

Incisional Hernia: A Review

J.M. Adotey FRCS, FWACS

Department of Surgery, University of Port Harcourt Teaching Hospital, Port Harcourt, Nigeria.

ABSTRACT

Background: *Otherwise known as post operative ventral hernia, incisional hernia is a common complication following abdominal surgery and is a significant cause of morbidity. This review examines incisional hernia from its historical perspective to the present.*

Method: *A Literature review of the topic was carried out using manual library search of journal articles on the topic published both locally and internationally. The search also made use of internet material from Pubmed and Medline on relevant parts of the topic. All relevant articles from the reference lists of these papers were also studied.*

Result: *Incisional hernia is a common complication of abdominal surgery. Its incidence is about 1% following primary healing and increasing to about 11% with postoperative wound infection. The most consistent causative factor is wound infection and the incidence may rise to 30% after abdominal wound dehiscence and resuture. It may be difficult to repair and a wide range of surgical procedures have been developed for such repair. The repair may be direct suture or prosthetic mesh using the open or laparoscopic technique. Prosthetic mesh has revolutionized the repair of incisional hernias. Laparoscopic repair, which was introduced in the 1990's, has been adjudged feasible, safe and as effective as the open methods of repair. Recurrence rates of up to 49% with direct suture repair have been reported. Open and laparoscopic mesh repair have recurrent rates of 0-10% and 0-9% respectively.*

Conclusion: *Despite improved surgical techniques and the use of prosthetic mesh incisional herniation remains a major problem for the general surgeon.*

KEYWORDS: *Incisional hernia; Causative factors; Surgical treatment; Recurrence.*

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INTRODUCTION

Incisional hernia is otherwise known as postoperative ventral hernia. It represents one of the most frequent complications of abdominal surgery¹. It is an iatrogenic condition² where there is failure of the lines of closure of the abdominal wall following a previous surgical incision. Rarely perineal incisional hernia may follow an abdominoperineal resection of the rectum with perineal wound failure. The pathogenesis is complex and not fully understood¹. The hernia can vary in size from very small to very large. The incidence is probably

underestimated¹ and ranges between 3.8-11.5%^{3,4,5}. The incidence depends on a number of factors. The most important causative factors are wound infection and wound dehiscence^{6,7}. Other predisposing factors are bowel surgery, abdominal distension, suture type, technique of wound closure, chest infection, old age, male sex and obesity⁶. Incisional hernia is a significant cause of long term morbidity⁸. Discomfort and incarceration are common features while strangulation is rare⁹. Emergency abdominal surgery is required when there is strangulation, intestinal obstruction or irreducibility^{5,10}. Although a common general surgical problem, a "best" method of repair has yet to be identified. This is evidenced by the documented recurrence rates of 25-52% with primary open repair. Recurrence rates of up to 33% after first repair and 44% after second repair have been reported¹². A wide spectrum of surgical techniques has been described. This ranges from primary suture (repair in one or two layers, Mayo-type overlap and use of fascia/suture darns) to the use of various types of prosthetic mesh⁵. Laparoscopic repair was introduced and first reported in 1993^{5,12,13}.

The results of this type of repair have so far been good¹³. This review examines incisional hernia from its historical perspective to the present.

MATERIAL AND METHODS

Manual library and Pubmed/Medline search from 1947 to 2005 on incisional hernia was carried out. Journal articles on the topic and all relevant references in these publications were reviewed to ascertain the historical perspectives, prevailing clinical features and management of this common general surgical problem.

RESULTS

Historical perspective. The rapid development of abdominal surgery in the 19th century was followed by incisional hernias as complications¹⁴. McDowell excised an ovarian cyst in 1809, Billroth performed a partial gastrectomy in 1881 and Langenbuch carried out cholecystectomy in 1882¹⁵. Such were some of the procedures that resulted in incisional herniation. Over the past one hundreds years there had been attempts at Repairing such hernias but these had failed. Such attempts at repair resulted in more complications and increase in recurrence¹⁴. Gerdy and Maydl repaired incisional hernias in 1836 and 1886 respectively, while

Judd in 1912 and Gibson in 1920 described techniques based on anatomical dissection¹⁵. Gallie and Le Mesurier used autologous fascial strips in repair in 1923¹⁶. The repair of incisional hernias is one of the first procedures in which implants of foreign material were used. Bartlett and McGavin in 1903 and 1909 respectively advocated the use of a silver wire filigree^{17,18}. Witzel and Geopel had earlier advocated the use of such silver wire in 1900¹⁴. Koontz and Throckmorton also used tantalum gauze in 1948^{19,20}. The drawback to the use of these metals was early fragmentation and recurrence of the hernia. The metal fragments were also noted to cause skin sinuses and perforation of the bowel. Shortly after this period synthetic plastic material, pliable plastic sheets and polyvinyl alcohol sponge were also introduced^{21,22}. The modern era of prosthetic hernia repair started in 1958 when Usher et al reported their experience with the use of polyamide mesh²³. Braided polyester mesh, polypropylene mesh and expanded polytetrafluoroethylene (PTEE) later came into use. It is these materials that have revolutionized the surgery of incisional hernia.

Darn techniques for incisional hernia repair were introduced in the early 20th century¹⁴. The variety of sutures used included strips of fascia lata, skin and animal tendon. Silk, cotton and linen were also used. Although the darn technique is excellent, it was not readily accepted universally because of the lack of a suitable suture material. In 1948 Abel reported his experience with monofilament stainless steel wire in the repair of hernia and closure of abdominal incisions²⁴. Hunter also reported his experiences with the use of monofilament nylon and suturing only the anterior rectus sheath²⁵.

