INTRODUCTION

Umbilicus is an important and essential aesthetic subunit of the abdomen. The shape and configuration of the umbilicus are especially important for females reconstruction of a neoumbilicus from nonumbilical tissues. It appears to be a simple procedure, but in practice this is not the case. Thus, any umbilical reconstruction technique should be carefully planned and performed to obtain an aesthetically pleasing umbilical shape with minimal scars.**(1)**

Max Thouk, in 1922 was the first to reconstruct the umbilicus as a free graft.(2). *Mansard, 1922* as well as *Thebesius* and *Weisenheimer, 1923* described umbilical pyramid-shaped island grafts, and in *1931 Buschke, Joseph and Birkenfeld* described the first recorded umbilical reconstructive procedure after complete removal of the original using four diamond-shaped areas of skin resection and several retention sutures.(3) Later techniques of umbilical transposition utilization anterior abdominal wall skin flaps were developed and employed by *Malbec* in *1948*, *Vernon* in *1957*, *Pitanguy* in *1967* and *Baroudi* in *1974*.(3)

The umbilicus is a fibrous cicatrix covered by adherent puckered skin lies a little below the midpoint of linea alba, below it the linea alba is narrow corresponding to the linear

interval, while in the supra umbilical portion of linea alba it is broader as the two recti diverge from each other.[4] It lies at the level of superior iliac crests at the level of 3rd and 4th lumbar vertebrae posteriorly (*midway between the xiphoid and the pubis*).[5]

Umbilicus is supplied by superficial, subdermal plexus and deep perforating system.[1] The deep arterial system is responsible for umbilical perfusion following abdominoplasty. Venous drainage to left and right umbilical vein then to venous sinus of liver. Lymphatic drainage from peri-umbilical skin to internal mammary nodes.[1]

Embryologically, Under normal circumstances,all tubed structures obliterate post- natally becoming inert ligaments.The importance of these ligaments lies in their contraction postpartum, which produces the characteristic depression of the normal umbilicus.[6]

The ideal umbilicus is apparently small, oval and non protruberant . It has ring shape with, tubular wall, base and superior hooding with vertical or T-shaped orientation.[1] A distorted or horizontally orientated umbilicus has been deemed less attractive by both surgeons and the patient.[1,7]

The umbilicus may require surgical reconstruction due to congenital or acquired conditions. Congenital umbilical

pathology includes umbilical hernia is the most common congenital anomaly, but most undergo spontaneous closure.[1] The omphalomesenteric duct persists in 2% of the population as aMeckel's diverticulum.[6] Acquired umbilical pathology includes infection endometriosis and malignancy that may present as cysts, sinuses or fistulae in a differential diagnosis including benign and malignant neoplasms.[6]

Key factors in the choice of technique for umbilicoplasty are the relative redundancy of surrounding tissue and the vascularity of the anterior abdominal wall as determined by the presence of scarring with respect to final cosmesis.[8]

Umbilical reconstruction should be reliable, reproducible, aesthetically appropriate. Umbilicplasty may be performed using different techniques including flaps, grafts and healing with secondary intention . Flaps have been described from both umbilical and abdominal tissue.[9-13] and the simplest is to produce a depression by subdermal stitches .[8,14]

The objective of this study is to provide an overview of different techniques for umbilical reconstruction and highlight the most commonly used techniques.

AIM OF THE WORK

The aim of this study is to analyze different methods of umbilical reconstruction and highlight the most commonly used technique.

ANATOMY OF THE UMBILICUS

The umbilicus is a fibrous cicatrix covered by adherent puckered skin lies a little below the midpoint of linea alba, below it the linea alba is narrow corresponding to the linear interval between the recti, while in the supra-umbilical portion of linea alba it is broader as the two recti diverge from each other and can be recognized on the surface as a hollow groove [(4)]

Anatomy of the Umbilicus:

Embryology:

The normal umbilicus consists of a sulcus that extends slightly superiorly as it approaches the abdominal wall fascia and a surrounding navel ring at its entrance that is hooded superiorly[(15)]

