VENTRAL HERNIA REPAIR; COMPARATIVE STUDY FOR DIFFERENT METHODS OF REPAIR

Thesis

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CONTENTS

LIST OF ABBREVIATIONS

ALT=SGPT: Alanine aminotransferase.
BMI : Body mass index.
CBC : Complete blood count.
cm : Centimeter
e.PTFE : Expanded polytetrafluoroethylene.
ECG : Electrocardiography
FEV1 : Forced expiration volume in 1 second
FVC : Forced vital capacity.
gm: : Gram.
HS : Highly significant
ICU : Intensive care unit.
K : Potassium.
kg: : Kilogram
mg: : Milligram
min : Minute
mm : millimeter
Na : Sodium.
NS : Not significant
PFT : Pulmonary function tests.
PNT : Postoperative narcotic therapy.
pO_2 : Partial pressure of oxygen saturation.
Pp : Polypropylene.
PTFE : Polytetrafluoroethylene.
S : Significant
SC : Subcutaneous.
SPA : Subjective pain assessment

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INTRODUCTION

Surgeons often face patients with ventral hernia, which can usually be closed by primary closure or with synthetic mesh after adequate undermining. The goal of ventral hernia repair is to achieve sound abdominal wall and to decrease the incidence of recurrence. Although different procedures were designed to avoid the application of alloplastic materials such as mesh, and durable skin coverage with local innervated tissues, the results were not satisfactory *(**Nho et al., 2003**)*.

Ventral incisional hernia is a common problem encountered by surgeons *(**Millikan, 2003**)*. Ventral hernia usually occur as a result of inadequate healing of a previous incision or excessive strain at the site of an abdominal wall scar *(**Eubanks, 2001**)*.

An incisional hernia usually starts as a symptomless partial disruption of the deeper layers of a laparotomy wound during the immediate or very early postoperative period *(**Bennett and Kingsnorth, 2004**)*. It is the most common postoperative wound complication after abdominal surgery, developing in 2% to 11% of ventral laparotomy incisions *(**Iskit et al., 1998** and **Mark et al., 2002**)*.

Much evidence suggests that hernia formation and recurrence depends in part on a systemic predisposition due to an abnormal metabolism of the connective tissue and in part on

other risk factors, surgical and as well as nonsurgical ***(Sorensen et al., 2002)***:

Tensile strength of wound is highly dependent on stable collagen molecules. Hydroxylation of proline and lysine plays a role in stabilizing collagen as this process produces inter- and intramolecular cross-linking and glycosylisation of collagen ***(Pans et al., 1997)***.

Synthetic mesh material used in hernia repair induces a foreign body reaction with intense inflammatory response and secondary fibrillogenesis and connective tissue deposition. However, the tissue response depends on the implanted mesh material ***(Pans et al., 1997).***

The structure of polypropylene allows penetration of newly formed vessels and a total integration with reparative tissue, whereas the ePTFE mesh is embedded sandwich-like by orderly connective tissue on the internal and external surface. However, all types of mesh material provide a scaffold for the reparative processes, creating a firm fibrotic scar ***(Bellon et al., 1995)***.

The management of major anterior abdominal wall ventral incisional hernia continues to be a fundamental and challengable problem for surgeons ***(Bauer et al., 1999)***.

Not all postoperative ventral hernia need to be repaired. One frequently finds a low, wide bulge down the length of the old incision, when it does not bother the patient and shows no

signs of growing, there is no indication for re-operating. For most other types, repair should be undertaken ***(Abrabamson, 1997).*** Small ventral hernia may be temporarily controlled, but no spontaneous cures can be expected. A wide belt or corset gives a patient with a large hernia some comfort and may be used for palliation when surgical treatment is contraindicated, although it hides potential problems ***(Read, 1996)***. The abdominal belt is sometimes satisfactory, especially in cases of a hernia through an upper abdominal incision ***(Bennett and Kingsnorth, 2004)***

Incisional ventral hernia repair vary from primary closure only, primary closure with relaxing incisions, primary closure with an onlay mesh reinforcement, onlay mesh placement only, inlay mesh placement, retrorectus mesh placement, and intraperitoneal mesh placement. Combinations of the above types of repair include a sandwich technique in which mesh is placed as both an onlay and either retrorectus or intraperitoneal, and a cuff technique in which mesh is placed around the muscle on each side of the defect and then the mesh-reinforced edges are primarily closed ***(Millikan, 2003)***.