Abrahamson and Elder modified this nylon darn technique and since 1973 have used the "shoelace" method for the repair of incisional hernias²⁶. The technique is, apparently simple to perform, extraperitoneal and associated with a low recurrence rate.

Incidence

The incidence of incisional hernias is difficult to estimate because of the fact that asymptomatic cases are not referred¹⁵. Incisional hernias from gynecologic surgery are usually excluded from purely "surgical" follow-up¹⁵. There is therefore under-recording of the true incidence of the condition. Moreover late development of incisional hernia has been reported in many studies^{6,10,27,28}, adding to the difficulty in determining the true incidence of incisional hernia.

An incidence of 0.5-11% has been reported in many studies^{27,28,29}. Ellis *et al*³⁰ and Mudge and Hughes⁶ reported rates of 72.5% and 43.5% developing within one year.

These figures however dropped to 5.8% and 6.3% after 2-5 years and 2-10 years respectively. The detection of late occurrence is difficult in our environment because of poor out-patient follow-up records⁴. Earlier short term studies have given an erroneous impression that most incisional hernias appear within one year postoperatively and that 80% develop within 2 years³¹. Ninety per cent of incisional hernias have been reported to occur within 3 years by other workers⁶. Recent studies however show that about one-third develop within 5-10 years postoperatively^{28,31}.

With the use of better suture materials and improvement in surgical technique a drop in the incidence should be expected.^{7,32}

Aetiology

Many factors are involved in the causation of hernia^{4,7,27,33}. The basic pathology is an area of a previous surgical incision which has healed unsatisfactorily. The most important aetiological factors are wound infection and burst abdomen^{4,6,7,29,34,35}. The minor factors are bowel surgery, suture type, abdominal distension, chest infection, old age, obesity, male sex and chronic constipation^{2,6,36,37,38}. Although considered a major aetiological factor, some authors have suggested that surgical technique has less influence on the development of incisional herniation³⁵.

The predisposing factors may act singly or in various combinations to produce a herniation. Incisional hernia has also been reported at the sites of ports following laparoscopic surgery^{4,39,40}. Incisional perineal hernia may follow abdominoperineal resection of the rectum or pelvic exenteration¹⁴. It is due to excision of the levator ani muscles and pelvic fascia with incomplete pelvic floor repair. Excision of the coccyx is a further aggravating factor. The hernia is however rare since many patients do not survive very long; also more anterior resections of the rectum are being done now¹⁴.

Sepsis

This is the most important causative factor in over 50% of cases of postoperative hernias developing within one year after operation^{1,3,4}. Bucknall *et al* in their study found incisional hernias in up to 23% of those with postoperative wound infection²⁷. The septic condition may range from cellulitis/fasciitis and necrosis of tissue on either side of the incision, to a low grade chronic sepsis around sutures such as braided silk¹⁴. The inflammation and edema produce a weakened wound. Sutures then tear and pull out through such wounds under the strain of intra-

abdominal pressure. George and Ellis found a significantly higher number of patients with recurrent incisional hernias after infection³⁸. Together with a study by van der Linden⁴¹, these publications have statistically supported wound infection as a risk factor of recurrence. Adesunkanmi *et al* found 86.4% of patients developing incisional hernia had wound infection⁴.

Postoperative Wound Dehiscence

This is commonly referred to as a “burst abdomen”. There is frank evisceration of abdominal contents and incisional herniation is a common development^{4,6,7,29}. van't RM *et al* found that incisional hernia develops in majority of patients after wound dehiscence repairs regardless of suture material or technique⁴².

The other predisposing factors of note are discussed as follows.

Surgical Technique

i. Surgical incisions a pararectus incision made along the lateral border of rectus sheath damages both nerves and vascular supply of medial structures⁴³. Such incisions therefore predispose patients to incisional hernia. On the other hand a lateral paramedian incision has a low incidence of incisional herniation⁴³. Many studies have shown that lower midline incisions are the most prone to incisional hernia formation^{4,25,29,30}. Transverse incisions have the lowest rate of incisional hernia because the orientation of the incision is parallel to the line of forces acting on it. The midline incision however is perpendicular to the lines of forces acting on it^{44,45}. Other reports dispute the above notion and suggest that incisional hernia develops regardless of the suture material or surgical technique^{35,42,46}.

ii. Layered closure this technique of closure is associated with a high incidence of incisional hernia. The reason may be ascribed to the large number of sutures in the wound¹⁴.

iii. Suture material the type of suture materials plays an important role in the etiology of incisional hernia⁷. Absorbable sutures like chromic catgut have the highest rate of burst abdomen and incisional hernia. Such sutures lose more than 50% of their tensile strength within a few days after use⁴⁷. Absorbable sutures, such as polyglycolic acid, polyglactin and polydioxanone, which are absorbed over long period, have a lower incidence of incisional herniation⁴. Nylon suture has been found to be the most reliable suture in preventing burst abdomen and incisional hernia^{4,7,32}. Monofilament stainless steel wire was introduced by Abel²⁴ in 1948 and used as interrupted mass closure. Stainless steel wire was later abandoned because it fragmented within a short time with recurrent herniation. The fragmented metal also caused skin sinuses and sometimes perforation of the bowel¹⁴. In 1975

