

## Association of Ventral Incisional Hernias with Comorbid Diseases

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### Rezumat

#### *Asocierea eventrațiilor cu comorbiditățile preexistente ca factori de risc*

**Generalități:** Comparativ cu alte tipuri de hernii, eventrațiile abdominale sunt mult mai des asociate cu comorbidități. Analizăm ipoteza că factorii locali nefavorabili legați de comorbidități pot predispuce la formarea de eventrații.

**Materiale și metodă:** Caracteristicile eventrațiilor (71 de pacienți), herniilor abdominale primare (114 pacienți) și grupurilor de hernii inghinale (820 de pacienți) au fost analizate și comparate între ele.

**Rezultate:** Vârsta avansată, sexul feminin, prezența unor boli preexistente, strangularea, încarcerarea, rezecțiile intestinale sau omentale, tromboza venoasă profundă, ileusul paralytic, infecțiile lezionale sunt caracteristici prezente în procente mai mari în lotul de eventrații comparativ cu celelalte grupuri, scorurile ASA fiind semnificativ crescute, la fel ca și perioadele de internare în cazul acestor pacienți. Prezența comorbidităților preexistente și scorurile de clase ASA au fost factori predictivi independenți ai perioadei de spitalizare în cazul pacienților cu eventrații. ( $p < 0,05$ ).

**Concluzii:** Eventrațiile abdominale sunt asociate cu o incidență mai ridicată a bolilor comorbide comparativ cu alte tipuri de hernii de perete abdominal. Pacienții cu boli preexistente pot prezenta factori locali nefavorabili ce predispun la formarea herniilor postincizionale.

**Cuvinte cheie:** eventrație, comorbiditate, scor ASA, hernie inghinală, hernie abdominală primară

### Abstract

**Background:** Ventral incisional hernias are more commonly associated with comorbid diseases when compared to other hernia types. We investigate the hypothesis that unfavourable local factors related to comorbid diseases may lead to incisional hernia development.

**Materials and Methods:** The characteristics of incisional hernia (71 patients), primary ventral hernia (114 patients) and groin hernia groups (820 patients) were analysed and compared among each other.

**Results:** Advanced age, female gender, presence of coexisting disease, strangulation, incarceration, bowel or omentum resections, deep venous thrombosis, ileus, wound infections, ASA scores were significantly higher and the duration of hospital stay was longer in the incisional hernia group when compared to the other groups. Presence of coexisting diseases and ASA class scores were independent predictors of length of hospital stay in incisional hernia patients ( $p < 0.05$ ).

**Conclusions:** Ventral incisional hernias are associated with higher incidence of comorbid diseases in comparison with other types of abdominal wall hernias. Patients with coexisting diseases might have unfavourable local factors that lead to incisional hernia development.

**Key words:** incisional hernia, comorbid diseases, ASA score, Inguinal hernia, primary ventral hernia

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## Introduction

Incisional hernia is a common complication of abdominal surgery which occurs in 11 to 23 % of patients after abdominal surgery (1). It is often a source of morbidity and the high costs for health care are very impressive (2). 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 (3). Incisional hernia develops late, up to 10 years after surgery, and is related to unknown mechanisms such as connective tissue disorders (4,5). There might be patient related factors causing incisional hernias as well as surgical factors. In order to be able to study the possible causative factors of incisional hernias, the characteristics of the incisional hernia patients should first of all be clarified and distinguished from the all other hernia patients. The hypothesis of this study is that ventral incisional hernias are more commonly associated with comorbid diseases and higher ASA scores when compared to other hernia types.

## Material and Methods

The prospectively recorded data of 71 patients who underwent elective or emergency surgery for preoperative diagnosis of incisional hernia between December 2005 and February 2010 in our clinic were retrospectively analysed and compared with 934 other types of hernia repairs including primary ventral hernias (821 groin, 76 umbilical, 21 paraumbilical, 16 epigastric) operated over this period. The incisional hernia was defined as: 'Any abdominal wall gap with or without a bulge in the area of a postoperative scar perceptible or palpable by clinical examination or imaging' (6). Data recorded for each patient included age, sex, type of presentation, presence of coexisting systemic diseases, American Society of Anesthesiologists (ASA) class, strangulation, incarceration, bowel-omental resection, surgical procedures, and mortality.