By studying thirteen autopsies specimens it was concluded that the umbilicus is formed as a result of contraction of four fibrous cords. These consist of the obliterated left umbilical vein, which runs superiorly in the round ligament of the liver; the obliterated urachus centrally, which runs inferiorly; and the two obliterated umbilical

arteries, which run laterally to their corresponding internal iliac artery. The resultant vector of these four cord contractors is usually directed inward and upward, resulting in the characteristic skin overhang superiorly with a shelving of the lower margin [15]

The anatomy of the umbilical ring and fascia may be appreciatedfrom the drawing presenting the relations of the-ring to thelineaalba, round ligament, urachus, and fascia ***(Fig. 1,2 & 3)*** [16]

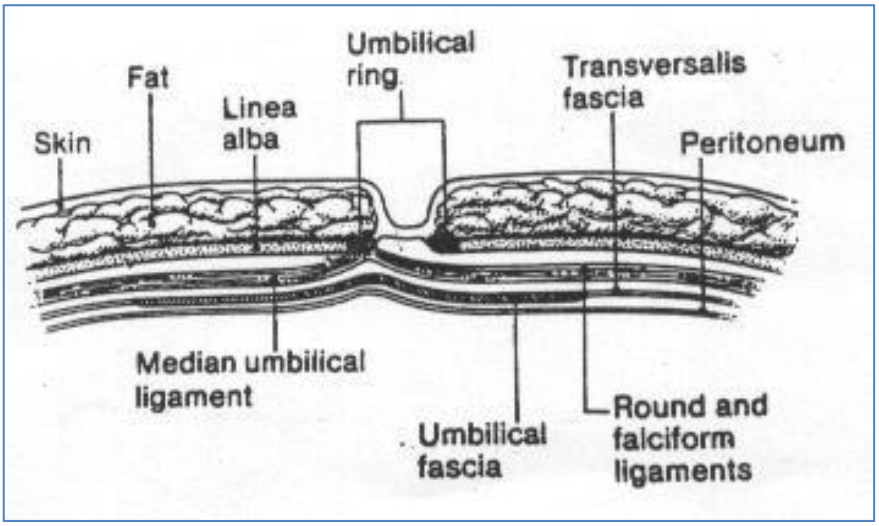

Fig. (1): Variations of the umbilical ring and umbilical fascia, shown by a sagittal sectionthrough umbilicus. Note the relation of the ring to the lineaalba, round ligament ofurachus, umbilical and transversalis fasciae, and the absence of fat over the ring [16]

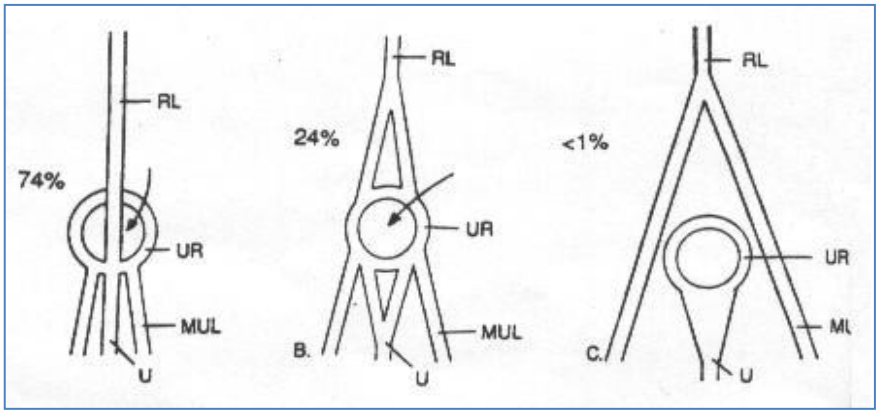

Fig. (2): Variations in the positions of the umbilical ligaments, as seen from the posterior(peritoneal) surface of the body wall. Arrows indicate: A) Usual relations (74%) ofthe umbilical ring (UR), the round ligament (RL), the urachus (U), and the medial umbilical ligaments (MUL). The RL crosses the UR to insert on its inferior margin.B) Less common configuration (24%). The RL splits and is attached to the superiormargin of the UR. C) Rare configuration (less than 1%). The RL branches beforereaching the UR. Each branch continues with the MUL without attaching to the UR [16]

