Review Article

Incisional Hernia: A Review of Etiopathogenesis, Clinical Presentation, Complications and Management

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ABSTRACT

Incisional hernia is one of the most common postoperative complications seen following abdominal surgery leading to poor quality of life and high treatment costs. With various operative techniques employed for wound closure of laparotomy incisions, the earlier reported incidence of incisional hernia of 3% after laparoscopic surgery and 15% after open surgery still occurs. Clarification regarding the type of mesh and its positioning and operative methods of open surgery and laparoscopic repair needs to be addressed. In addition to surgical closure techniques, patient's risk factors also influences surgical outcome following wound closure.

Methods: *An internet database search of Medline/pubmed/cochrane was used to retrieve articles of retrospective and cohort studies related to incisional hernia. A systematic review of incisional hernia related to its etiology, pathogenesis, treatment and complications was undertaken.*

Results: *Age, gender and risk factors such as diabetes, smoking, anaemia, old age, etc, contribute for development of primary and recurrent incisional hernia. Although complete prevention of development of incisional hernia is not possible, repair of hernia by replacement of simple suture technique with that of mesh reinforcement has shown better long term results and patient satisfaction.*

Conclusion: *For management of incisional hernia the available evidence have been favourable for good quality long term results with mesh repair techniques. Further randomized trials/comparative studies are recommended for comparison of conservative management and surgical repair techniques.*

Key words: *Incisional hernia, Pathophysiology, Mesh repair*

INTRODUCTION

Laparotomy wounds usually heal well with a tough scar without complications. Usually, even with increased intra-abdominal pressure of up to 180 mm Hg and local suture tensions of up to 16 N/cm^2, the sutured abdominal wounds heals within a few weeks and form a solid scar that is similar in stability to healthy abdominal wall. Acute separation of the sutured abdominal wall in the postoperative period, known as acute wound dehiscence or burst abdomen occurs in less than 1% of surgical wounds. In more than 20% of them there is occurrence of chronic wound dehiscence with the formation of a hernial sac and neck months to years after surgery known as incisional hernia.[1,2] Incisional hernia is now routinely considered as a long-term consequence of abdominal surgery. The

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outcomes for incisional hernia repair in the past were unsatisfactory with conventional surgical techniques using sutures and use of prosthetic implants which had recurrence rates of more than 50%.[3,4,5] Recently adoption of new surgical procedures, innovative implants and standard treatment protocols have shown satisfactory surgical repair of incisional hernia with good long term results and preservation of good quality of life.

METHODS

An internet database - medline/pubmed /cochrane search was performed and articles on incisional hernia related to etipathogenesis, clinical presentation, management and complications were obtained and reviewed.

RESULTS AND DISCUSSION

Table 1: Factors favouring development of incisional hernia

Surgical	Patient factors	Associated disease	Hereditary connective tissue disorders
Type of incision	Impairment of local wound healing	Obesity, Diabetes	Ehlers-Danlos syndrome
Suture material	Age ↑	Anaemia, Underlying malignancy	Osteogenesis imperfecta
Suture technique	Female = Male	Abdominal aortic aneurysm	Cutis laxa, Congenital dislocation of hip
Wound infection	Smoking	Medication	

SURGICAL METHODS

Many retrospective studies have focused on the type of incision, type of suture material and suture technique as factors influencing incisional hernia. Transverse incisions, Pfannenstiel incisions and other pararectal incisions were found to reduce the incidence of incisional hernia when compared to vertical incisions. [6,7,8] Two controlled studies of elective procedures found no difference in the incidence of incisional hernias between horizontal and vertical incisions, however evidence of an incision-related effect on the incidence of incisional hernia are remote.[9-13] Minimally invasive procedures have an incidence of hernia at the trocar site of 1 to 4%.[14-18] Several meta-analyses on the type of suture material report the lowest incidences of incisional hernia for monofilament, nonabsorbable or long-term absorbable suture materials.[19-23] In 1976, Jenkins proposed a "precise surgical suture technique" as suture length to wound length ratio of 4 : 1. Meta-analyses support the use of a continuous suture technique with the same principles of surgical technique.[4] Incisional hernias develops one year after initial intervention with a low incidence in children and adolescents. The high recurrence rates after primary closure and even after mesh

repair could be due to other pathogenetic factors.[24]

