INTRODUCTION

Over 1 million abdominal wall hernia repairs are performed each year in the United States, with inguinal hernia repairs constituting nearly 770, 000 of these cases; approximately 90% of all inguinal hernia repairs are performed on males ***(Nicks and Askew, 2013).***

Hernia repair went through several stages dating back to ancient Egypt ***(Sherwinter, 2013)*** through the conventional repair with tissue approximation that was associated with a recurrence rate of 60% till 1958 when Francic C. Usher introduced a polypropylene based prosthesis to bridge the hernia defect and to reinforce the abdominal wall without tension. With the implantation of prosthesis the recurrence rate in hernia repair was downsized ***(Kurmann and Beldi, 2011).***

Repair of an inguinal hernia via surgery is the only treatment for inguinal hernias and can prevent incarceration and strangulation. Health care providers recommend surgery for most people with inguinal hernias and especially for people with hernias that cause symptoms. Research suggests that men with hernias that cause few or no symptoms may be able to safely delay surgery until their symptoms increase. Men who delay surgery should watch for symptoms and see a health care provider regularly. Health care providers usually recommend surgery for infants and children to prevent incarceration ***(Kleigman et al., 2011).***

Conventional surgery was based on Bassini's operation; this consisted of apposition of the transversus abdominis and transversalis fascia and the lateral rectus sheath to the inguinal ligament. However, the Lichtenstein technique is widely used, where a piece of open-weave polypropylene mesh is used to repair and reinforce the abdominal wall. This operation is easier to learn, gives earlier mobility and has a very low recurrence rate ***(Currie et al., 2011).***

Since the early 1990s, laparoscopic techniques have entered the field of general surgery; the first cases of minimally invasive inguinal hernia repair were reported in 1992, and the results of laparoscopic repair were impressive in comparison to the open repair of inguinal hernias, with less complications and better cosmotic outcome. Many techniques have been developed the better of which were the transabdominal technique and the totally extraperitoneal technique.

Transabdominal preperitoneal (TAPP) inguinal hernia repair includes laparoscopic exploration of both inguinal areas and the whole peritoneal cavity, a further incision to the overlying peritoneal sheet in order to reduce the hernia sac and to place a prosthetic mesh against the inguinal wall at the level of properitoneal space ***(Arregui et al., 1992).***

The technique of totally extraperitoneal repair (TEP) allows exploration of the myopectineal orifices, the dissection and reduction of the hernia sac and its content and placement of

the mesh without entering the abdominal cavity ***(McKernan and Laws, 1993).***

It has been estimated that complications like ischaemic orchitis and testicular atrophy occur in approximately 2% to 3% of all hernia repairs, Recurrence occur in 1.0% (most happening within five years of operation), other complications that may happen include Wound infection, Bladder injury, Intestinal injury, A hydrocele from fluid accumulation in the distal sac usually resolves spontaneously but sometimes requires aspiration. The overall prognosis is good depending on comorbidity ***(Kulacoglu, 2011).***

In the present study we are going to assess the difference between the two laparoscopic techniques (TAPP) and (TEP) and we are going to study their outcomes either intraoperatively, early postoperative and their recurrence rate in our study period.

AIM OF THE WORK

The aim of this work is to compare the outcome of laparoscopic Transabdominal preperitoneal technique **(TAPP)** versus laparoscopic totally extra peritoneal technique **(TEP)** in inguinal hernia repair as regard their efficacy, postoperative complications and recurrence.

Chapter 1

SURGICAL ANATOMY OF INGUINAL REGION

The inguinal region of the body, also known as the groin, is located on the lower portion of the anterior abdominal wall, with the thigh inferiorly, the pubic tubercle medially, and the anterior superior iliac spine (ASIS) superolaterally. The inguinal canal is a tubular structure that runs inferomedially and contains the spermatic cord in males and the round ligament in females. The floor of the inguinal canal is the inguinal ligament, otherwise known as the Poupart ligament, which is formed from the external oblique aponeurosis as it folds over and inserts from the ASIS to the pubic tubercle. This folded edge is called the shelving edge and is important for surgeons in hernia repairs. The inguinal canal is a conduit where structures pass, which has significance from a pathological standpoint.