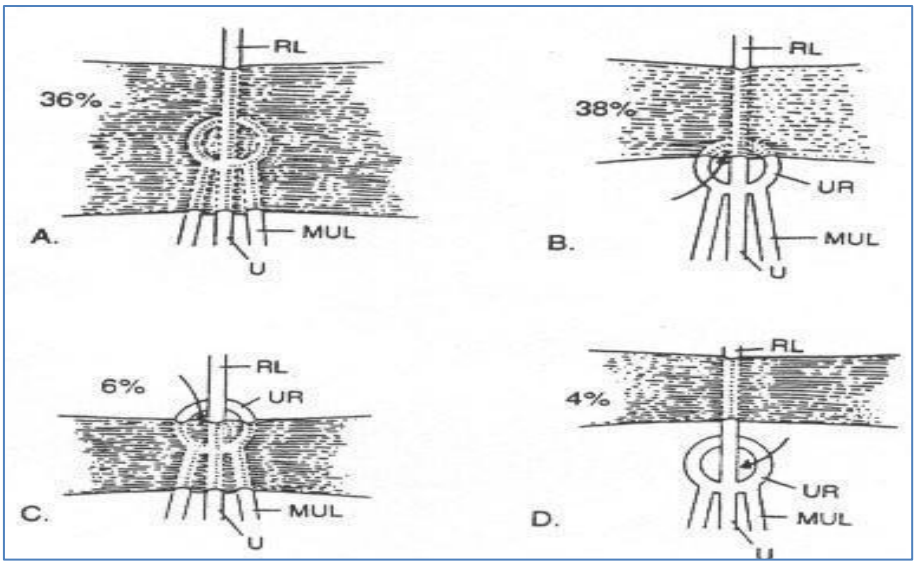

Fig. (3): Variations of the umbilical fascia in relation to several anatomic entities [16]

Thus an anatomic umbilical reconstruction should have:

(1) A normal slant superiorly.

(2) A superior hood.

(3) A normal shape (i.e. cylindrical with a wide attachment tothe abdominal wall fascia).

(4) No external scars, especially nonlying circumferentially inthe navel ring, which could result in stenosis. [17]

 Surgical anatomy of the umbilicus:

Anatomists and plastic surgeons describe the umbilicus as being an inconstant landmark, lying in the healthy adult at the junction of L3 and L4 vertebrae. It is lower in the infant and in the pendulous abdomen.[18]

The normal position of the umbilicus has been described as occupying the midline, level with the iliac crests andapproximately 2.5 cm. above maximum waist suppression.[19]

Psillakis had defined the waist as extending 7-10 cm between the inferior costal ribs and the iliac crests **(Fig. 4)**[18].

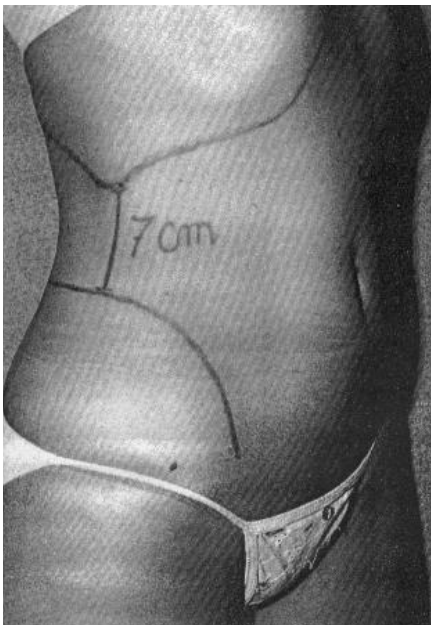

Fig. (4): The height of the waist measures 7-10 cm, and it is limited by the bony skeleton [18]

A more exact location is given by Vernon who positions the umbilicus two to four centimeter below the waistline though this is also an inexact measurement intraoperatively. [20]

- Arterial vascular anatomy of the umbilicus

The umbilicus has a dual blood supply (from the deep layer and from the skin) and can survive on either. Therefore the umbilicus can be circumscribed either through the skin or transected at its entry to the rectus muscle and still receive adequate blood flow. [18]

The umbilicus receives arterial inflow by means of three distinct deep sources in addition to the subdermal plexus. These deep sources are:

(1) The right and left deep inferior epigastric arteries that each give off several small branches, and a large ascending branch, which courses between the muscle and the posterior rectus sheath passing directly to the umbilicus.