PATIENT FACTORS

Biological factors related to the patient's pre-existing disease and it systemic effects have a role in the aetiology of incisional hernia. Wound healing is a complex process involving the interaction of several different cell types with the extracellular matrix. The quantity and quality of connective tissue produced is the primary determinant of the degree of normal physiological function and tissue stability achieved during scar formation. The ratio of type I to type III collagen is considered a predictor of connective tissue stability.[25,26] Of the known collagen variants, type I collagen due to its tensile properties is particularly responsible for mechanical tissue resistance. In patients with incisional hernias, a significant decrease in the collagen type I/III ratio relative to normal fascias is observed, suggesting a dysfunction in collagen metabolism.[27] Local infections and seromas have an impact on wound healing due to an increase in the production of cytokines and proteases, leading in turn to a reduction in fibroblasts and diminished wound stability.[28] Necrosis resulting from excessive suture tension can alter wound healing and stable scar formation. In a retrospective analysis of 2,983 patients who had undergone laparotomy, being aged above 45 years was found to be a significant risk factor for incisional hernia.[29,30] This can be explained by delayed wound healing in older individuals, with changes in fibroblast migration and structural changes with reduced collagen formation and high prevalence of associated disease. Though studies suggest that men are at a greater risk than women in developing incisional hernia there were no consensus influence of gender among the studies reviewed. Many studies identify obesity as a risk factor for incisional hernia development. [31-33]

Poor nutritional status, ill health, diabetes mellitus, anaemia and malignancy also contribute to incisional hernia formation. The incidence rate of incisional hernia following abdominal aortic aneurysm surgery is at 28 to 38% and is significantly higher than the rate observed after laparotomy performed for other indications. It has recently been shown that these patients also suffer in part from genetically determined type III procollagen disorder with an impairment of new collagen synthesis.[34,35] Smokers have been shown to have not only a significantly increased rate of relapse after inguinal hernia repair, but also a four-fold risk of developing incisional hernia. Drugs such as ACE inhibitors, corticosteroids, non-steroidal anti-inflammatory substances and chemotherapeutic agents have an impact on the various stages of wound healing. Connective tissue disorders such as Ehlers-Danlos syndrome, osteogenesis imperfecta, cutis laxa, congenital dislocations of the hip are generally associated with an increase in the incidence of hernias or an increase in recurrence after primary repair. [36-39]

CLINICAL SYMPTOMS AND SIGNS

Patient's with incisional hernia present with history of mass per abdomen or bulge during physical activity such as exercise or coughing, and disappearing after stopping the activity. Presentations of patient with irreducible

swelling and associated with incarceration are rare. Examination is performed both in standing and lying down position, to assess the symmetry of the anterior abdominal wall, for protrusions/expansile impulse during cough and compression. On palpation, the hernial protrusion is examined for its consistency, reducibility, tenderness, size of vent and its anatomical relationship to the anterior abdominal wall. Occasionally multiple incisional hernias within a scar with fascial septa in between and irreducible may be palpable which is known as latticed hernia. [25-30]

COMPLICATIONS OF INCISIONAL HERNIA [1-46]

Bowel obstruction/ incarceration
Bowel strangulation
Respiratory distress
Skin ulceration and necrosis
Evisceration of abdominal contents
Spontaneous/traumatic rupture

INVESTIGATIONS

Ultrasonography is a non invasive, cost effective and repeatable diagnostic investigation of choice, particularly in small or impalpable hernias and in obese patients. The details of location, size and hernial content can be assessed. Some salient sonographic features for identifying hernias are detection of a fascial gap, visualization of hernial content and increase in the size of the hernial sac on Valsalva maneuver. [6-10]

Computerized tomography or magnetic resonance imaging are employed for complicated hernias and large abdominal wall defects to visualize internal hernial sac structures and their relationship to intra-abdominal organs. [15-20]

PREREQUISITES FOR INCISIONAL HERNIA SURGERY

No infection at the site of hernia.
Ideally at least six months should have been completed after primary / initial intervention.
Defect of any size, when incisional hernia surgery is warranted.