Goligher reported less than 1% early incisional hernia using stainless steel wire mass closure and no late herniation⁴⁸. Alternative suture materials are very heavy monofilament polypropylene or polyamide sutures¹⁴.

iv. Suturing technique - the technique of suturing has been found by some to be an important factor in the causation of incisional hernia^{4,46}. Other reports have not found it to be so^{35,42,45}. Additionally wounds closed with excessive tension heal unsatisfactorily. Such technique reduces the vascular supply to the site with subsequent defective healing and wound dehiscence. Maingot describes these failures on the part of the surgeon as “inept methods of suture”⁴⁹.

v. Drainage devices drainage devices brought out through the operation wound are a potent cause of postoperative herniation. Wound infection is more frequent when drains are used in this way⁵⁰. The irritation by the drain causes edema and softening of the tissues allowing the sutures to tear through. Drainage devices should be brought out through a separate stab site¹⁴.

Obesity

Some reports blame obesity for the high percentage of incisional hernia and also for recurrence after repair of such hernias^{1,3,52}. Ellis and his group found a three-fold increase in incisional herniation and recurrence in obese patients²⁷. The underlying factors are rather difficult to pinpoint. However the large mass of fat and the increased retraction of the tissues during operation may increase the infection rate¹⁴. Additionally, tissue infiltrated with fat may not be able to hold sutures well. Obese patients also tend to develop postoperative complications like atelectasis and paralytic ileus. These conditions may increase the incidence of incisional hernia³⁶. Other workers dispute obesity as a significant causative factor of incisional hernia. Adesunkanmi *et al* did not find the role of obesity significant as a causative factor⁴. Others have had conflicting reports of obesity and age as etiologic factors^{7,34}.

Type of Operation

Infected or potentially infected operations are more likely to be followed by incisional hernia¹⁴. Laparotomy for peritonitis (localized or generalized) due to conditions like perforated duodenal ulcer, appendicitis and diverticulitis is likely to result in wound infection. Surgery for intra-abdominal malignancy and re-operation through a previous wound, (especially within 6 months of initial surgery) are likely to produce incisional herniation⁵².

others

Other factors which may be described as less significant and which influence the rate of postoperative hernia include malnutrition, generalized wasting hypoproteinemia, diabetes mellitus, malignant disease, age, anemia and male gender³⁵. Other conditions are avitaminosis (eg Vitamin C), prolonged steroid therapy, immunosuppressive therapy, chronic renal failure, alcoholism, ascites, liver failure, jaundice, postoperative chest infection^{6,27} and prolonged paralytic ileus/intestinal obstruction resulting in abdominal distension. In some other reports, postoperative chest infection was not demonstrated as a significant causative factor⁴.

Late Hernias

Sometimes incisional hernia may appear several years after the initial operation in what is apparently a perfectly healed wound¹⁴. The cause of such herniation is ill-understood but is thought that there is some failure of collagen in the scar.

Rodrigues has shown a decrease in oxytalan fibres and an increase in the amorphous substance of elastic fibres with advancement in age⁵³. These age-related changes and raised intra-abdominal pressure due to prostatism, chronic cough, constipation and chronic infection are considered to be causative factors in the etiology of such late hernias⁵⁴. Collagen abnormalities, either in production or maintenance, have been demonstrated in some patients with recurrent hernias⁵⁵. In a study by Massimo Franchi *et al* the conclusion was that "late incisional hernia formation does not depend on conditions present at the time of operation or on surgical technique". Other factors like diabetes mellitus seem to play an important role in the development of such hernias⁴⁶.

Pathology

An incisional hernia develops through an area of a previous surgical incision⁵⁶. It is commonly found in the midline or paramedian position. Incisional hernia may also develop after Lanz, subcostal and stab incisions for drains and following closure of colostomy¹⁴. High epigastric hernias following sternal splitting incisions in cardiac surgery have also been encountered¹⁴. More recently, with the introduction of laparoscopic surgery, incisional hernias have developed through the sites for ports used to gain access to the abdominal cavity^{39,40}.

The hernia opening may vary in size depending on the length of the initial incision. Only part or the whole length of the incision may have failed to heal well. There may also be several defects along the same incision¹⁴.

The hernia sac may be small or large and multiloculated. It protrudes forward, downwards and to the sides. As it enlarges it burrows into the subcutaneous

tissue. The enlargement may cause the hernia to overhang the pubis and the thighs¹⁴. Some of these hernias may reach enormous dimensions⁵⁶; the overlying skin at the fundus then becomes stretched, thin and sometimes ulcerates. Such hernias may rupture either spontaneously^{57,58} or following trauma⁵⁹.

The contents of the sac may be omentum, loops of small bowel, transverse colon or stomach. Adhesions commonly develop between the sac walls and the contents and this may be the cause of irreducibility of such a hernia⁵⁶. Adhesions may also form between parts of the contents.

Clinical Presentation/Complications

There is an unsightly bulge usually associated with discomfort or pain¹⁴. There may be a heavy sickening and dragging sensation on coughing or straining.

Pressure ischemic necrosis may occur in areas of overlying skin especially in very large and dependent hernias^{49,60}. A significant proportion of patients develop incarceration⁵. When strangulation, obstruction and irreducibility set in an emergency surgery is indicated^{5,56}. More commonly the presentation is one of recurrent mild attacks of colicky abdominal pain and vomiting suggestive of incomplete obstruction¹⁴. Intertrigo develops in the deep crease between the hernia and abdominal wall rendering the skin moist, infected and odorous. Obese patients with large and pendulous hernias may become virtually immobilized¹⁴.

