Faculty of Medicine

Anesthetic Management of Endovascular Aortic Aneurysm Repair

Essay

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Presented by

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بسم الله الرحمن الرحيم

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وَاللّٰهُ بِكُلِّ شَيْءٍ عَلِيمٌ

صدق الله العظيم

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Mostafa Sayed Amin Hussein

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List of Abbreviations

Abbrev.	Full-term
AAA	: Abdominal aortic aneurysm
ACC	: American College of Cardiology
ACT	: Activated Coagulation Time
AHA	: American Heart Association
CIN	: Contrast-induced Nephropathy
CKD	: Chronic Kidney Disease
CRP	: C-reactive protein
CSF	: Cerebral Spinal Fluid
CT	: Computed tomography
DSA	: Digital Subtraction Arteriography
ECG	: Electrocardiogram
eGFR	: Estimated Glomerular Filtration Rate
ePTFE	: Expanded Polytetrafluoroethylene
EVAR	: Endovascular Aortic Aneurysm Repair
EVSG	: Endovascular Synthetic Graft
GA	: General Anethesia
ICU	: Intensive Care Unit
IMA	: Inferior Mesenteric Artery
IVUS	: Intravascular Ultrasound
MAC	: Monitored Anesthesia Care
MAP	: mean Arterial pressure
MEPs	: Motor Evoked Potentials

MR : Magnetic resonance

NAC : N-acetylcysteine

NSAIDs : Non-Steroidal Anti-inflammatory Drugs

PTFE : Polytetrafluoroethylene

RWMAs : Regional Wall Motion Abnormalities

SCI : Spinal Cord Ischaemia

SSEPs : Somatosensory Evoked Potentials

TAA : Thoracoabdominal Aortic Aneurysm

TEE : Transesophageal Echocardiography

TIVA : Total Intravenous Anesthesia

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Abstract

Background: For most individuals, an aortic diameter greater than 3.0 cm is generally considered aneurysmal. Endovascular repair of abdominal aortic aneurysm (EVAR) represents a widely available alternative to open surgical repair. **Aim of the work:** The aim of this work is to discuss anatomical and surgical considerations and technique of endovascular aortic aneurysm repair, discuss its different anesthetic techniques, in addition to its post operative complications. **Conclusion:** Despite advances in endovascular salvage techniques for endograft complications, some circumstances require conversion to open repair. The overall incidence of conversion (early or late) is about 2%. Elective open surgical conversion following failed endovascular repair may be associated with increased morbidity and mortality, particularly if the patient was deemed at high risk for open surgery.

Key words: Anesthetic Management, Endovascular Aortic Aneurysm Repair (EVAR), endograft, endovascular,

Introduction

Endovascular aortic repair (EVAR) has become a standard approach to treatment for thoracic and abdominal aortic aneurysms, accounting for well over half the patients who would otherwise undergo an open surgical repair. Since EVAR does not require intrathoracic or intraabdominal exposure of the aorta, or aortic cross-clamping, perioperative morbidity and mortality are reduced compared with open repair. Also, EVAR has made treatment possible for some patients with comorbidities who might not otherwise be candidates for aortic repair ***(Schermerhorn et al., 2008).***

Around two-thirds of abdominal aortic aneurysms (AAA) are incidental discoveries during the investigation of backache, hip pain or urinary tract complaints. They are much more common in men than women (5:1) and account for 2% of all deaths in men aged >60 yr. Surgery is recommended when the AAA exceeds 55 mm in anteroposterior diameter as measured by ultrasound scan. The risk of spontaneous rupture depends on aneurysm size, ranging from <1% per annum for AAA <55 mm diameter to >17% per annum for aneurysms >60 mm diameter. Ninety per cent of AAAs are located distal to the renal arteries ***(Kristensen & Knuuti, 2014).***

Since vascular access for EVAR is achieved through either percutaneous or open access via small incisions to

femoral vessels. The procedure can be performed using local infiltration anesthesia (LA), general anesthesia (GA) or regional anaesthesia (RA). The latter may be performed as a spinal, epidural or combined spinal epidural (CSE). The potential advantages of LA and RA are that there is usually excellent perioperative and postoperative analgesia with a stable cardiovascular system. However, there is no evidence to suggest that outcome is improved with LA or RA compared with GA ***(Nataraj and Mortimer, 2004).***

Surgical complications include primary endoleak, damage to the femoral arteries, dissection, embolization, ischemia, aneurysm rupture, reaction to contrast media, neurological deficit, bleeding, myocardial ischemia, renal failure, hypotension, delayed stent displacement and other device-related complications ***(Kahn et al., 2001).***

Aim of the Work

The aim of this work is to discuss anatomical and surgical considerations and technique of endovascular aortic aneurysm repair, discuss its different anesthetic techniques, in addition to its post operative complications.

Chapter 1
Anatomical Considerations and Surgical Technique

Endovascular aortic repair requires that specific anatomic criteria are fulfilled, and, for those with appropriate anatomy, this technique has become a preferred approach and allows the treatment of patients who might not otherwise be candidates for surgical aortic repair due to medical comorbidities.