SURGICAL INTERVENTIONS

Suture method

1. Repair of the defect using continuous or interrupted suture technique or Mayo's is in vogue. [1-6]
2. Recurrence rates of > 50% are documented depending on the length of follow-up. [3-9]
3. Conventional suture techniques have to be selected for patients with significant co-morbidity, repairs involving bowel and small trocar hernias. [5-8]

Mesh repair

1. Mesh material was first used for incisional hernia repair more than 50 years ago and primarily for defect bridging. [36]
2. Use of mesh for abdominal wall reinforcement was first described in the 1970's by French surgeons namely Chevrel, Rives and Stoppa. [35-40]
3. According to the positioning of the mesh prosthesis, epifascial mesh reinforcement is known as the onlay technique and retromuscular mesh reinforcement as the sublay technique.
4. An advantage of abdominal wall reinforcement is that it permits the

reconstruction of the abdominal wall as an anatomical functional unit. [33]

5. The inlay technique is a simplest form of repair where mesh is sewn into the fascial defect. The suture between the mesh prosthesis and the mesh is similar to conventional suture repair. As the broad mesh contact between the fascia and the material is not established the inlay technique has high relapse rates. [39-43]

6. The onlay technique reinforces the fascial suture by placing a mesh over the fascia. This requires extensive epifascial preparation to ensure sufficient wrapping of the mesh over the fascial defect . [43]