Indications for Repair

It is not all incisional hernias that require repair. Low wide-mouthed types which are asymptomatic and not enlarging can be observed and treated conservatively¹⁴.

O'Dwyer and Courtney report that 20% require surgical treatment⁶¹. Most other types, however, will require surgery for the following reasons namely, cosmesis, pain/discomfort, irreducibility, narrow neck and history of recurrent attacks of subacute intestinal obstruction. Obstruction and strangulation are absolute indications for surgery^{5,56,61}. Enormous hernias with thinned-out shiny skin and imminent ulceration and possible rupture should be also repaired. In morbidly obese patients the optimal timing and management of incisional hernia repair should weigh the risk of recurrence and perioperative complications against the risk of hernia associated complications⁵¹. Patients with skin infection and intertrigo or those with continuing deep sepsis should not be subjected to elective repair until such conditions have been adequately treated¹⁴.

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Principles of Repair/ Preoperative Preparation

As much as possible one should aim at reconstituting the normal Anatomy and only tendinous or aponeurotic fascial structures should be sutured together^{14,60}. The suture material chosen should retain its tensile strength for a long time in order to maintain tissue apposition and allow sound union. Hsiao *et al* found late-absorbable polydioxanone suture more beneficial than early-absorbable polyglactin 910 suture in preventing incisional herniation⁶³. The length of the suture used for the continuous mass closure should be at least four times the length of the incision¹⁵. Tissue handling should be minimal to avoid postoperative ileus. Smokers should give up smoking at least a month before surgery⁶⁴. Chest infection should be vigorously treated and every effort made to get obese patients to lose weight^{14,61}.

When fascia cannot be sutured together without tension, repair by mesh should be undertaken.

It is advisable to investigate for and exclude any co-existing abdominal pathology if there is any clinical indication. This will help avoid embarrassment for any missed pathology and subjecting a patient to another surgery soon after a major repair⁵. It is good practice to delay repair for at least a year after the original operation or after the last attempt at repair. It is also advised that repair should be deferred for one year after infection and all sinuses have healed⁵⁴. Davis and Houck showed that bacteria can lie dormant for years in old infected wounds that have healed. Such bacteria can re-infect later repairs of incisional hernias^{54,62}. It is possible that other more urgent indications may force an earlier treatment as may be found in strangulation.

In order to accommodate the hernia contents without undue respiratory and cardiovascular embarrassment some have advocated the use of pre-operative pneumoperitoneum to stretch the abdominal cavity^{65,66}. The technique is however tedious, time consuming and unpleasant to the patient and has not been popular.

Prophylactic subcutaneous heparin should be given as well as liberal amounts of antibiotics^{65,67}. Antibiotics are particularly necessary when the repair is by mesh⁵.

General anaesthesia with good relaxation is recommended. Small hernias in thin people can be repaired under local anaesthesia¹⁴.

TREATMENT

Treatment may be non-operative or operative. Non-

operative (conservative) this mode of treatment can be employed in situations where there is no urgency about an operation⁶⁸. The hernia has a wide defect and reduces spontaneously on lying down. There is no risk of strangulation. Under these circumstances, an abdominal support (corset) may prove helpful⁶⁸.

Operative

This involves repair and there are 3 main broad groups of repair namely, layer by layer (resuture), keel ("shoelace") and prosthetic mesh repair. The method chosen depends on the size of the defect. Small hernia defects can be resutured^{5,14}. Attempts at resuturing wider defects result in tension and recurrence³⁸. The repair technique may be open or laparoscopic.

Open Suture Repair

This was the method of repair for most incisional hernias before the introduction of knitted polypropylene mesh in the early 1960's⁵. It comprised methods like fascia closure, modified Mayo technique with overlap of fascia edges and use of internal retention sutures^{5,69}. The proliferation of techniques of open suture repair is evidence of the poor outcome of such treatment. The technique however continues to enjoy patronage especially in centres where prosthetic mesh is difficult to come by or cannot be afforded because of cost. The poor results have been blamed on excessive tension created by such repair techniques^{5,38}.

This method of repair is used for,

- i. Small hernia defects where the musculoaponeurotic edges come together easily when the muscles are tensed and
- ii. Where there is no significant protrusion of such hernias. The technique is obviously associated with opening of the sac and separation of adhesions if any. Naraynsingh and Ariyanayagam in order to avoid such tedious and potentially risky dissection of adherent loops of bowels, repaired this type of hernia by the keel method⁷⁰. Those preferring not to open the sac maintain that the risk of bowel injury, fistula formation and development of postoperative ileus and bleeding is minimised⁵. The repair is best done under general anaesthesia to ensure good relaxation¹⁴. Any of the modern synthetic non absorbable suture materials can be used. The best and most commonly used worldwide is polypropylene^{5,14}. The other modern synthetic non absorbable sutures that can be used are polyester fibre Thread (Dacron, mersilene) and polytetrafluoroethylene (teflon)^{9,14,71}.

Open Keel Repair

Otherwise known as “shoelace” repair, this method is used for large, diffuse and pendulous hernias¹⁴. The visceral contents of the sac of such hernias are usually involved in many adhesions. The sac, after mobilization, is reduced without opening into it. The risk of postoperative ileus is circumvented⁵. The potential risk of bowel injury, fistula and bleeding is also reduced. If there has been a pre-operative history of intestinal obstruction however, it is advisable to open the sac^{5,14}. The method is reported to be simple, quick and involves an entirely extraperitoneal dissection²⁶. Polypropylene is the suture material of choice. Other sutures like Darcon/mersilene and polytetrafluoroethylene (teflon) can be used.