Tissue layers of the groin:

The lower abdominal wall is composed of several layers, each placed on top of the other from the peritoneum outward to the skin, similar to the layers of an onion ***(Flament, 2001).***

The layers of the lower abdominal wall include the following:

1. The Skin.
2. Superficial fascia (Camper's & Scarpa's).
3. Innominate fascia (Gallaudet). This may not always recognized as a distinct entity.
4. External oblique aponeurosis including the inguinal, lacunar and reflected inguinal ligament.
5. Internal oblique muscle.
6. Transversus abdoninis muscle and aponeurosis modified to conjoint tendon (Falx Inguinale).
7. Transversalis fascia associated with the pectineal ligament (Cooper), iliopubic tract, transversalis fascia sling and the deep inguinal ring.
8. Preperitoneal connective tissue and fat.
9. Peritoneum. ***(Skandalakis et al., 2004)***

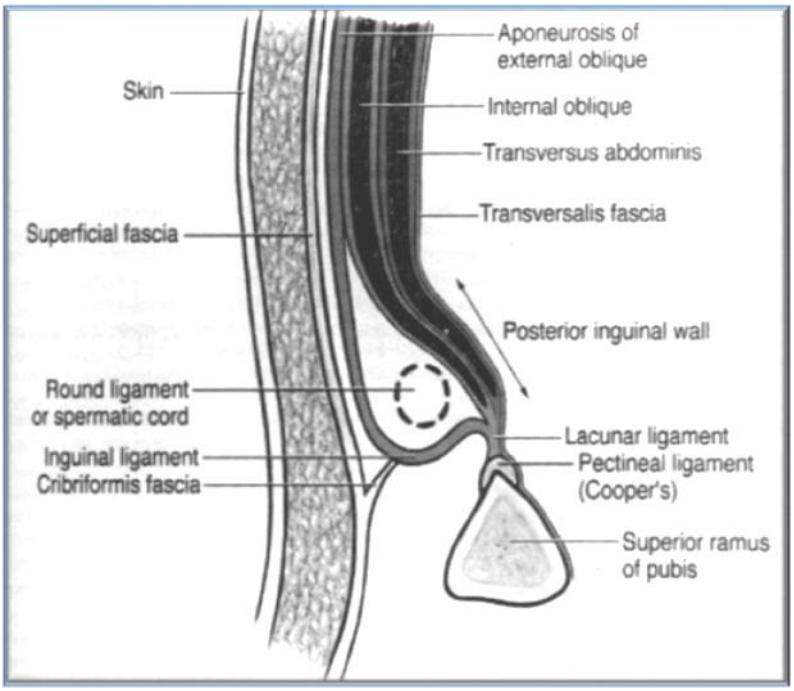

Figure (1): Sagittal cross section of the lower abdominal wall at the inguinal region ***(Flament, 2001).***

- ***Superficial fascia:***

The superficial fascia is divided into a superficial fatty part (Camper's fascia) and a deep membranous part (Scarpa's fascia). Structurally, the first anatomic layer that influences groin herniation is the Scarpa's fascia, because the skin and subcutaneous tissues within the groin provide little support to the underlying myopectineal orifice. The Scarpa's fascia is a dense homogeneous membranous sheet of areolar tissue that forms a definable lamina within the subcutaneous tissue. It attaches inferiorly to the linea alba, the dorsum of the penis, the anterior thigh, and the iliac crest. Sometimes mistaken for the external oblique aponeurosis in the elderly, this layer can be

identified by applying simple traction to the layer of interest. If the skin moves with the application of traction, the layer is the Scarpa's fascia ***(Spitz and Arregui, 2001).***

The fusion of the Scarpa's fascia to the anterior thigh inferior to the inguinal ligament is the anatomic reason why some femoral hernias are found to reflect superiorly and lie superficial to the external oblique aponeurosis ***(Flament, 2001).***