7. The onlay technique is difficult for incisional hernias in which the fascial defect extends to

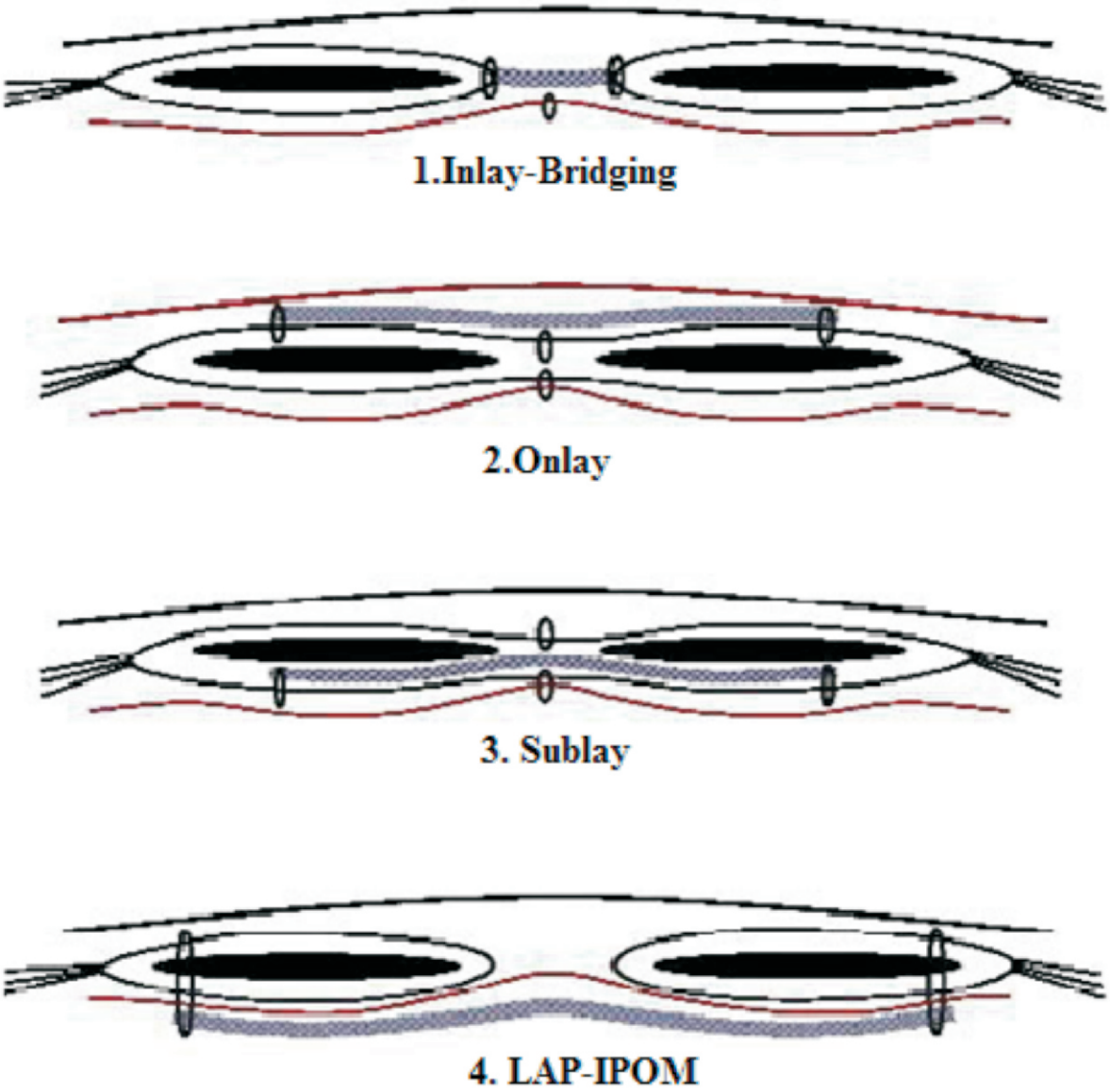

Fig 1: Schematic representation of the various methods of mesh positioning

Table 2: Results of incisional hernia repair based on positioning of mesh

Author	Year	No of patients	Mesh position	Mesh material	Follow up (months)	Recurrence %
Carbojo et al	2003	270	Lap-ipom	pp	44	4.4
Ladumer et al	2001	57	sublay	pp	6-33	2
Berger et al	2002	147	Lap-ipom	ptfe	90	2.7
Toy et al	1998	135	Lap-ipom	ptfe	7	4.5
Schumpelick et al	1999	81	sublay	pp	22	4.9
Rios et al	2001	246	onlay	pp	77	17.5
Anthony et al	2000	29	inlay	pp	45	29
De vries et al	2004	23	inlay	pp	33	44
Conze et al	2005	165	sublay	Pp od pol	24	12.5
Rosen et al	2003	96	Lap-ipom	Ptfee/pp	30	17.7
Heniford et al	2000	407	Lap-ipom	ptfe	23	2.0
Belsini et al	2003	49	sublay	pp	18	6.0
Ambroisiani et al	1994	82	inlay	ptfe	>12	41
Vestweber et al	1997	31	onlay	pp	32	44

pp-polypropylene, ptfe-polytetrafluooethylene, ipom-intraperitoneal onlay mesh, pol-polyester

bony structures such as the xiphoid process or the symphysis pubis.

8. Relapse rates between 6 and 17% have been reported in the literature for this technique. [43-45]

9. Presently the sublay technique has been much preferred as the gold standard for incisional hernia with a recurrence rate of 2-12%. Here, the mesh is positioned in the retro muscular space posterior to the rectus abdominis muscle. In a study of over 250 patients with incisional hernia who underwent retro muscular mesh repair a recurrence rate of 8.9% was observed based on an average follow-up of 48 months. As surgical technique has been standardized over the last few years, the relapse rate has been further reduced even. [15-20]

10. In laparoscopic incisional hernia repair (Lap-IPOM) the mesh prosthesis is placed after good preparation from the inside, as a defect bridging onto the fascial defect. As most of the tension rests on the fixation points of the mesh, local pain is frequently reported in the early postoperative period.

THE MESH MATERIALS

Incisional hernia repair is done using synthetic and non-absorbable biological materials. Depending on the polymer used, the

fibre construction and pore size are made these have an impact on textile properties such as surface weight and elasticity. Mesh prostheses are manufactured from polypropylene, polyester and polytetrafluorethylene. By adapting the mesh material to the physiologic conditions of the abdominal wall, a completely new generation of light-weight mesh materials was developed. These by providing thinner, partially absorbable fibre material and by enlarging pore diameter were standardized with regard to their biological compatibility. This development was felt by the experience of a shrinking and hardening of mesh material after their early introduction which led in part to stiff abdomen and other complications.[40-46]

CONCLUSION

Good long term results with incisional hernia repair depends on the surgical techniques used, patient associated factors and the choice of mesh material used.

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