Open Prosthetic Mesh Repair

This technique of repair is reserved for large defects⁹ where the margins of apneurotic tissue cannot be approximated in the conscious patient¹⁴. Usher introduced knitted monofilament polypropylene mesh into clinical practice in 1963^{5,23}. Other types of mesh have been available since then although the two most commonly used are polypropylene and expanded polytetrafluoroethylene⁵. New developments have led to the production of low weight, large pore polypropylene prosthesis which enhances proper tissue integration^{72,73}. Prosthetic mesh repair has revolutionized the repair of incisional hernias and rendered obsolete, most of the older methods of repair^{3,14}. In our environment however, where prosthetic mesh materials are not readily available or are unaffordable, this revolution has not happened. The older methods of repair have therefore continued to be used. The technique varies but in most cases, the hernia sac is mobilized and opened to allow adhesions to be separated⁵. This allows the contents to be reduced into the abdomen. Opening of the sac is mandatory when the mesh is placed intraperitoneally⁵. When the prosthetic mesh is placed extraperitoneally some surgeons still open the sac to enable them explore the abdomen to exclude other pathology⁵. Other surgeons will open the sac only when there is a definite history of obstruction or where the hernia is irreducible³. Different modifications of the technique have been described. These include mesh placed deep to the rectus sheath with overlap and mattress suturing^{10,74}, “sandwich” of mesh and rectus sheath with overlap and two points of fixation^{75,76}, fixation of large mesh anterior to the rectus with two points of fixation and a combination of fascia and mesh^{77,78}. Procedures and techniques which incorporate overlapping give better repair and result when fascia is used alone or in combination with mesh^{10,75,76,77}. The use of mesh, in addition to ensuring better results, is also associated with less recurrence^{12,79}. Satisfactory results

have been obtained with almost all the various techniques (onlay,extraperitoneal,subfascial and intraperitoneal)⁵. Some surgeons have used polypropylene sutures to anchor the mesh but others have said this results in excessive tension and postoperative pain⁵. This problem can be avoided by the use of absorbable suture like polyglactin in such circumstances⁸⁰.

Laparoscopic Mesh Repair

This technique of incisional hernia repair is a recent introduction. Introduced in the 1990's⁵ it was first reported in 1993¹³. It was expected that this minimal access surgical procedure would give similar recurrence rates as those treated by the open method. The added advantages of shorter recovery time and hospital stay were expected to make it more attractive too. The procedure is also credited with fewer complications⁵. All the reports, based on Medline literature search, (about 14 in number by 2002) have described placement of the mesh in the intraperitoneal position and the techniques used have been similar⁵. There is universal agreement that an overlap of at least 3cm between the mesh and the fascia edge is necessary for good results⁵. Most authors have not used drains in contrast to the open mesh repair method where drains are universally employed⁵. In the presence of extensive adhesions, it is difficult to establish an adequate pneumoperitoneum which is essential for the procedure. Such a condition precludes the safe performance of a laparoscopic repair⁸¹. Under such circumstances the repair can be converted to the open type.

PREVENTION

The prevention of incisional hernia poses a difficult challenge because of the multifactorial nature of the etiology in the pre-operative phase the patient's nutritional state should be adequate and the haemoglobin level satisfactory. Any pre-existing illnesses (Infections, diabetes mellitus etc) should be treated or adequately controlled^{14,56,60}. Smoking should be stopped and breathing/chest exercise instituted; weight reduction should be encouraged and any conditions tending to cause an increase in intra abdominal pressure must be treated⁶⁰. Any predisposing factors like prostatism, chronic cough and constipation should be adequately treated pre-operatively⁵.

At surgery strict aseptic technique should be observed, adequate hemostasis ensured and tissue handled with great care^{56,60}.

The most reliable nonabsorbable sutures (like polypropylene) or long term absorbable sutures (like polyglycolic acid, polydioxanone and polyglactin) are recommended to prevent burst abdomen and incisional herniation^{4,7,32}. The technique of repair should be satisfactory and the importance of this has been stressed by Burger *et al* who advocate that suture repair should be abandoned⁸².

Post operative complications like abdominal distension, wound infection and wound dehiscence should be prevented or satisfactorily and energetically treated^{4,60}.

Complications Of Treatment

Complications reported after open suture include wound infection, hematoma, stitch sinus, seroma, flap necrosis and recurrence. Such complications are found in 10-44% of cases^{5,83}. Suture repair therefore gives poor results.

The recurrence rates after open mesh repair vary between 0 and 10%⁵. Where the technique involves opening of the sac other complications encountered are intraperitoneal bleeding, postoperative ileus, bowel injury with fistula formation^{5,80}. As with open suture repair, wound infection and seroma formation are common complications in 1-15% of cases⁵.

Incisional hernias repaired with continuous nonabsorbable suture have a risk of developing "button-hole" defects at the puncture sites of each "bite" of suture^{68,84}. This complication can be avoided by the use of absorbable monofilament material like polydioxanone⁸⁴.

The common complication of laparoscopic repair include wound infection, seroma, ileus and haematoma⁵. In some cases such complications necessitates the removal of the mesh^{5,85}. The recurrence rates of laparoscopic mesh repair varies between 0-9%, with fewer cases of more serious complications like small bowel injury⁵.