- ***Innominate fascia:***

The next layer encountered beneath the Scarpa's fascia is the innominate fascia (Gallaudet fascia). Otherwise known as the investing layer of the external oblique muscle, it attaches along the anterior superior iliac spine, the anterior thigh, and the pubic tubercle**.** It functions to bind the midportion of the inguinal ligament to the tissues of the anterior thigh, thus producing the gentle curve noted in the inguinal ligament. Additionally, it fuses with the posterior investing fascia of the external oblique muscle to give rise to the external spermatic cord fascia, which by definition changes the spermatic cord structures within the inguinal canal into the true spermatic cord ***(Kux, 2002).***

- ***External oblique muscle:***

The next layer encountered is a true supporting layer of the myopectineal orifice. The external oblique muscle originates from anterior ribs 5 to 12 and inserts into the anterolateral half of the

iliac crest, anterior superior iliac spine, and pubic tubercle. At the level of the myopectineal orifice, the external oblique muscle is composed only of its aponeurosis. The external oblique aponeurosis gives rise to the external (superficial) ring and inguinal ligament. Within the inguinal canal, the inguinal ligament supports the spermatic cord structures as they pass through the abdominal wall (***Quinn, 2002).***

- ***Internal oblique muscle:***

In contrast to the external oblique, the internal oblique muscle is composed of both a muscular portion and its aponeurosis within the region of the myopectineal orifice. Originating from the thoracolumbar fascia, costocartilages 7 to 12, the iliac crest, and the lateral two thirds of the inguinal ligament, the internal oblique fibers travel in a superomedial direction to insert medially into the rectus sheath. Within the groin, the internal oblique muscle and its aponeurosis function to support the lateral posterior wall of the inguinal floor. However, as the fibers of the internal oblique travel medially to insert into the rectus abdominis, they arch cephalad to the inguinal ligament, thus producing a potentially weak area. The degree or size of this weak area on the medial aspect of the inguinal floor is variable from individual to individual ***(Kux, 2002).***

- ***Transversus abdominis muscle:***

Similar to the internal oblique, the course of the transverses abdominis muscle within the groin creates a potentially weak area on the medial aspect of the inguinal floor. The transversus abdominis muscle originates from the thoracolumbar fascia, costocartilages 7 to 12, the iliac crest, and the lateral one third of the inguinal ligament, and then inserts medially into the rectus sheath. Composed of mostly muscle within the groin, the transversus abdominis muscle forms the shutter mechanism at the internal ring and supports the lateral posterior wall of the inguinal floor.

Unfortunately, as compared with the lateral posterior floor of the inguinal canal that is supported by all 3 muscles of the lateral abdominal wall, the medial inguinal floor is covered simply by the aponeurosis of the external oblique (region of external ring) and the investing layer of the transverses abdominis muscle or transversalis fascia ***(Bendavid, 2001).***

The musculopectineal orifice of fruchaud

The musculopectineal orifice of Fruchaud is a space within the anterior abdomen with the following boundaries: the inferior borders of the transversus abdominis and internal oblique muscles superiorly, the rectus abdominis muscle medially, the iliopsoas muscle laterally, and the pecten of the pubis inferiorly (Fig.2).

