International Journal of Surgery 12 (2014) S164–S169

Contents lists available at ScienceDirect

International Journal of Surgery

journal homepage: www.journal-surgery.net

Original research

Incisional hernia in the elderly: Risk factors and clinical considerations

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ARTICLE INFO

Article history:
Received 15 May 2014
Accepted 15 June 2014
Available online 23 August 2014

Keywords:
Incisional hernia
Risk factors
Elderly patients

ABSTRACT

Objective: Ventral incisional hernia is a common complication of abdominal surgery. The marked improvements in medical technology and healthcare, lead to an increasing number of elderly patients to take advantage of even complex surgical procedures. The objective of this literature review was to analyze the risk factors for ventral incisional hernia in elderly patients and to identify measures that might decrease the incidence of this complication. **Materials and methods**: An analysis of the surgical literature was performed using the search engines EMBASE, Cochrane Library, and PubMed with particular reference to elderly patients using the keywords: abdominal hernia, wound dehiscence, incisional hernia, incidence, trocar site hernia, and hernia prevention. **Results**: In our opinion the risk factors for incisional hernia should be separately considered. First those related to the patients and to the abdominal surgery and, in addition, those related to the surgery of the abdominal wall defects. **Conclusions**: Reparative surgery of the abdominal wall, to date uniquely characterized by the use of the mesh, should be considered an additional risk factor for the occurrence of incisional hernia. However, the low incarceration risk, the risk of recurrence, the relevant rate of postoperative pain and discomfort and complications associated with mesh repair, as small bowel obstruction, mesh infection, and enterocutaneous fistula, suggest that the general indication for surgical treatment of incisional hernias, in a symptomatic or oligosymptomatic elderly patients, should be critically reconsidered in order to avoid unnecessary surgery.

1. Introduction

Incisional hernia, a failure of the abdominal wall fascia to heal, is a common postoperative complication following abdominal surgery with an incidence varying between 2% and 50% [1–8] and extreme values ranging from 0 to 91% [9,10]. This wide variability probably depends on the not quite accurate reports of incisional hernias and the reparative surgery performed by a different surgeon or a too short period of follow-up. Incisional hernias are often diagnosed within the first 3 years after initial laparotomy [11–13], but some may not become evident for up to 10 years after the initial surgery [14,15].This wide variation in the reported rates of incisional hernia is not unexpected, given the heterogeneity of the cohort of patients included into the studies, the performed surgery and the duration of follow-up. Further considerations should be made on the used classifications. Many reports have grouped primary and secondary hernias together when reviewing or studying ventral hernias, especially for the laparoscopic treatment. However, this can produce falsely favorable results, because these two hernia types are inherently different in various aspects, even, as evidenced by some Authors in those demographic [16]. The primary finality of any classification should be to improve the possibility of comparing different studies and their results. In order to be able to study the possible causative factors of incisional hernias, the characteristics of the patients with incisional hernia should be clarified and distinguished from the all other hernia patients. Chevrel and Rath [17] proposed an attractive and simple classification in 2000. Although apparently easy to use, this classification has not been always used in the literature. At the 29th Congress of the European Hernia Society (EHS) in Athens in May 2007, the president of the EHS, Andrew Kingsnorth, stressed the importance of a unique classification of ventral and incisional hernias [18]. An EHS definitive classification for primary abdominal wall hernias and a division

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http://dx.doi.org/10.1016/j.ijsu.2014.08.357
1743-9191/