Hesselink *et al*² reported that the larger the hernia the greater the risk of recurrence. Other workers however found no association between hernia size and risk of recurrence⁹.

Undue respiratory embarrassment can be precipitated in situations where hernia contents are reduced into a reconstructed abdomen with inadequate space⁶⁸. The diaphragm is splinted under such circumstances for those treated conservatively, abdominal corset is commonly prescribed. Although such corset may control the hernia it may cause considerable discomfort⁶⁸.

CONCLUSION

The incidence of incisional herniation has increased with the increase in performance of major abdominal

surgery and the extension of such surgery to the very old and patients with malignancy. The outstanding and most consistent causative factor is wound infection. Direct suture repair is ideal only for the smallest of defects when easy apposition of the edges can be achieved. The results of direct suture repair in other situations are very poor with recurrence rates between 31-49%. Mesh repair with non-absorbable polypropylene material is recommended as a standard method for large defects. Mesh repair can be by the open or laparoscopic technique and the recurrence rate in both cases is about the same. Although the introduction of polypropylene suture and mesh has revolutionized the repair of incisional hernias this revolution is yet to be felt in our environment. In view of the ever present risk of wound infection and recurrence, it is recommended that incisional hernia repair should be conducted under the cover of prophylactic antibiotics. Laparoscopic mesh repair, a recent introduction, has so far shown good results. It is anticipated that as experience in this area improves and facilities become more widely available, laparoscopic mesh repair will be adopted on a large scale and even become the first line of treatment.

REFERENCES

1. Yahchouchy-Chouillard E, Aura T, Picone O, Etienne JC, Fingerhut A. Incisional hernia. Related risk factors. *Dig Surg* 2003; 20(1): 3-9.
2. Hesselink VJ, Luijendijk RW, de Wilt JHW, Heide R, Jeekel J. An evaluation of risk factors in the incisional hernia recurrence. *Surg Gynecol Obstet* 1993; 176:228-234.
3. Khaira HS, Lall P, Hunter B, Brown JH. Repair of incisional hernias. *JR Coll Surg Edinb* 2001; 46:39-43.
4. Adesunkanmi ARK, Fasuba BO, Faleyimu B. Incisional hernia after Caesarean Operations: Aetiological factors. *Nig J Surg* 1999; 6(2):58-61.
5. Cassar K, Munro A. Surgical treatment of incisional hernia. *Br J Surg* 2002; 89:534-545.
6. Mudge M, Hughes LE. Incisional hernia: a 10-year prospective study of incidence and attitudes. *Br J Surg* 1985; 72:70-1.
7. Devlin HB. Hernia. Recent advances in surgery 1983; 12:299-333.
8. Parker HH, Nottingham JM, Bynoe RP, Yost MJ. Laparoscopic repair of large incisional hernial. *Am Surg* 2002; 68(6):530-3.
9. Luijendijk R, Hop W, Tol M, de Lange D, *et al*. Should incisional hernias be repaired with mesh or sutures? *N Engl J Med* 2000; 343:392-8.
10. Read RC, Yoder G. Recent trends in the management of incisional herniation. *Arch Surg* 1989; 485-8.
11. Franklin ME, Gonzalez JJ, Glass JL, Manajarez A. Laparoscopic ventral and incisional hernia repair: an 11-year experience. *Hernia* 2004; 8(1):23-7.