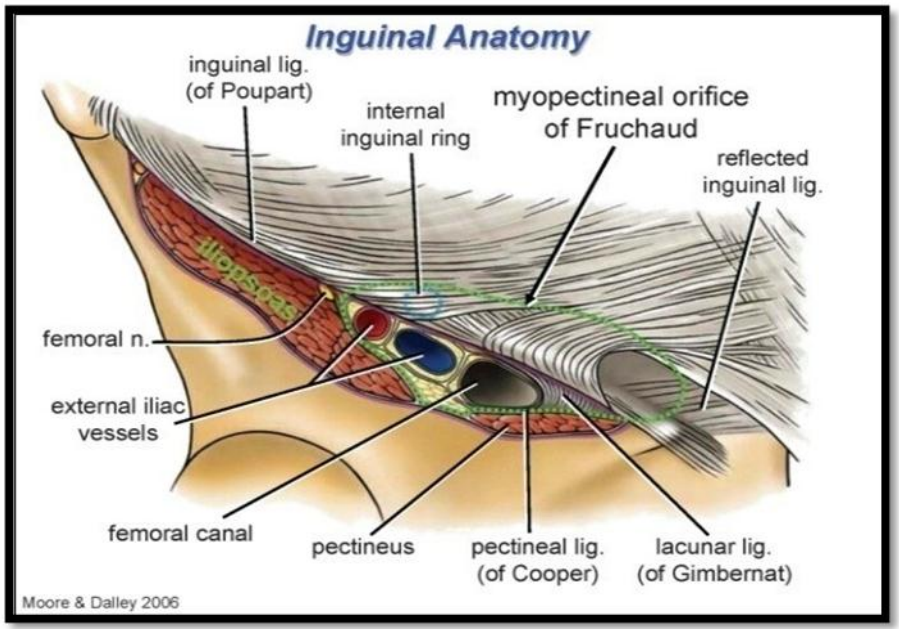

Figure (2): The musculopectineal orifice of Fruchaud ***(Moore et al., 2005).***

This space is of great clinical significance because it is considered a "hole in the muscle" and therefore, a weak site in the abdomen where hernias may occur ***(Avisse et al., 2000).***

Superficially, this myopectineal orifice is divided into two levels by an aponeurotic structure, the inguinal ligament (or crural arch), which represents the termination of the aponeurosis of the external oblique muscle. The superior, inguinal level provides a passage for the spermatic cord (or round ligament).The inferior, femoral (or crural) level provides a passage for the femoral vessels. Deeply, the myopectineal orifice is closed by the transversalis fascia, which becomes invaginated around the spermatic and femoral structures traversing the region ***(Avisse et al., 2000).***

Inguinal triangle of hesselbach

The inguinal triangle is the site of direct inguinal hernias. This triangle is most often described from the anterior aspect, in which case the inguinal ligament forms the base of the triangle, the rectus abdominis the medial border, and the inferior epigastric vessels the superolateral border. The triangle as originally described by ***Hesselbach*** had the pectineal ligament as its base. The latter descriptionis quite useful to the surgeon viewing the abdomen from within because the inguinal ligament cannot be seen from this view point. When the inguinal triangle is transilluminated, the thinness and translucency of the area of abdominal wall within the triangle emphasizes its importance in hernia development and repair. In the most translucent area, little or no muscle is present. Only the peritoneum and the transversalis fascia form the floor of the triangle here. The aponeurotic arch of the transversus abdominis crosses the triangle just below the apex in most people. A high aponeurotic arch affords less reinforcement to the triangle and may therefore predispose a person to the formation of a direct inguinal hernia ***(Fitzgibbons and Puri, 2006).***

Transversalis fascia

The transversalis fascia (endoabdominal fascia) is perhaps the most commonly misunderstood structure in the literature devoted to groin hernia ***(Nigam and Nigam, 2008).***

Confusion results because surgeons may actually be referring to very different anatomic structures when discussing various hernia repairs; however, each may use the same anatomic term or eponym ***(Fitzgibbons et al., 2006).***

The term transversalis fascia generally is defined as the deep or endoabdominal fascia covering the internal surface of the transversus abdominis, the iliacus, the psoas muscles, and the obturator internus and intervening portions of the periosteum. One variant of this convention is the use of terms specific to the muscle covered by the fascia (e.g., iliac fascia). Most authors feel that only one layer of transversalis fascia exists, whereas others maintain that the transversalis fascia comprises two layers, or laminae. The anterior lamina is more uniform and is adherent to the deep surface of the transversus abdominis and the rectus abdominis muscles. The posterior (deep) lamina is a layer of fibrous connective tissue that widely varies in density and continuity and is interspersed with adipose tissue (the extraperitoneal fat). This layer is often referred to simply as "the preperitoneal fascia". The posterior lamina is contained within the *preperitoneal space*, which is defined as the space between the peritoneum and the anterior lamina of the transversalis fascia (Fig. 3) ***(Fitzgibbons et al., 2006).***