Aortic Anatomy

The aorta is the major arterial conduit conveying blood from the heart to the systemic circulation. It originates immediately beyond the aortic valve ascending initially, then curving to form the aortic arch, and finally descending caudally adjacent the spine. The descending thoracic aorta continues through the hiatus of the diaphragm to become the abdominal aorta which extends retroperitoneally to its bifurcation into the common iliac arteries at the level of the fourth lumbar vertebra. The abdominal aorta lies slightly left of the midline to accommodate the inferior vena cava which is in close apposition. The branches of the abdominal aorta include the left and right inferior phrenic arteries, left and right middle suprarenal arteries, the celiac axis, superior mesenteric artery, left and right renal arteries in addition to occasional accessory renal arteries, left and right gonadal arteries, inferior mesenteric artery, the paired lumbar arteries (L1-L4) and middle sacral artery (Fig) ***(Sandhu & Pipinos, 2005).***

The abdominal aorta bifurcates into the left and right common iliac arteries, which most often arise at the level of the 4th lumbar vertebra. The common iliac artery bifurcates into the external iliac and internal iliac arteries at the pelvic inlet. The internal iliac artery has superior and inferior divisions that supply the pelvic viscera and muscles. The external iliac artery passes beneath the inguinal ligament to become the common femoral artery ***(Cahill, 1997).***

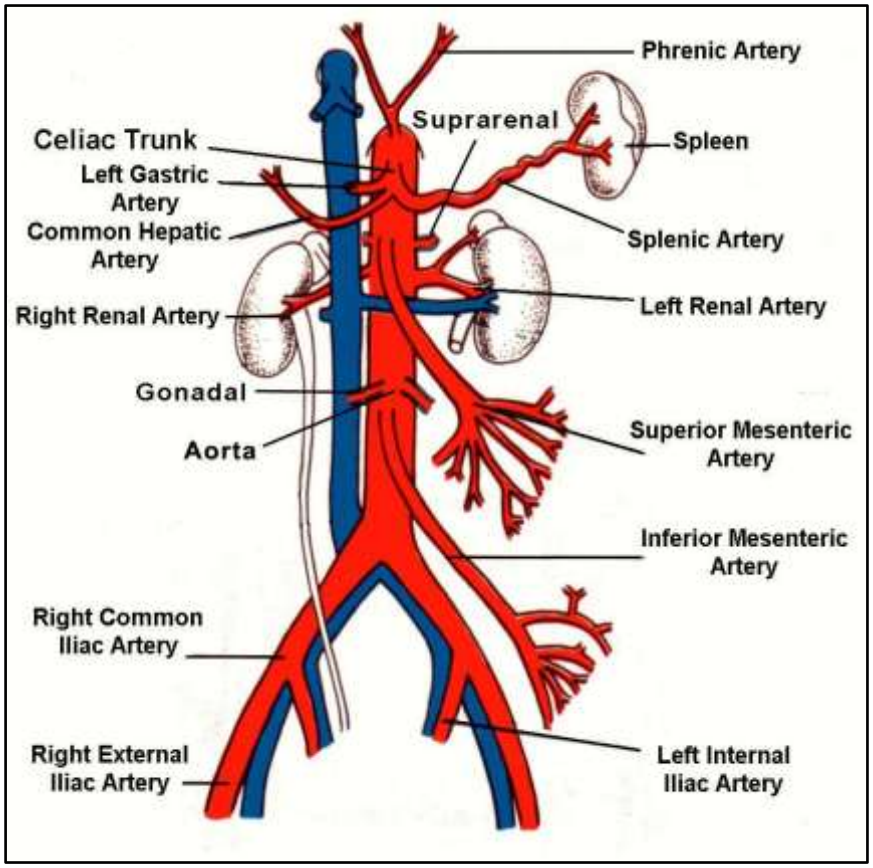

Fig. (1): Branches of Abdominal Aorta ***(Cahill, 1997)***

The abdominal aorta is the most common site of arterial aneurysm. The abdominal aorta is defined as aneurysmal when a localized dilation is identified, and the diameter of the dilated region is increased more than 50 percent relative to normal aortic diameter. The normal diameter of the aorta at the level of the renal arteries is approximately 2.0 cm (range 1.4 to 3.0 cm). An aortic diameter greater than 3.0 cm is considered aneurysmal for most individuals ***(Johnston et al., 1991).***

Aneurysm Extent:

Abdominal aortic aneurysms (AAAs) are described as infrarenal, juxtarenal (pararenal), or suprarenal depending upon the involvement of the renal or visceral vessels.

1. Infrarenal – aneurysm originates below the renal arteries.
2. Juxtarenal – aneurysm originates at the level of the renal arteries.
3. Suprarenal – aneurysm originates above the renal arteries.

Abdominal aortic aneurysms (AAAs) most often occur in the segment of aorta between the renal and inferior mesenteric arteries; approximately 5 percent involve the renal or visceral arteries. Up to 40 percent of AAAs are associated with iliac artery aneurysm(s).