into subgroups for incisional abdominal wall hernias, concerning the localization of the hernia, was finally formulated. In addiction a consensus was reached on the decision to separate primary ventral hernias and incisional ventral hernias [19]. The symptoms usually reported by patients affected by incisional hernia include pain, discomfort, cosmetic complaints, skin problems, functional disability, and pulmonary dysfunction. However, up to one third of patients are not always aware of having an incisional hernia, especially when older or the hernia is small. About half of these have no symptoms [20,21]. The widely accepted definition formulated by the European Hernia Society is: "any abdominal wall gap with or without a bulge in the area of a postoperative scar, palpable or perceptible by clinical examination or imaging" [19] To date, there exist no standardized criteria for the diagnosis of incisional hernia. Physical examination includes abdominal wall inspection and palpation with the patient supine and standing, as well as during Valsalva maneuvers. The examiner looks for a bulge and, if a hernia is believed to be present, the examiner attempts to define the fascial edges. Sometimes radiological imaging is needed. Hernias in fact can be missed on physical examination in cases of small fascial defect and/or obese patient. Ultrasound and high-quality CT have been increasingly used to diagnose and characterize hernias, particularly those that necessitate a complex operative repair. The imaging techniques not only can determine the contents of the hernia sac and the relationship with other abdominal wall landmarks, such as bony structures, but they also provide important details about the mesh position if previous surgical repair of a hernia was performed. Potential complications such as incarceration and obstruction of the intestinal lumen, strangulation and ischemia of the hernia contents are the most important reasons inducing face the relatively low risk of surgical repair. Furthermore, incisional hernias tend to enlarge, which makes their repair increasingly difficult. All hernias causing intense symptoms should be prudently considered for operation because of the risks related to bowel incarceration. However, due to the lack of a systematic trial in incisional hernia patients, the actual risk of incarceration in the entire vulnerable population is unknown, especially in those oligosymptomatic. According to the European Hernia Society guidelines, surgical repair is no longer the only treatment option for minimally symptomatic inguinal hernias, and watchful waiting should be considered [22,23]. As well as for inguinal hernias, raise the question of whether the general indication for surgical treatment of incisional hernias is always justified especially in elderly patients. Incisional hernia repair is among the most common operative procedures performed by plastic and general surgeons and should not be considered a low-risk operation [21,24]. In fact these operation often involve concurrent intra-abdominal procedures, collaboration between multiple surgical teams to achieve fascial closure and the placement of mesh for reinforcement of the repair [25,26]. However, studies have demonstrated the safety and efficacy of this surgical procedures but have had relatively young patient populations, few focused upon the feasibility in the elderly [27-29].

2. Elderly people and surgery

Citing figures from the World Health Organization, the proportion of elderly people aged 65 years or more was 9.9% and life expectancy is currently 74.4 years for men and 81.8 years for women because of recent improvements in early diagnosis and a well-developed mass-screening program [22,30]. Moreover, the marked improvements in medical technology and healthcare, lead to an increasing number of elderly patients to take advantage of even complex surgical procedures. But every subsequent laparotomy carries the risk of further weakening the abdominal wall and consequently to lead to recurrence. Also the introduction of laparoscopic surgery in 1987 and its widespread use in the past 20 years has increased the number of elderly patients undergoing this surgical approach. Recently, laparoscopic surgery has been widely accepted as a minimally invasive treatment to reduce the morbidity after conventional surgery, and a number of studies have demonstrated the feasibility of laparoscopy in the elderly with advantages that include good cosmetic effect, improved quality of life, minimal degree of pain, shorter hospital stay, early rehabilitation and early return to social activity [31-34]. Given the prevalence of this particular operative procedure, it is clear that factors that influence outcomes, especially when morbidity is added to the vast number and the high costs after incisional hernia repair, will have a large impact on healthcare expenditures.

3. Risk factors and incisional hernia

Numerous risk factors have been identified in the effort to limit the incidence of ventral incisional hernia, and numerous studies have been performed to determine surgical approaches and types of fascial closure with the best results and lowest incidence of incisional hernia. From this viewpoint, even the prophylactic placement of mesh has been proposed especially in patients at high-risk of recurrence [20,35,36]. The higher incidence of incisional hernias in the elderly could be attributed to several factors and is thought to be a multi-factorial process [37]. However, the etiology of this common disorder is not well understood and several risk factors for early development of incisional hernia such as wound infection and suture technique have been suggested [6].