12. Langer S, Christiansen J. Long term results after incisional hernia repair. *Acta Chir Scand* 1985; 151:217-219.
13. Kua KB, Coleman M, Martin I, O'Rourke N. Laparoscopic repair of ventral incisional hernia. *ANZ J Surg* 2002; 72(4):296-9.
14. Abrahamson J. Incisional hernia. In: Zinner MJ, Schwartz SI, Ellis H (Eds) *Maingot's Abdominal Operations* 10th ed. Connecticut: Appleton and Lange 1977:479-580.
15. Devlin HB. Periostomal hernia. In Dudley H (Ed), *Operative Surgery, Alimentary Tract and Abdominal Wall*, 14th ed, London: Butterworths; 1983:441.
16. Gallie WE, Le Mesurier AB. Living suture in the treatment of hernia. *Canad Med Assoc J* 1923;13:469-480.
17. McGavin L. The improved filigree for the repair of large defects in abdominal wall. *Ann Surg* 1903;38:47-50.
18. McGavin L. The double filigree operation for the radical cure of inguinal hernia. *Br Med J* 1909;2:357-9.
19. Koontz AR. Preliminary report on the use of tantalum mesh in the repair of ventral hernias. *Ann Surg* 1948;127:1079-83.
20. Throckmorton TD. Tantalum gauze in the repair of hernias complicated by tissue deficiency. *Surgery* 1948;23:32-35.
21. Thompson W. Radical cure of inguinal hernia with a plastic insert. *Lancet* 1948;2:182-4.
22. Schofield TL. Polyvinyl alcohol sponge; an insert plastic for use as a prosthesis in the repair of huge hernias. *Br J Surg* 1955; 42:618-622.
23. Usher FC, Ochsner J, Tuttle LLD. Use of marlex mesh in the repair of incisional hernias. *Am Surg* 1958;24:969-972.
24. Abel AL, Hunt AH. Stainless steel wire for closing abdominal incisions and for repair of herniae. *Br Med J* 1948;2:379-81.
25. Hunter RR. Anatomical repair of midline incisional hernia. *Br J Surg* 1971;58:888-92.
26. Abrahamson J, Elder S. "Shoelace" repair of large postoperative ventral abdominal hernias: a simple extraperitoneal technique. *Contemp Surg* 1988;32:24-28.
27. Bucknall TE, Cox PJ, Ellis H. Burst abdomen and incisional hernia: a prospective study of 1129 major laparotomies. *Br Med J* 1982; 284:931-3.
28. Santora TA, Roslyn JJ. Incisional hernia. *Surg Clin North Am* 1999;73:557-70.
29. Israelsson LA, Johnson T. Incisional hernia after midline laparotomy: a prospective study. *Eur J Surg* 1996; 162:125-9.
30. Ellis H, Gajraj H, George CD. Incisional hernia. When do they occur? *Br J Surg* 1983; 70:190-291.
31. Bucknall TE, Ellis H. Abdominal wound closure a comparison of monofilament nylon and polyglycolic acid. *Surg* 1981; 89:672-5.
32. Corman ML, Viedenheimer MC, Collier JA. Controlled clinical trial of three suture materials for abdominal wall closure after bowel operations. *Am J Surg* 1981; 141:510-513.
33. Gislason H, Gronbech JE, Sorcide O. Burst abdomen and incisional hernia after major gastrointestinal operations, Comparison of three closure techniques. *Eur J Surg* 1995; 161:349-54.
34. Newsome HH, Lowry YW. Greater risk of incisional hernia with morbidly obese than steroid dependent patients and low recurrence with prefascial polypropylene mesh. *Am J Surg* 1996; 171:80-4.
35. Hoer J, Lawong G, Klinge V, Schumpelick V. Factors in treating the development of incisional hernia. A retrospective study of 2983 laparotomy patients over a period of 10 years. *Chirurg* 2002; 73(5):474-80.
36. Manninen MJ, Lavomus M, Perhoniemi VJ. Results of incisional hernia repair. *Eur J Surg* 1991; 157:2931-33.
37. Luijendijk RW, Lemmen MHM, Hop WCJ, Wereldsma JCJ. Incisional hernia recurrence following "vest over pants" or vertical Mayo repair of primary hernias of the midline. *World J Surg* 1997;21:62-66.
38. George CD, Ellis H. The result of incisional hernia repair: a twelve-year review. *Ann R Coll Surg Eng* 1986;68:185-187.
39. Mortz FJ, Holschneider CH, Munro MG. Incisional hernia following laparoscopy. A survey of the American Association of Gynecologic and Obstetric Surgeons. *Obstet Gynecol* 1994;84:881-4.
40. Khan A, Siddiqui M, Hammeed K. Incisional hernia after laparoscopic cholecystectomy. *Ann R Coll Surg Eng* 1993;75:448-54.
41. van der Linden FT, van Vroonhoven TJ. Long term results after surgical correction of incisional hernia. *Neth J Surg* 1988; 40:127-9.
42. van't RM, De Vos Van Steenwijk PJ, Bonjer HJ, Steyerberg EW. Incisional hernia after repair of wound dehiscence: incidence and risk factors. *Am Surg* 2004;70(4):281-6.
43. Donald DR, Hegarty JH. The lateral paramedian incision- an experience with 850 cases. *Br J Surg* 1982;69:630-3.
44. Douglas D. Wounds and their problems. *J R Coll Surg Edinb* 1975;20:77-95.
45. Cahalane MJ, Shapiro ME, Silen W. Abdominal Incision. Decision on incision. *The Lancet* 1989;2:146-148.
46. Franchi M, Ghezzi F, Buttarelli M, Tateo S, Balestreri D, Bolis P. Incisional hernia in Gynecologic Oncology patients: a 10-year study. *Obstet and Gynecol* 2001;97:696-700.
47. Jenkins TPN. The burst abdomen. A mechanical approach. *Br J Surg* 1980;67:335-336.
48. Goligher JC, Irvin T. A controlled clinical trial of three methods of closure of laparotomy wounds. *Br Surg* 1975;62:823-6.