(2) The ligamentum teres hepaticum.

(3) Along the median umbilical ligament.

The umbilicus should have robust arterial inflow if only one rectus muscle is removed, such as during a unilateral Transverse Rectus Abdominis Myocutaneous (TRAM) flap, because the contralateral side should still provide large direct vessels from the deep inferior epigastric arteries to the umbilicus. During bilateral TRAM elevation, all of the large arterial sources are removed from the umbilical inflow and circulation must depend on small vessels from the ligamentum teres and median umbilical ligament. Care should be taken in this latter clinical situation to preserve these sources of blood flow during umbilical flap creation.[21]

Venous drainage of umbilicus:

Veins in the skin and subcutaneous tissue consisted of venae comitantes and non-venae comitantes. The main trunk of the non-venae comitantes was the superficial inferior epigastric vein, and it forms a polygonal venous network in the skin layer. A large communicating vein, connect the venous network to a vena comitans of a large paraumbilical arterial perforator. Venous blood that had perfused the dermis of the paraumbilical region had two kinds of pathways to a deep vein: through the superficial inferior epigastric vein to the femoral vein and through the vena comitans to the deep inferior epigastric vein.[22]

AETHETICS OF THE UMBILICUS

The umbilicus is an important and essential aesthetic component of the abdomen. It has a key effect on the aesthetic appearance of the abdomen. Its position in the abdominal wall, its shape and depth are important influential factors of beauty and psychological well-being, which must be preserved or considered when one contemplates an abdominal reconstructive or esthetic procedure .[23]

It is also essential to the contour of the abdomen. It helps define the medial abdominal sulcus and contributes to the shapely curve of the inferior abdomen. Its absence leads to an unnatural abdominal appearance, but an abnormally shaped or misplaced umbilicus may draw undue attention to the central abdomen. Currently, a number of plastic surgery procedures may alter the shape and location of the umbilicus. To reconstruct or improve the umbilical appearance, the ideal must be known .[1]

The novel hypothesis explains why umbilicus has aesthetic value, and why umbilicus has had a distinctive role in different cultures. It is surprising how the remnant scar tissue has inspired tremendous attention throughout

human history. Prehistoric female figurines found in Austria (Venus of Willendorf, *circa* 30,000–25,000 BCE) and Russia (Kostenky settlement, 23,000–21,000 BCE) have a distinctive umbilicus. Greeks and Romans drew special attention to the shape and position of umbilicus in art, and Renaissance and Baroque painters mimicked natural variation of female umbilicus astonishingly **(Fig.5).**

The importance of umbilicus in social context is supported by the facts that several medicinal companies perform umbilical surgeries to increase the aesthetic value of their customers' abdomens and that umbilicus has been characterized as a sexual symbol in psychology.[24]

