

INCISIONAL HERNIA
Evaluation of the different prosthetic materials
used and applied methods

Essey

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INTRODUCTION

Although most abdominal wall defects could be repaired adequately through the use of adjacent tissue, occasional cases are found in which additional support is needed to close the hernial defect, and to provide reasonable assurance of the long-term success of the repair. The use of autogenous materials, such as fascia has been successful. However, some of their limitations, especially in large defects increase the interest in the use of non-living materials. Moreover large abdominal wall hernia not amenable to primary closure may require insertion of a prosthesis.

The aim of the present work is to give a review of the literatures on this problem beside evaluation of the different prosthetic materials used and the applied methods.

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ANATOMY

ANATOMICAL CONSIDERATION

Anatomy of The Abdominal Wall:

General Consideration:

The normal structure of musclofascial layers of the abdomen which is described in earliest editions of textbooks of anatomy (Gray's 1858) has been transferred unchanged. Only recently, more details of the structure and function of the aponeurosis of the abdominal wall were described.

There are three muscles in the anterolateral part of the abdominal wall (External oblique, Internal oblique and transversus abdominis), and two muscles in the ventral part (Rectus abdominis and Pyramidalis).

Subcutaneous Tissue:

The superficial fascia of the anterior abdominal wall includes fat which varies markedly in amount and distribution from one individual to another. In the lower part of the anterior abdominal wall the superficial fascia is formed of two layers: a superficial fatty layer - termed Camper's fascia - where the amount of fat is variable, and a deep membranous, elastic layer containing no fat, is commonly called Scarp's fascia.

Muscles of The Anterior Abdominal Wall:

The body wall consists essentially of three layers of muscles which encircle the body cavity and there fibres

lie in different directions of obliquity. The three layers are separated in the flanks where they are known as external oblique, internal oblique and transversus abdominis. There is another muscle in the ventral part which is the rectus abdominis muscle and a smaller muscle in the midline-is the pyramidalis muscle.

The external oblique muscle is the most superficial muscle and the broadest of the Anterolateral group. It arises from the lower eight ribs by eight digitations. The fibres pass from above downwards, forwards and medially. It is made up of muscular tissue superiorly and laterally, but it becomes aponeurotic in its medial and inferior extent. The upper and medial fibres pass into the aponeurosis which extends medially into the linea alba and laterally to get insertion in the iliac crest and anterior superior iliac spine. Medially it makes a portion of the rectus sheath. The posterior and inferior fibres of the muscle pass vertically downwards to be inserted in the anterior half of the outer lip of the iliac crest.

The spermatic cord in male and the round ligament of the uterus in females, pass through the superficial inguinal ring which is a triangular opening in its aponeurosis and it lies above and lateral to the pubic tubercle.

Inferiorly, the free margin (between the anterior superior iliac spine and the pubic tubercle) is rolled

posteriorly on itself to form the inguinal ligament (Paupart's ligament) which is not thicker than the structure from which it is derived (Mc Vay, 1954). Gallaudet (1931) and Mc Vay (1960) have pointed out that the lowermost margin of the inguinal ligament is free. The lateral portion of the inguinal ligament is firmly attached to the anterior superior iliac spine. It is also attached to the fascia lata of the thigh and to fascia covering the iliopsoas muscle, this latter relation is remarkably effective as a barrier to the hernia formation.

Internal oblique muscle lies deep to the external oblique muscle. It arises from the lateral two-thirds of the inguinal ligament, the anterior two-thirds of the iliac crest and the lumbar fascia. Its fibres are directed upward and forward. The highest fibres run upwards and medially to be inserted into the lower three ribs, while the remainder form a wide aponeurosis which splits to enclose the rectus abdominis and passes into the linea alba. The fibres of the infero-medial edge of the internal oblique are carried downwards by the descending testis to form the cremaster muscle. The most inferior part runs downwards to the pubis as a part of the conjoint tendon.

Aside from variations in the inguinal region, one

variation of the internal oblique muscle is in the way in which its fibres may be grouped so as to form rather distinct bands with relatively weak places between them, preperitoneal fat may herniate through these weak spots, (Morgan, Anson, Mc Vay, 1960).

The strength and anatomic arrangement of the internal oblique are extremely variable in patients with groin hernias. This is generally true in individuals with direct inguinal hernias, where the interval between the lowermost fibres of the internal oblique and the inguinal ligament is wide which prevent an adequate shutter action when the muscle is contracted. In this type of muscle, there is an anatomico-physiologic deficiency in the region of the inguinal canal (Zimmerman, Anson, 1967).

The transversus abdominis muscle forms the deepest muscle of the abdominal wall. It has a very long origin extending from the deep surface of the lower six ribs, lateral edge of the lumbar fascia and the anterior two-thirds of the lateral third of the inguinal ligament. The muscle fibres pass forward and become aponeurotic and pass behind the rectus muscle to decussate with the internal oblique aponeurosis to form the linea alba. The lowest fibres of the muscle join the lowest fibres of the internal oblique muscle to form the conjoint tendon. Immediately above the medial half of the inguinal ligament the internal oblique and transversus muscle fail to reach the inguinal

ligament but have a free arched lower border. The gap below this arched border of the two muscles is a weak point in the anterior abdominal wall and is occupied by the spermatic cord. To give some strength to this weak point in the abdominal wall, the medial end of the conjoint tendon curves behind the spermatic cord supporting its exit from the superficial inguinal ring.