49. Maingot R. A further report on the "keel" operation for large diffuse incisional hernias. *Med Press* 1958;240:989-93.
50. White TJ, Santos MC, Thompson JS. Factors affecting wound complications in repair of ventral hernias. *Ann Surg* 1998;64(3):276-80.
51. Bonatti H. Ventral hernia repair in bariatric surgery. *Obes Surg* 2004;14(5):655-8.
52. Lamont PM, Ellis H. Incisional hernia in re-opened abdominal incisions - an overlooked risk factor. *Br J Surg* 1988;75:374-6.
53. Rodrigues-Junior AJ, de-Tolosa EM, de-Carvalho CA. Electron microscopic study on the elastic and elastic related fibres in the human fascia transversalis at different ages. *Gegenbaurs Morphol Jahrb* 1990;136:645-8.
54. Houck JP, Rypins EB, Sarfeh IJ. Repair of incisional hernia. *Surg Gynecol Obstet* 1989;169:397-399.
55. Peacock EE Jr. Biological aspects of inguinal hernia. Paper presented at seminar "Advances and improvements in Hernia Surgery" Miami, March 12-14 1987.
56. Giles GR, Halasz NA. The abdominal wall and hernias. In: Cushieri A, Giles GR, Moosa AR (Eds). *Essential Surgical Practice*. 3rd edn. Oxford: Butterworth-Heinemann 1995:1433-1445.
57. Hamilton RN. Spontaneous rupture of incisional hernias. *Br J Surg* 1966;53:477-9.
58. Senapati A. Spontaneous dehiscence of an incisional hernia. *Br J Surg* 1982;69:313-5.
59. Adotey JM, Akani CI, Ikimalo JI. Evisceration of abdominal viscus through a ruptured incisional hernia following traditional abdominal massage in labor. *Medlink Journal* 2005;6:35-36.
60. Badoe EA, Archampong EQ, Jaja MOA. Principles and practice of Surgery including pathology in the tropics. 2nd ed Tema: Ghana Publishing Corporation 1994;473-479.
61. O'Dwyer PJ, Courtney CA. Factors involved in abdominal wall closure and subsequent incisional hernia. *Surg J R Coll Surg Edinb* 2003;1:17-22.
62. Davis JM, Wolff B, Cunningham TF. Delayed wound infection: an 11-year survey. *Arch Surg* 1982;117:113-6.
63. Hsiao WC, Young KC, Wang ST, Lin PW. Incisional hernia after laparoscopy: prospective randomized comparison between early-absorbable and late-absorbable suture materials. *World J Surg* 2000;4(6):747-51.
64. Clarke JL. Ventral incisional hernia recurrence. *J Surg Res* 2001;99(1):33-9.
65. Moreno IG. Chronic eventrations and large hernias: preoperative treatment by progressive pneumoperitoneum. *Surgery* 1947;22:945-8.
66. Toniato A, Pagetta C, Bernante P, Piotto A, Pelizzo MR. Incisional hernia treatment with progressive pneumoperitoneum and retromuscular prosthetic hernioplasty. *Langenbecks Arch Surg* 2002;387(5-6):246-8.
67. Read RC Editorial comment. *Curr Surg* 1990;47:278-80.
68. Johnstone JMS, Rintoul RF. Abdominal herniae. In: Rintoul RF (Ed). *Farquharson's Textbook of Operative surgery*. 8th edn Edinburgh: Churchill Livingstone, 1995:523-546.
69. Sitzmann JV, McFadden DW. The Internal retention repair of massive ventral abdominal wall hernia. *Br Surg* 1989;55:719-23.
70. Naraynsingh V, Ariyanayagam D. Rectus repair of midline ventral abdominal wall hernia. *Br J Surg* 1993;80:614-15.
71. Chrysos E, Athanasakis E, Saridaki Z, *et al*. Surgical repair of incisional ventral hernias, tensionfree technique using prosthetic materials (expanded polytetrafluoroethylene Gore-Tex Dual Mesh). *Am Surg* 2000;66(7):679-82.
72. Schumpelick V, Klinge U, Junge K, Stunpf M. Incisional abdominal hernia: the open mesh repair. *Langenbeck's Arch Surg* 2004;389(1):1-5.
73. Langer C, Liersch T, Kley C, *et al*. Twenty-five years of experience in incisional hernia surgery. A comparative retrospective study of 432 incisional hernia repairs. *Chirurg* 2003;74(7):638-45.
74. Browse NL, Hurst P. Repair of long large, midline incisional hernias using reflected flaps of anterior rectus sheath re-inforced with marlex mesh. *Am J Surg* 1979;138:738-9.
75. Usher FC. New technique of repairing incisional hernias with marlex mesh. *Am J Surg* 1979;138:740-1.
76. Matapurka BG, Gupta AK, Agarwal AK. A new technique of "marlex peritoneal sandwich" in the repair of large incisional hernias. *World J Surg* 1991;15:768-70.
77. Molloy RG, Moran KT, Waldron RP, Brady MP, Kirwan WO. Massive incisional hernia: abdominal wall replacement with marlex mesh. *Br J Surg* 1991;78:242-4.
78. Whiteley MS, Ray-Chaudhuri SB. Combined fascia and mesh closure of large incisional hernias. *J R Coll Surg Edinb* 1998;20:29-30.
79. Liakakos T, Karanikas I, Panagiotidis H, Dendrinous S. Use of marlex mesh in the repair of recurrent incisional hernia. *Br J Surg* 1994;81:248-9.

80. Temudom T, Siadati M, Sarr MG. Repair of complex giant or recurrent ventral hernia by using tension-free intraparietal prosthetic mesh (Stoppa technique): lessons learned from our initial experience (fifty patients). *Surgery* 1996;120:738-43.
81. Lav H, Patil NG, Yuen WK, Lee F. Laparoscopic incisional hernioplasty utilizing on-lay expanded polytetrafluoroethylene dual mesh: prospective study. *Hong Kong Med J* 2002;8:413-7.
82. Burger JW, Luijendijk RW, Hop WC, Halm JA, Verdaasdonk EG, Jeek J. Long term follow-up of a randomized controlled trial of sutures versus mesh repair of incisional hernia. *Ann Surg* 2004;204(4):578-83.
83. Kuzbari R, Worseg AP, Tairysh G, *et al.* Sliding door technique for the repair of midline incisional hernias. *Plast Reconstr Surg* 1998;101:1235-42.
84. Krukowshi ZH, Matheson NA. "Button-hole" incisional hernia: a late complication of abdominal wound closure with continuous non absorbable sutures. *Br J Surg* 1987;74:84-825.
85. Gillion JF, Begin GF, Mariws C, Fourtainer G. Expanded polytetrafluoroethylene patches used in the intraperitoneal or extraperitoneal position for repair of incisional repair of the anterolateral abdominal wall. *Am J Surg* 1997;174:16-19.