk: Supplies the esophagus, stomach, proximal duodenum, liver, gallbladder, pancreas, and spleen.
- Superior mesenteric artery (SMA): Supplies the distal duodenum, jejunum, ileum, and colon to the splenic flexure.
- Inferior mesenteric artery (IMA): Supplies the descending colon, sigmoid colon, and rectum.

The mesenteric arterial system involves extensive collateralization **(Fig. 1),** such that chronic intestinal ischemia rarely occurs unless at least two of the three main mesenteric arteries are compromised ***(Arvey et al., 2010).***