The three musculo-aponeurotic muscles which have different direction where the external oblique fibres coursing obliquely downward, forward and medially, while the internal oblique fibres are directed upward and medialward and the transversus fibres run, for the most part, a horizontal course, these different courses of the muscle fibres provide a firm and elastic wall to retain the abdominal viscera in position and to appose the action of gravity on them in the erect and sitting postures. This function is principally dependent on the normal tonus of the oblique muscles, especially the internal oblique (Roger Warwick, Peter L. Williams, 1973), also, all the three lateral abdominal muscles work together as compressors of the abdomen, probably at the same time constricting and strengthening the inguinal canal.

Rectus abdominis is a long straplike muscle. The recti stretch between the thorax and the pubis on each side of the linea alba. Inferiorly, the muscle arises from the

pubic crest and the ligaments in front of the symphysis pubis. Toward the thorax, the muscle widens and becomes thin. It inserts by three large slips, into the anterior aspect of the costal cartilages of the fifth, sixth and seventh ribs and by a smaller slip to xiphoid process of the sternum.

The rectus muscle is broken up into segments by irregular tendinous intersections, although variable, they are usually three in number and are placed as follows: at the level of the umbilicus, opposite the xiphoid process and midway between these two. A fourth intersection is sometimes encountered below the level of the umbilicus. The intersections are adherent to the anterior part of the sheath of the rectus, but have no attachment to the posterior wall of the sheath and hence serve to prevent sliding of the muscle inside its sheath and also preventing retraction of the muscle in transverse incisions. The attachment of the tendinous intersections to the anterior rectus sheath and lateral edge of linea alba by means of fine tendinous fibres, some of the fibres are directed upwards and medially to join the internal oblique aponeurotic fibres having the same direction, others are directed downwards and medially to join the external oblique fibres. Both together with other fibres in the anterior rectus sheath, cross the midline to join the fibres having the same direction on the opposite side, (Askar, 1984).

The attachment of the tendinous intersections, especially the lower one to the lateral edge of the linea alba, may have a relationship to the development of aponeurotic hernia. Severe contraction of the lower part of the rectus muscle as would occur in straining during labour, may exert harmful downward lateral traction on the already exhausted stretched aponeurosis, sufficient to produce a tear at this critical spot, where the lower tendinous intersection is attached to the midline (Askar, 1984).

The muscle is separated from its fellow on the opposite side by the linea alba.

The pyramidalis muscle: it is a small triangular muscle, arises from the pubic crest between the rectus abdominis and its anterior sheath to be inserted into the linea alba an inch or more above its origin. It is innervated by T.12. It is often absent. The flat triangular muscle apparently a tensor of the linea alba (Brücke, 1954).

The Rectus Sheath:

The composition of the rectus sheath is variable, depending upon the level under consideration. Aponeurotic contribution from the three flat abdominal muscles that cross in the midline make up the powerful sheath (Ponka, 1980).

Above the costal margin, the rectus muscle lies directly on the costal cartilages while its anterior surface

is covered by the aponeurosis of the external oblique only.

From the costal margin to a point midway between the umbilicus and the symphysis pubis, the arrangement of the aponeurotic layers is such that the external oblique aponeurosis passes in front of the rectus abdominis muscle and the internal oblique aponeurosis divides into two laminae at the lateral margin of the rectus abdominis, one layer passes in front to form a portion of the anterior rectus sheath while the other layer is contributed to the posterior rectus sheath. In 1935, Chanke's opinion was that the internal oblique muscle splits into two parts from its origin at the iliac crest to the linea alba. Even Anson and Mc Vay (1940) found that often the external oblique and the internal oblique layers had passed in front of the rectus abdominis without the internal oblique dividing while the transversus abdominis aponeurosis actually provided a layer to the anterior rectus sheath and one to the posterior sheath as well.

Below a point mid way between the umbilicus and the symphysis pubis, layers forming the rectus sheath have yet another arrangement. Here the aponeurosis of the three muscles pass anterior to the rectus abdominis muscles and the transversalis fascia forms the fascial layer posterior to the rectus abdominis muscle where the posterior rectus sheath ends at that point forming an

arched lower border called the arcuate (or semicircular) line.

From the above description it is clear that while the anterior surface of the rectus muscle is always covered by aponeurosis, the posterior surface of the muscle rests on aponeurosis only in its intermediate part, its upper part rests on cartilages, and its lower part rests on fascia transversalis. The arrangement compensates for the different thicknesses of the anterior rectus sheath. Where the anterior rectus sheath is thin - in its upper part - the rectus muscle rests on strong tissue made of cartilage and where the anterior rectus sheath is thick - in its lower part - the rectus muscle rests on areolar tissue of transversalis fascia, while in the intermediate part of the rectus muscle is covered by external oblique aponeurosis and anterior layer of the aponeurosis of the internal oblique and rests on the posterior layer of internal oblique and the aponeurosis of the transversus abdominis. Actually this arrangement provides a strength to the rectus sheath and makes it less liable to herniation.

Besides the rectus abdominis muscle, the rectus sheath contains the pyramidalis muscle (if present) and the anterior rami of the lower six thoracic nerves, the superior and inferior epigastric vessels and lymphatics.