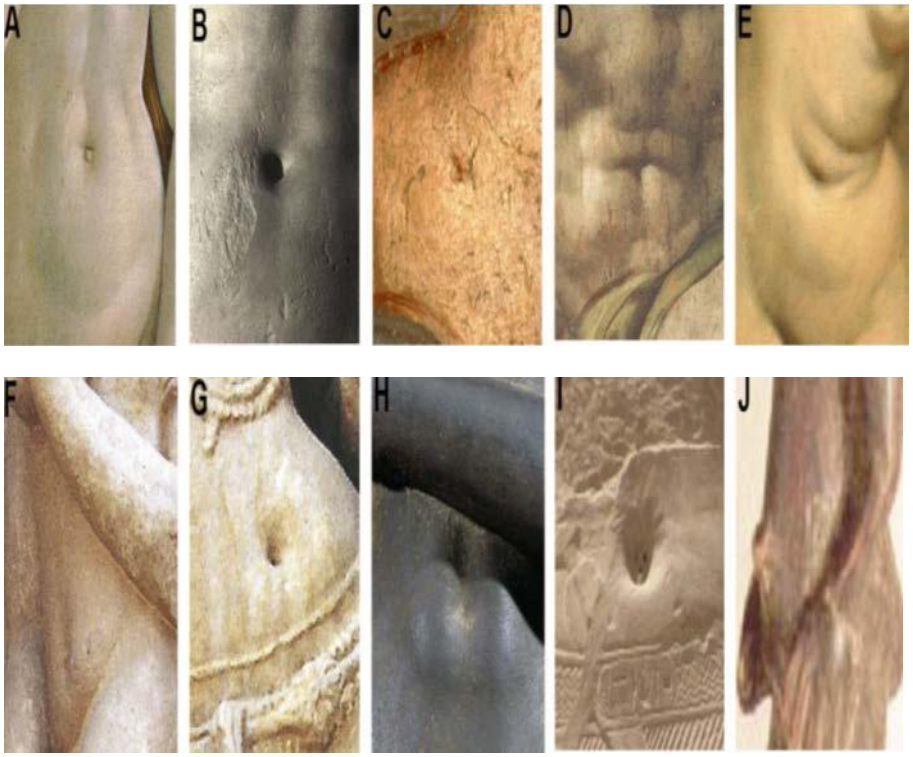

Fig. (5): Representations of human umbilicus in different cultures (*A*) Female umbilicus in *Birth of Venus* by Sandro Botticelli, 1486; (*B*) Female umbilicus of Venus de Milo, Greece, ca. 130–100BCE; (*C*) Female umbilicus from a wall painting in Pompei, Italy, ca. 79 CE; (*D*) Male umbilicusin *The Last Judgment* by Michelangelo Buonarroti, 1508–1512; (*E*)Umbilical skin area of a sirenin *The Debarkation at Marseilles*by Peter Paul Rubens, 1622–1625; (*F*) Male umbilicus,Lakshman temple, Khajuraho, India, ca. 950 CE; (*G*) Female umbilicus, Lakshman temple; (*H*)Umbilicus of Pharaoh Menkaure's Queen, Egypt, 2548–2530 BCE; (*I*) Pharaoh's umbilicus inKamak temple, Egypt, 1991–1186 BCE (Original photo by Andy McLaughlin 2007); (*J*) Femaleumbilicus from Senufo culture in West Africa, 19–20th century (original photo by Herbert E. Roese**.**[(24)]

The umbilicus itself has been described as a depressed scar surrounded by a natural skin fold that measures 1.5 to 2

cm in diameter and lies anatomically within the midline at the level of the superior iliac crests. It is generally flat and vertically oriented in young individuals, and later it develops hooding and deepening of the stalk as fat accumulates along the deep fat pocket that surrounds the umbilicus. Transverse orientation generally occurs after childbirth; however, aging in combination with weight gain will contribute to a deeper umbilical stalk and an overall widened appearance .[1]

In 1997 *Massiha* [25] described variations of the appearance of the umbilicus with different body types. Mainly a corpulent patient with excess subcutaneous fat, the umbilicus has a crater of skin going down to the level of skin of the umbilicus. In a thin athletic person, this crater is shallow and the base of the umbilicus can be seen

in a study on the ideal female umbilicus, *Craig* [1] in 2000 conducted a photographic analysis of the umbilicus in 147 women between the ages of 18 and 62 years to ascertain the characteristics of an ideal umbilicus to be used for umbilicoplasty. He characterized umbilici on the basis of size, shape, hooding and umbilical protrusion, and accordingly an umbilical scoring system from 1 to 10 was assessed.

Within this study population, the most commonly seen umbilical shape was T-shaped. This was followed by the oval, vertical, horizontal, and distorted shapes, respectively **(Fig. 6)**.