Primary closure techniques can vary from surgeon to surgeon. The most simple closure technique involves using continuous or interrupted sutures to approximate the edges of the fascial defect ***(Millikan, 2003)***. This type of closure is usually performed for small fascial defects less than 5cm in greatest diameter. Even for small hernia defects, recurrence

rates in excess of 50% have been reported *(**Anthony et al., 2000*** and ***Luijendijk et al., 2000**)*.

Tension-relaxing incisions may be required and should be placed well laterally *(**Bennett and Kingsnorth, 2004**)*. The keel procedure uses bilateral relaxing incisions in the anterior rectus fascia to aid in the closure of the upper midline incisional ventral hernia *(**Millikan, 2003**)*.

The component separation technique (separation-of-parts) in which release of the external oblique muscle bilaterally allows for movement of the rectus abdominis myofascial flaps up to 15 cm on each side has been advocated for massive midline ventral hernia and also in patients where wound contamination is considered as a contraindication to mesh placement. Personal communication and presentation from Greg Dumanian and Alexandrina Saulis Society's November 2001 meeting reported 8% recurrence rate and approximately 10% significant skin and wound problems with the separation-of-parts technique *(**Millikan, 2003**)*.

Primary hernia repair (the repair of the ventral hernia without the use of a prosthetic material) can be associated with several complications, such as bleeding, infection, ileus, that plague every aspect of abdominal surgery. There are also complications that are specifically related to ventral hernia repair itself, including pulmonary complications and hernia recurrence *(**Marshall and Debord, 2002**)*.

The use of prosthetic biomaterials to repair ventral hernia can develop complications as those in primary repair of hernia, such as haematoma, seroma, and wound infection. A second set of complications can develop secondary to the prosthesis itself, consisting of infection of the prosthetic material, fistulas, and bowel obstruction ***(Marshall and Debord, 2002)***.

The most consistent risk factor for recurrence is wound infection. Open incisional hernia repair is associated with a significantly higher infection rate than other clean general surgical procedure, and so it is not surprising that the use of prophylactic antibiotics for incisional hernia repair has increased, particularly when using mesh ***(Sanders et al., 1999, Heniford et al., 2000, Zanghi et al., 2000)***.

Reconstruction of large ventral hernia is still a major problem in surgical practice ***(Tammo et al., 2003)***. Re-herniation rates of up to 46% have been reported after primary closure, because most of these defects cannot be closed primarly as the fascial edges are retracted far laterally into the flank from shortening of the external oblique ***(Luijendijk et al., 2000).***

Now, it is felt that the subject of ventral hernia repair is still opened for further evaluation of the different techniques.

AIM OF THE WORK

This thesis is limited to the postoperative ventral hernia (incisional hernia), while spontaneous ventral hernia had been excluded. The aim of this study is to compare between open primary suture closure approximation repair (group 1) and primary closure repair supplemented with onlay mesh repair (group 2), as regards:

١. History taking and detailed clinical examination both generally and locally.
٢. The size of the defect and the condition of the abdominal wall musculature.
٣. The routine laboratory investigations.
٤. Bacteriological study of the skin of the expected anatomical site of repair and the role of prophylactic antibiotics to decrease incidence of wound infection according to culture and sensitivity tests.
٥. Pulmonary function tests with exclusion of marked chronic pulmonary obstructive airway disease.

All patients in this thesis will be followed up for one year for post-operative complications and the possibility of recurrence.