Elderly patients, especially those older than 80 years old, are always associated with several comorbid diseases and higher ASA scores, thus putting these patients at a greater risk of intra- and post-operative complications that are able to favor the formation of the incisional hernia [38].

An accurate review of the surgical literature was performed to determine and classify the risk factors related to the development of incisional hernia in the elderly. EMBASE, Cochrane Library, and PubMed engines were used with the keywords: abdominal hernia, incisional hernia, trocar site hernia and hernia prevention.

A large number of studies have been taken into account and allowed us to outline the many risk factors associated with the occurrence of incisional hernia.

In our opinion the risk factors related to the elderly patient and those related to the surgical procedure, open or laparoscopic, should be considered separately.

Additional specific risk factors, closely related to the surgery of the abdominal wall defects such as primitives or incisional hernias and its complications, all able to influence the onset of recurrence, should be also considered.

4. Risk factors related to the elderly patient

The most common medical comorbidities associated with the advanced age are hypertension, diabetes, obesity, anemia, smoking, dyspnea, chronic obstructive pulmonary disease, use of corticosteroid, previous coronary intervention, renal disease requiring dialysis, vascular disorder, recent weight loss, malnutrition, immunosuppression [39–44]. It should also be considered the prevalence of co-morbidities that could lead to increased intra-abdominal pressure like constipation, ascites, hypertrophy of the prostate. More abdominal operations, the association of multiple comorbidities or connective tissue disorders are also reported [36,45–48]. Significant correlations between tissue alterations and occurrence of incisional hernia have been highlighted in major studies [49–51]. The biomechanical forces in the abdominal wall

would change after laparotomy, inducing a greater rate of incisional hernia. The high recurrence rate has not only emphasized the importance of research in development of better mesh material, but also has prompted further studios on primary tissue healing mechanisms and scar formation. Collagen is the principal component of the extracellular matrix of both primary and scar tissue [52,53]. Balanced collagen maturation and degradation is a requirement for normal scar formation. The study by White et al. shows a decreased collagen I/III ratio in primary skin and fascia biopsies of patients with recurrent incisional hernias and strongly suggest that the abnormal collagen metabolism of patients is not only the result of abnormal wound healing, but is also the result of an impaired constitutive collagen expression and formation [51]. Moreover a decrease of the general thickness of the abdominal rectus muscle in females and in older people has been described [8,54]. However, little is known about the effect of abdominal incisions on changes in the abdominal wall and muscle atrophy. The hypothesis that the midline incision would shift laterally with the increase of the tensile force on a part of the sutures and the separation of the wound edges, are described as a major predictor of incisional hernia [55–57]. Interesting results relating to a possible genetic profile of patients with incisional hernia have been achieved in a pilot study developed by R. Calaluce et al. The Authors have identified distinct gene expression profiles in these patients and have furthered the understanding of recurrent incisional hernia formation with an association between the hernia's gene GREM1 [58].

5. Risk factors related to the abdominal surgery

Otherwise, incisional hernia formation can also be influenced by factors related to the surgeon or the surgical procedure, such as suture technique, surgical site infections and fascial dehiscence [59–61]. With regard to the different techniques of fascial closure, for example, it seems that the use of slowly adsorbable sutures such as PDS is related to a lower risk of infection and incisional hernia [62,63]. Despite the increasing acceptance of laparoscopic surgery, laparotomy still remains the most common surgical approach for abdominal surgery, particularly in the elderly. In relation to the surgical incision, many studies showed a statistically significant incidence of ventral incisional hernia for midline vs. transverse incision [64–66]. Emergency surgery, postoperative peritonitis due to intestinal rupture are all acknowledged risk factors [67]. The introduction of laparoscopic surgery has brought with it new technical challenges. One of these is fascial closure at port sites, which is necessary especially when large trocars are used or a dilation of a port site for organ extraction is needed. A particular and well-known complication, closely related to the laparoscopic procedure, is in fact represented by the trocar or port-site hernia [1,68,69]. The steady increase of this particular incisional hernia, resulting in the laparoscopic access, is strictly correlated to the growing number and complexity of laparoscopic procedures. This complication often requires further surgical intervention to repair the wall defect and can in turn be associated with considerable morbidity [70,71]. The incidence of port-site herniation is estimated to be between 0.7 and 2.8% but it is commonly accepted that without medium-term to long-term follow-up, most asymptomatic cases will remain undiagnosed [72,73].