All ventral localizations of incisional hernia types were included in the study, but small hernias smaller than 5 cm were excluded from the study for standardization. Patients who had incisional hernia repair with suture closure or prosthetic material were enrolled into the study. Incarceration was defined as irreducibility of an external hernia and strangulation as irreducibility with objective signs of ischemia or

gangrene at operation procedure.

Statistical analysis was done by using SPSS for Windows version 16 (SPSS, Chicago, Illinois). The data were tested for normality by using Kolmogorov-Smirnov normality test. One-way analysis of variance or Kruskal-Wallis test were used to compare the three groups in terms of numeric variables. Parametric and nonparametric data were compared between the two groups with either t-test or Mann-Whitney test, respectively. Normally distributed data are presented as mean  $\pm$  SD, nonparametric data are presented as median (minimum-maximum). Categorical data (gender, incarceration, strangulation, resection, ASA status, presence of coexisting disease) were analysed using Chi-square test. Multivariate binary logistic regression or multivariate linear regression were performed in order to analyse the independent predictors of poor presentation or outcome data (incarceration, resection, duration of hospital stay). P-values of  $<0.05$  were considered significant.

## Results

A total of 1005 patients underwent hernia surgery during the study period and were analysed, divided in the incisional hernia group (71 patients), primary ventral hernia group (114 patients) and groin hernia group (820 patients). The incisional hernia patients' mean age was  $57 \pm 12$ , out of which 52 (73%) were female, 19 (27%) were male. Among the 71 patients enrolled in the study, 41 had a primary incisional hernia, and 30 had a first or multiple recurrence of incisional hernia. These 71 patients had incisional hernias at seven different incision localizations and three different types of open surgical procedures were performed (Table 1).

Advanced age, female gender, presence of coexisting disease, strangulation, incarceration, bowel or omentum resections, the incidence of deep venous thrombosis, ileus, wound infections were significantly higher in the incisional hernia group when compared to the other groups ( $p < 0.05$ ) (Table 2). The duration of hospital stay was longest in the incisional hernia group ( $p < 0.05$ ) (Table 2). The rates of coexisting systemic diseases and ASA scores in the incisional hernia group were found significantly higher when compared with other two types of hernias ( $p < 0.05$ ) (Table 3). There was no mortality in the three groups.

Group regression analysis of incisional hernia patients

**Table 1.** Incision localizations and surgical procedures of ventral incisional hernia repairs

Ventral Incision		Surgical Procedure		
Localization	n (%)	Suture Repair	Onlay Mesh	Sublay Mesh
MAU	19 (27%)	3 (16%)	14 (74%)	2 (10%)
MBU	23 (34%)	2 (9%)	17 (74%)	4 (17%)
MAU + MBU	12 (17%)	2 (17%)	6 (50%)	4 (33%)
Pfannenstiel	8 (11%)	—	6 (75%)	2 (25%)
Subcostal	4 (6%)	—	3 (75%)	1 (25%)
Paramedian	2 (3%)	—	2 (100%)	—
TU	3 (4%)	2 (67%)	1 (33%)	—
Total	71 (100%)	9 (13%)	49 (69%)	13 (18%)

MAU: Median above umbilicus, MBU: Median below umbilicus, TU: Transverse at umbilicus level

**Table 2.** Patient characteristics and outcomes in incisional hernia or other types of hernia repairs. Data: number of patients (%), mean±SD or median (min-max)

	Hernia Type	Incisional N=71	Ventral N=114	Groin N=820	P value	
	Age (year)	57±12*#	50±13	51±16	0.001	
	Female gender	52(73%)*#	62	82	0.008	
Coexisting diseases	No coexisting disease	23*#	56	432	0.018	
	Pulmonary disease	11(16%)	13	112	0.278	
	Diabetes mellitus	9(13%)*	13	43	0.484	
	Hypertension	23(32%)*	36	172	0.517	
	Cardiac diseases	16(23%)#	10	141	0.009	
	Cancer	1(1%)	0	2	0.384	
	Cirrhosis	1(1%)	3	1	0.503	
	Chronic renal failure	1(1%)	0	0(0%)	0.384	
	Connective tissue disorder	2(3%)*	0	0(0%)	0.146	
	Hyperthyroidism	1(1%)	1	2	0.622	
	Anemia	0(0%)	0(0%)	5	0.313	
	Prostate hyperplasia	0(0%)	1	12	0.616	
	Duration of symptoms	14(2-300)*	13(1-360)	12(1-600)	0.915	
	Incarceration	55*	89	96	0.531	
Strangulation	5(7%)*	7	16	0.933		
Surgery	Emergent surgery	4	11	35	0.379	
	Resection	9(13%)*	13	15	0.484	
	Operation time (minutes)	103±43*#	68±38	66±23	< 0.001	
Postoperative complications	Pneumonia	1	0	3	0.384	
	Acute respiratory failure	1	2	8	0.672	
	Acute heart failure	0	1	3	0.616	
	Deep venous thrombosis	2*	0	0	0.146	
	Cerebrovascular accident	1	0	3	0.384	
	Ileus	4*	3	12	0.255	
	Wound infection	5*	5	14	0.205	
	Hematoma	2	1	6	0.158	
		Duration of hospital stay (days)	4(1-75)*#	1(1-11)	1(1-16)	< 0.001