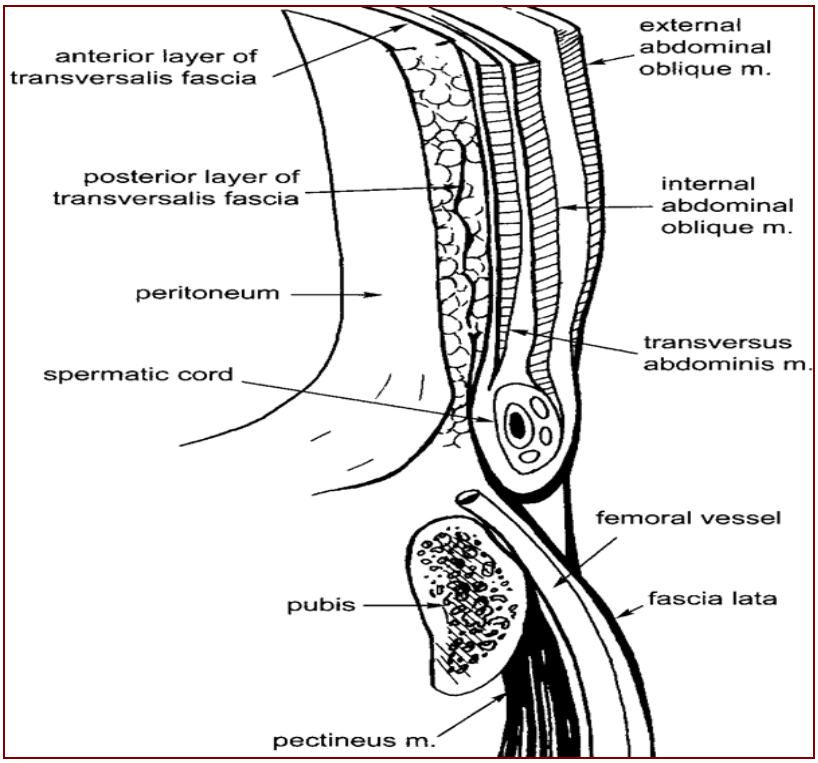

Figure (3): Two layers or laminae of transversalis fascia; the anterior (superficial) layer formerly called the transversalis fascia proper and the posterior (deep) layer formerly called the preperitoneal fascia ***(Skandalakis et al., 2009).***

The iliopubic tract

The iliopubic tract is the thickened band of transversalis fascia formed at the zone of transition between the surfaces of the iliac and transversus abdominis muscles. It courses parallel to the more superficially located inguinal ligament, is attached to the iliac crest laterally, and inserts on the pubic tubercle medially. The tract forms along its course a portion of the inferior crus of the deep inguinal ring and then contributes to the anterior and medial walls of the femoral sheath. The tract

fuses with the inguinal ligament to form part of the inferior wall of the inguinal canal. At its insertion on the pubic tubercle, it curves backward slightly to blend with Cooper's pectineal ligament ***(Fitzgibbons et al., 2006).***

The iliopubic tract has particular significance because of its importance as a landmark to the laparoscopic surgeon. Many of the branches of the lumbar plexus run inferior to the tract, and damage to these nerves may be the result of aggressive dissection or the placement of tacks or staples to fix prosthesis below this structure. The tract is not obviously visible in every patient, but its location should always be immediately known to the surgeon ***(Lange et al., 2002).***

The preperitoneal space:

The preperitoneal or properitoneal space is the space between the peritoneum internally and the transversalis fascia externally. Accepting the bilaminar formation of the transversalis fascia into anterior and posterior laminae, two spaces are formed: one between the peritoneum and the posterior lamina of the transversalis fascia and another between the two laminae of the transversalis fascia (Fig 4). Occasionally, the posterior lamina is not well developed. In such cases, the space is limited by the peritoneum internally and the anterior lamina of the transversalis fascia externally ***(Mirilas et al., 2005).***