Few articles propose various predisposing factors that might lead to the development of a port-site hernia [69] and how this complication should be avoided or minimized [36,37,74,75].

A part the already analyzed co-morbidities these include large trocar size, location in the linea alba, bladed trocars, inadequate fascial closure, length and complexity of the procedure [71,76,77]. However despite these reports, these potential predisposing factors have not been consistently demonstrated as independent predictors of herniation [78]. New developments, such as single-port laparoscopic surgery and the need for small esthetic incisions, make fascial closure a current issue.

6. Hernia repair surgery

Hernia repair has improved over the past 20 years, but it is still associated with significant morbidity and recurrence. Simple closure of the defect involving re-approximation of fascial edges under tension is associated with a high rate of hernia recurrence. This prompted the development of open repair techniques utilizing mesh in a retro-muscular pre-peritoneal fashion. The introduction of the prosthetic mesh to ensure abdominal wall strength without tension has decreased the recurrence rate [79]. In comparison studies, mesh repairs have proven superior to primary repair, with recurrences of 11–21% compared to 25–52% for simple closure [26]. The use of a prosthetic mesh, typically polypropylene or expanded polytetrafluoroethylene, is reported to produce lower recurrence rates, in a tension-free repair especially in repairing large hernias. Unfortunately, open mesh repair carries a significant complication rate of 14–50%, which is mainly attributed to wound complications [80].

Over the last decade the technique of laparoscopic ventral hernia repair has been developed and refined. In fact laparoscopic incisional hernia repair has been reported to have superior outcomes in terms of hernia recurrence and postoperative complications [29,80,81].

Patient characteristics, associated comorbidities, characteristics surgical procedure and reconstructive options, all influence the outcome after open and laparoscopic surgery but specific technical aspects still need to be highlighted.

7. Risk factors related to the surgery of the abdominal wall defects

The size of the hernia defect is one of the most controversial issues in laparoscopic hernia repair. Some investigators recommend open surgery in patients with large defects because of the major technical complexity, whereas others do not initially consider any size limit for considering a laparoscopic approach [82,83]. In our opinion the predictive value of defect size should be taken into account for the occurrence of recurrence, reserving the laparoscopic treatment for hernias that do not exceed 10 cm.

The type of mesh, amount of mesh overlap, use of trans-fascial sutures, and other specific complications are all considered important factors related to the primary or incisional hernia repair [84,85]. One major concern facing all surgeons is the risk of wound and mesh infection. This produce such chronic wound problem that ultimately requires removal of the mesh, leaving a colonized defect that is difficult to repair. The rate of wound complications after open ventral hernia repair is reported to be up to 27% [86,87]. Host response to the mesh can include adhesion and erosion into bowel or the formation of an entero-cutaneous fistula, the latter to be considered in the chapter on iatrogenic complications.

Mesh shift after laparoscopic surgery results from an initial technical error of pushing or driving the mesh away from the operative side. Intra-operative shift is related to pushing or driving the mesh away. It seems natural to err with maneuvers such as driving the suture passer or placing tacks. Techniques that may help to decrease mesh shift or its clinical significance include increasing mesh overlap, securing trans-fascial sutures before tacking, placing ports on both sides of the abdomen, and placing ipsilateral trans-fascial sutures and tacks first. Postoperative mesh shift is likely related to the continuing effects of intra-operative technique, as

well as patient factors. Factors such as the type of mesh placed, permanent trans-fascial sutures, and wide overlap may have a role in preventing mesh shift and recurrence [88–91].