EMBRYOLOGY OF THE ABDOMINAL WALL

The anterior abdominal wall is formed of the ectoderm and the parietal mesoderm, which form the somatopleure. At this stage, no muscles, vessels, or nerves are present. During the sex week of gestation, the mesoderm form myotomes lying on either side of the vertebral column invades the somatopleure. The myotomes become divided into a small posterior part, epimere and larger anterior part, hypomere. The right and left rectus abdominis muscles are formed first; then the mesodermal sheets of muscle split into three layers. By the middle of the seventh week of gestation, the three paired, flat abdominal muscles and the rectus abdominis can be recognized. Approximation of the two recti proceeds from the cranial and caudal ends, so that the abdomen becomes essentially closed by the 12^{th} week of gestation, except for the umbilical ring where the line of fusion of the mesenchyme forms the linea alba. At the ring, the body wall, with its developing muscles, gives way to undifferentiated somatopleure over the surface of the umbilical cord. Although true skin may grow a short distance beyond the body, the structure of the cord remains embryonic ***(Kingsnorth et al., 2000)***.

Each segmental spinal nerve as it emerges from its intervertebral foramen, is divided into posterior primary ramus that innervates the epimere and anterior primary ramus that supplies the hypomere. The epimere gradually develop into the extensor muscles of the vertebral column, while the hypomere form the prevertebral flexor muscles of the vertebral column ***(Jacob et al., 1986)***.

ANATOMY OF THE ANTERIOR ABDOMINAL WALL

The anterior abdominal wall is a multilayered distensible encasement for the viscera, which also provides support for the spine and the force necessary to aid respiration, defecation, and urination. A great number of interdependent structures must run through its interior. Failure of any of the layers or the tissues running between them may cause the loss of integrity in the entire system. Even the outermost layer of the wall, the skin, is subject to physical principles as evidenced by Langer's tension lines. There is no deep fascia over the trunk, only the superficial fascia, (if there were, i.e, we would presumably be unable to take a deep breath or enjoy a large meal!) ***(Kux, 2002)***.

I. Skin and fasciae of the anterior abdominal wall:

The anatomy of the abdominal skin envelope of an individual is related to body hiatus and previous surgery. The obese patient has an excess amount of skin. Patients with previous incisions may have significant disturbances in the cutaneous blood supply. Tissue expansion will change the anatomy of the dermis and epidermis, and the capsule will assist in skin perfusion ***(Rohrich et al., 2000)***.

The superficial abdominal fascia above the umbilicus is considered to be a single layer of connective tissue that contains a variable amount of fat. This layer is thicker inferiorly, especially in obese individuals, and differentiates into a superficial fatty layer (Camper's fascia; panniculus adiposus)

and a deeper membranous layer (Scarpa's fascia), between which are superficial vessels, nerves and the superficial inguinal lymph nodes ***(Salmons, 1995)***.

The superficial layer of fascia is continuous with the outer layer of fascia covering the perineum, the penis, the scrotum, and the thigh. The superficial fatty layer of fascia loses its fat component as it passes into the male external genitalia. This layer also contains the dartos muscle of the scrotal wall. The deeper layer of the superficial fascia, or Scarpa's fascia, is thicker and more complex in the inferior abdominal wall than it is superior to the umbilicus. The deep layer of superficial fascia in its inferior reaches contains elastic fibers. It is loosely adherent to the fascia covering the aponeurosis of the external abdominal oblique and, after it crosses the inguinal ligament, to the fascia lata of the thigh. The deep layer of fascia forms the fundiform ligament of the penis, continues onto the penis and the scrotum (labia majora), and then fuses with the superficial fascia of the perineum (Colle's fascia). In the perineum, it is attached behind to the perineal body and posterior margin of the perineal membrane and, laterally, to the rami of the pubis and ischium ***(Kux, 2002)***.

As a result of the previous attachments, rupture of the urethral bulb may be followed by extravasation of blood and urine into the scrotum, perineum and penis, and then into the lower abdomen deep to the fibrous layer of superficial fascia, but not by extravasation downwards into the lower limb, from which the fluid is excluded by the attachment of the fascia to the deep fascia of the upper thigh ***(Dyson, 1995)***.