\*p<0.05 compared to groin hernias, # p<0.05 compared to ventral hernias

**Table 3.** Comparison of concomitant diseases and ASA class between the incisional hernia and other hernia type repairs

Type of the hernia	ASA Class			p	Coexisting Diseases*			p
	ASA I	ASA II	ASA III-IV		One	Two	Multiple	
Incisional n=71	25	32	14		36 (53.5%)*#	9 (13%)	3 (4%)	
Ventral n=114	57	40	17	0.077	39(34%)	17(15%)	2(2%)	0.104
Groin n=820	434	307	79	0.034	281(34%)	94(11.5%)	13 (%2)	

\*Coexisting Diseases: Pulmonary (Chronic obstructive/restrictive, Asthma, Bronchitis, Bronchiectasis etc), Cardiovascular (Coronary artery disease, Congestive Heart Failure, Hypertension etc), Endocrine (Diabetes Mellitus, Hipo/hyperthyroidism etc), Renal, Malignancy etc.

Other Hernia Types: Groin, epigastric, umbilical, paraumbilical

\*p<0.001 compared to the groin hernias, #p<0.05 compared to ventral hernia

revealed that the number of coexisting diseases and ASA class score were statistically significant independent predictors of longer duration of hospital stay (Table 4).

## Discussion

Unfortunately incisional hernia is a common complication of abdominal surgery and an important source of morbidity with a considerable proportion of incarceration, strangulation, and

emergency surgery requirement (1). Suitable for this, our study also establishes the high rates of complicated presentations and postoperative complications in incisional hernia patients.

Incisional hernias deserve attention because incidence of this hernia type is high and it has potential morbidity. It was formerly believed that the formation of incisional hernia was due to the technical problems of the surgery with suture repair, but the association of technical failure and the recurrence rates of up to 49% (7) was not convincing. Even mesh repairs were

**Table 4.** *Statistical significance of risk factors according to unfavorable presentation and outcomes in incisional hernias*

Factors	Incarceration	Resection	Hospital .stay
Female sex	NS	NS	NS
Age	NS	NS	NS
Coexisting disease	NS	NS	P=0.039
ASA score	NS	NS	P=0.004

NS: Non Significant

associated with long term recurrence rates of 20%-30% (8), suggesting other systemic risk factors, especially related to wound healing in the formation of incisional hernias. A myriad of factors that are patient-related and those that depend on surgical technique have been associated with incisional ventral hernias but unfortunately, strong literature support is seldom found for the significance of the individual risk factors (9). We now report the systemic risk factors of incisional hernia patients compared with other types of hernias; the former was determined to be associated with high rate of coexisting systemic diseases and ASA scores.

The high incidence of incisional hernias and the even more disappointing recurrence rates have led to the hypothesis that incisional hernias are related to a disorder of the connective tissue biology (10). The majority of recurrences of incisional hernia develop after a considerable delay following the previous repair with the time course never reaching a plateau and supporting that the development of a recurrence in an incisional hernia repair is a biologic phenomenon rather than a technical one (11). The ratio of collagen type I to type III, as an indicator of tissue quality, was significantly reduced in patients with primary and recurrent incisional hernia (12-15). This decreased ratio supports the hypothesis of a "high-risk" population and the phenomenon of a biologic one (10,11,16). Our results can be discussed from two different points of view. First, there might be high risk patients (such as those had coexisting diseases and therefore high ASA scores) who are more prone to develop incisional hernia after laparatomies although this hypothesis can only be indirectly shown by our results. Systemic diseases impair the wound healing process, so that the high rates of concomitant systemic diseases with incisional ventral hernias which were analysed in this report could be a related factor in the process of hernia formation after primary laparotomy. The effects of systemic diseases can weaken a well healed abdominal wound over the course of years and give rise to an incisional hernia. This hypothesis can only be directly proved with long-term observation of laparotomy patients and by comparing the patients with and without co-existing disease regarding the development of incisional hernias. A second explanation for our results would be that there is a high incidence of coexisting diseases and therefore higher ASA scores in incisional hernia patients when compared to other hernia types, and incisional hernia patients should be regarded separately from other hernia patients as high risk patients. Indeed the formation of incisional hernias may be similar with hiatal hernias. In the surgical treatment of hiatal hernias, meshes are also used for strengthening the defect in order to reduce recurrences (17).