While the incidence of local wound complications for laparoscopic ventral hernia repair is low, seroma formation is an expected outcome in most patients especially after repair of a large hernia defect [92–94]. The majority of seromas resolve with time within 4–8 weeks and only a small number are clinically significant and require intervention [28,33]. In our opinion seromas should be drained only when they become significantly symptomatic in order to avoid infection of the superficial surgical site and the mesh, both essential conditions for the recurrence.

8. Conclusions

Thanks to the marked improvements in medical technology, healthcare and surgical techniques today an increasing number of elderly patients undergo surgery.

Incisional hernia is one of the most prevalent complications of abdominal surgery and frequently causes morbidity which rises healthcare costs.

Despite the extreme values of incidence ranging from 0 to 91%, an accurate review of the literature leads us to consider the overall incidence of around 4% with an overall incidence of incisional hernia after laparotomy of about 10%.

Several factors may explain this wide variability, such as heterogeneity of the cohort of patients included into the studies, the performed surgery and the length of follow-up.

Laparoscopic abdominal approach seems to have a positive impact with a marked reduction in the rate of incisional hernia even if this surgical procedure is not immune to complications.

The minimally invasive approach and the lower incidence of wound infections, restricts the presence of incisional hernia at the trocar site with an incidence ranging from 0.7 to 2.8%.

A careful consideration of risk factors, related to the development of incisional hernia, may improve outcomes in terms of costs and complications.

In our opinion should be considered the risk factors related to the elderly patients, those related to the abdominal surgery and, in addition, those related to the surgery of the abdominal wall defects.

Reparative surgery of the abdominal wall, to date uniquely characterized by the use of the mesh, should in fact be considered an additional risk factor for the occurrence of incisional hernia.

Among the risk factors related to the elderly patient should be emphasized the most common medical comorbidities associated with the advanced age. Should also be considered the potential disorders of connective tissue, which are widely present in the elderly population and their implications in the mechanisms of repair after abdominal surgery.

Other risk factors as surgical incision, suture technique, surgical site infections and fascial dehiscence are closely related to the surgical procedure.

The benefits of laparoscopic surgery have been well established over the last two decades. From a patient perspective, it decreases post-operative pain and discomfort, reduces hospital stay, improves cosmetic appearance and ultimately facilitates a more rapid recovery and resumption of normal activity. At the same time the development of a port-site hernia after laparoscopic intervention carries a significant associated morbidity.

Additional considerations, as mentioned, must be made on risk factors related to the surgical procedure to repair abdominal wall defects.

The size of the hernia defect, the type of mesh, the mesh overlap and, not the least, the mesh shift after laparoscopic surgery, should be carefully considered as important events that may impact on the onset of incisional hernia.

A significant reduction in local wound complications and recurrence rates has allowed laparoscopic ventral hernia repair to supplant open repair as the procedure of choice for ventral and incisional hernias. Many study demonstrates that laparoscopy can be performed in elderly patients with morbidity which equals that of younger patients.

However, the low incarceration risk, the risk of recurrence, the relevant rate of postoperative pain and discomfort and complications associated with mesh repair, as small bowel obstruction, mesh infection, and entero-cutaneous fistula, suggest that the general indication for surgical treatment of incisional hernias, in asymptomatic or oligosymptomatic elderly patients, should be critically reconsidered in order to avoid unnecessary surgery.

Actual effectiveness of systematic use of prosthetic material seems to be an interesting approach to minimizing the risk of incisional hernia in the general population, but its use particularly in the elderly must be confirmed in studies of larger numbers of patients, with a longer follow-up period.

Ethical approval

None required.

Funding

All authors have no source of funding.

Author contribution

Pietro Caglià: Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data; also participated substantially in the drafting and editing of the manuscript.

Angelo Tracia: Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data.

Laura Borzì: Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data.

Luca Amodeo: Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data.

Lucio Tracia: Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data.

Massimiliano Veroux: Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data.

Corrado Amodeo: Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data; also participated substantially in the drafting and editing of the manuscript.

Conflict of interest

The authors have no conflict of interest or any financial support.

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