Laparoscopic Adrenalectomy

Essay

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Submitted by

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Osama Gamal Tawfik

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List of Abbreviations

ACTH	Adrenocortical hormone
APA	Aldosterone produsing adenoma
CNS	Central nervous system
CRH	Corticotrophin releasing
CT	Computarized Tomography
DHEA	Dehydropeandrosterone
DNA	Deoxy ribonucleic acid
DOPA	DIhydroxy phenylalanine
FNA	Fine needle aspiration
HVA	Homovanillinic acid
IHA	Idiopathic hyperaldosteronism
MEN	Multiple endocrine neoplasia
MIBG	Metaiodo bezyl guanidine
MRI	Magnetic resonance imaging
MSH	Melaocyte stimulating hormone
MTC	Medullary thyroid carcinoma
PA	Primary aldosteronism
US	Ultrasound
VHL	Von hipple lindau disease
VMA	Vanillymandelic acid

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Introduction

Since its first description in 1992, laparoscopic adrenalectomy has become the gold standard for the surgical treatment of most adrenal conditions. The benefits of a minimally invasive approach to adrenal resection such as decreased hospital stay, shorter recovery time and improved patient satisfaction are widely accepted. However, as this procedure becomes more widespread, critical steps of the operation must be maintained to ensure expected outcomes and success **(Matthew et al., 2008).**

A commonly accepted indication for laparoscopic adrenalectomy is hormonally active tumors including aldosteronomas, pheochromocytomas, and cortisol-producing adrenal tumors. Other indications involve size criteria and include nonfunctioning tumors less than 4-6 cm and smaller nonfunctioning tumors with rapid or progressive growth. Although no definitive size criteria for removal of nonfunctioning adrenal masses exists, it is well accepted that tumors greater than 6 cm should be removed due to an increased incidence of cancer with increasing size (**William et al., 2013).**

In light of surgical and anesthesia expertise, laparoscopic resection of benign pheochromocytomas is safe and effective with resultant short hospital stays. A low threshold to convert to an open procedure reduces operative

times and decreases potentially serious complications. Although there have been no recurrences to date, long-term follow-up is required for all patients, especially those with hereditary forms of pheochromocytomas **(Brunt, 2004).**

Several authors advocate laparoscopy as the preferred approach to adrenalectomy however, in patients with pheochromocytoma laparoscopic surgery may increase the risk of serious cardiovascular complications as the induction of pneumoperitoneum may trigger adrenergic reactions. On the other hand careful laparoscopic manipulation of the tumor may reduce the release of adrenergic substances achieving better cardiovascular stability **(Bjorn et al., 2001)**.

The retroperitoneal approach has the advantage of avoiding the intra-abdominal organs and allowing direct access to the adrenal. This technique does not provide the same operative exposure as transperitoneal attempts and tumors larger than 7cm may not be amenable to this technique. Additionally, there is a general lack of anatomical landmarks, making dissection more challenging. The major indication for the retroperitoneal approach is previous intra-abdominal surgery with the presence of adhesions. Our institution has adopted a technique similar to the method described by Sung et al (**Matthew et al., 2008).**

Transperitoneal approach offers the greatest visualization of the operative field, reducing intraoperative injuries and ensuring minimal morbidity. In addition to a

monitor tower and gas insufflator set at intra-abdominal pressure of 15mmHg, we use 0° and 30° 10-mm laparoscopes. One 12-mm and three 5-mm trocars are generally used. Our surgical instruments include suction aspirator, curved ultrasonic shears, right-angle forceps, bipolar forceps, monopolar Endoshears, 5-mm Hem-o-Lok (Weck) clip-applier, Endopouch specimen bag, and PEER retractor Pneumoperitoneum is established using a Veress needle technique. The open Hasson method to obtain peumoperitoneum may also be used **(Matthew et al.,2008).**

Aim of the Work

The aim of this study is to explain the role of laparoscope in management of adrenal diseases as a new technique and its efficacy, advantages compared to open surgery.

Chapter I:

Anatomy of the Adrenals

Historical overview:

The adrenal glands were first described by the Italian anatomist Bartolomeo Eustachi in 1563. The German comparative anatomist Albert von Klliker (1817-1905), who noted the presence of the adrenals in a number of vertebrate species, is credited with first identifying two distinct portions of the adrenal gland, the cortex and the medulla. Although Thomas Addison described the clinical features of primary adrenal failure in 1855, it was not until almost a century later that the adrenal hormones were fully isolated and characterized. Adrenaline (or epinephrine) was first isolated from adrenal extract at the turn of the century **(Yeh and Duh, 2012).**

Embryology:

Adrenal cortex and medulla have disparate embryologic origins. The primordial cortex arises from the coelomic mesodermal tissue near the cephalic end of the mesonephros during the fourth to fifth week of gestation. Biosynthetic activity can be detected as early as the seventh week. Cortical cell mass dominates the fetal adrenal at 4 months of development and steroidogenesis reaches is maximum during the third trimester. **(Yeh and Duh, 2012).**

The adrenal medulla arises from the ectodermal tissues of the embryonic neural crest. It develops in parallel with the sympathetic nervous system, beginning in the fifth to sixth week of gestation. From their original position adjacent to the neural tube, neural crest cells migrate ventrally to assume a para-aortic position near the developing adrenal cortex. There, they differentiate into chromaffin cells that make up the adrenal medulla **(Yeh and Duh, 2012).**

Surgical anatomy:

The adrenal glands lie in the retroperitoneum along the superomedial aspect of each kidney. They are composed of a cortex and medulla, the dimensions of the normal adrenal are approximately 4 to 5cm, 2 to 3cm, 0.5 to 1cm, and the gland weighs 4 to 6g. The right adrenal is somewhat pyramidal in shape, whereas the left gland is more flattened or crescentic and more closely applied to the kidney than the right (**Brunt, 2004)**.

Each adrenal gland, together with the associated kidney, is enclosed in the renal fascia (of Gerota) and surrounded by fat. The glands are firmly attached to the fascia, which is in turn attached firmly to the abdominal wall and the diaphragm.

A layer of loose connective tissue separates the capsule of the adrenal gland from that of the kidney. Because the kidney and the adrenal gland are thus separated, the kidney can be ectopic or ptotic without a corresponding

displacement of the gland. Fusion of the kidney. however, is often accompanied by fusion of the adrenal glands. Occasionally the adrenal gland is fused with the kidney so that separation is almost impossible. If individuals with such a fusion need a partial or total adrenalectomy **(Skandalakis, 2014).**

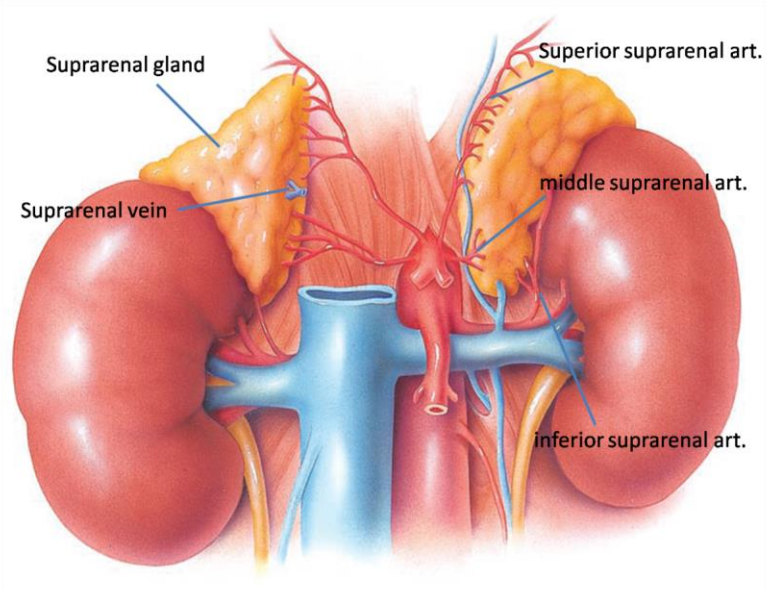

Fig. (1): Location, blood supply of adrenal gland **(Tortura, 2009).**

Relations of the adrenal glands:

- **<u>Right Adrenal Gland</u>**:

Anterior surface:

A. ***Superior***: "bare area" of liver.
B. **Medial**: inferior vena cava.
C. ***Lateral***: "bare area" of right lobe of the liver.
D. ***Inferior***: peritoneum (very rarely, if ever) and first part of the duodenum (occasionally).

Posterior surface:

A. ***Superior***: diaphragm.

B. ***Inferior***: anteromedial aspect of right kidney.

- **Left Adrenal Gland:**

Anterior surface

A. ***Superior***: peritoneum (posterior wall of omental bursa) and stomach.

B. ***Inferior***: upper pole of left kidney

Posterior surface

A. ***Medial***: left crus of diaphragm.

B. ***Lateral***: medial aspect of the left kidney body of the pancrease (**Skandalakis, 2014)**.

Vascular supply of adrenal glands:

Arterial supply

The blood supply of the right adrenal is derived from branches of the inferior phrenic artery, the right renal artery, and the aorta typically, multiple small branches enter the gland along its superior, medial, and inferior aspects. Arterial branches from the aorta generally course posterior to the vena cava before entering the adrenal. Control of the adrenal vein is the most critical aspect of right adrenalectomy, in that the short course of this vessel makes it susceptible to tearing or avulsion from the IVC. The arterial blood supply of the