We don't have information regarding the local risk factors of the primary wound of incisional hernia patients such as fascial closure technique, infection, seroma, hematoma; this might be considered a limitation of the study. Indeed among patients who develop a wound infection, the rate of clinical herniation is increased nearly 5-fold (18). Patients with coexisting diseases might have unfavourable local factors that lead to incisional hernia development. It would be crucial to prospectively observe patients with laparatomies and to analyse whether patients with coexisting disease are more prone to the development of incisional hernias than the patients without any concomitant systemic illness.

Approximately thirty years ago Bucknall and co-workers reported that many factors were associated with incisional herniation: old age, male sex, obesity, bowel surgery, type of suture, chest infection, abdominal distension, and, most important, wound infection (18). Since then there have been many reports related to systemic and local risk factors, however strong literature support is seldom found for the significance of the individual risk factors associated with incisional hernia (9). Indeed the routine usage of meshes reduces the recurrence rate from 40% to 50% to about 10% (19,20). However we agree with Klinge and colleagues that it was not the hernia itself or the technique required for repair, but the patients and their co-morbid conditions which were analysed in this study that generated difficulty during the management of this condition (11). High long term recurrence rates of mesh repairs of 20%-30% (8) support this observation and the relation between hernia and systemic risk factors. In a study by Vidović and colleagues the recurrence rate after incisional hernia repair was also found to be significantly influenced by type of repair, obesity, hernia size, wound healing disorders and some chronic comorbidities. They also postulated that prostatic hyperplasia and ascites were predisposing factors for the development of incisional hernia recurrence (21). They concluded that it was very important to be aware of and respect the risk factors for recurrence following incisional hernia repair in order to be able to comply with three crucial demands: (1) individual approach; (2) preoperative elimination of risk factors that the surgeon can manipulate, such as obesity and prostatic hyperplasia; (3) the selective use of mesh in patients who run a higher risk for recurrence, especially when dealing with an obese patient or one with a large incisional hernia. In fact the effect of obesity has been cited by many others as a risk factor for the recurrence of incisional hernias (22-24). Unfortunately we did not have accurate and complete data about the time course of the body mass index of our patients including the time of the primary laparotomy, but we

also believe that to be an important factor. We also agree that perioperative optimal control of comorbid diseases may change the outcome of incisional hernias, but this assumption needs to be proved by prospective studies.

## Conclusions

Consequently incisional hernia is one of the most prevalent complication of abdominal surgery and frequently causes morbidity which rises health care costs. Even with the routine use of meshes, repairing an incisional hernia is a challenge because of systemic risk factors which have been associated with co-morbid diseases in the development of incisional hernia. As well as with the aging population, increasing chronic diseases can influence the wound healing process after a laparotomy. As a conclusion, the existence of high rates of coexisting systemic diseases and correlative high ASA scores in this study are factors associated with incisional hernia which prolong hospital stay. Therefore incisional hernia patients should be regarded separately from other hernia patients as high risk patients. These high risk patients may also occupy intensive care unit beds as the larger the number of comorbid conditions and the higher the ASA class scores are there is more need for critical care beds. This result may have clinical implications in health care management issues such as triaging of hospital beds, operating room planning as well as therapeutic decisions of hernia repairs, for example the usage of a biomaterial in order to strengthen the laparotomy closures in these high-risk patients (25-27). Future studies are needed not only to guide the therapeutic management issues in high risk incisional hernia patients but also to reveal the possible association of comorbid diseases and the development of incisional hernias.

## Conflict of interest

None of the authors declare any conflict of interests.

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