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Risk Factors of Incisional Hernia

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Abstract: Incisional hernia represents a common wound complication after abdominal surgery. Many factors seem to be associated with its development. **Aim of the study:** To show the important and most frequent risk factors and their relationship to the occurrence of incisional hernia. **Patients and Methods:** A cross-sectional study of 80 patients (35 patients were males and 45 were females) admitted in Baghdad teaching hospital / surgical department during the period from April 2013 to January 2015, diagnosed as incisional hernia, history has been taken and physical examination was done for all patients. Data collected from patient's history, discharging notes, and clinical examination. Data include patient factors and wound factors. The patient's related factors include: age, obesity, smoking, diabetes mellitus, COAD, malignancy and steroid use. Wound factors include: wound infection, incision type and circumstances of the first surgery whether elective or emergency. **Results:** Male: female ratio was 1:1.2. Age group between 40-59 years is more affected by incisional hernia which was occurring in 58.8 %. Vertical incisions were more prone for developing incisional hernia in 72.5 % of the cases, while emergency surgery in the first operation occurred in 66.2 %, wound infection in 42.5 %, smoking in 40%, diabetic patients were 22.5% of study population, COAD presented in 20%, malignancy was in 15% and steroid use in 8.8%. There were 12.5% of the patients that were presented with complicated incisional hernia and underwent emergency surgery. **Conclusion:** Vertical incision and emergency surgery were the more frequent risk factors for incisional hernia in our study. Smoking was statistically significant as a risk factor in incisional hernia so all patients should be advised to stop smoking to decrease the incidence of this potential postoperative complication. By knowing treating these risk factors whenever possible we could reduce the incidence of incisional hernia.

Keywords: Incisional hernia and Risk factors.

INTRODUCTION

Incisional hernia is a well-known complication after abdominal surgery with incidence rates of approximately 3% and 15% after laparoscopic and open surgery respectively. (Andersen, L. *et al*., 2008)

Approximately 200,000 cases of incisional hernia repairs are performed each year in the United States, 90% of incisional hernias occur within 3 years of the operation. (National Health Statistics Center, 1995; Wedbush Morgan Securities, 2001)

Despite the significant advances in operative techniques, improved sutures materials better pre- and post- operative care, the use of antibiotics etc...., this iatrogenic type of hernia not seems to be significantly decreasing in frequency. (Wedbush Morgan Securities, 2001)

Many studies were published dealing with impact of operative technique on the development of incisional hernia, type of incision, length of incision, suture materials used, methods employed for closure, site of drain, all had led to improvement and decrease in the incidence of incisional hernia, but it still occur indicating that the problem is multifactorial and other factors play a role. Repair of large incisional hernia is a difficult surgical problem and recurrence rate of 33% after the first operation and 58% after the second repair have been reported. (de Vries Reilingh, T. S. *et al*., 2003)

RISK FACTORS

- **Vertical Incision:**

The type of incision is one of the most important factors in proper wound healing, and the major factor that the surgeon can control. It is documented that transverse incision heals more firmly without herniation about three to five times than a vertical incision dose. (Chawala, G. S. *et al*., 2000)

- **Emergency Surgery:**

There is a high rate of incisional hernia in emergency cases due to many reasons. Emergency laparotomies are usually performed for acute abdomen causes which have been deteriorated due to the course of acute illness in which the patient may be in shock state, hypoxia, improper resuscitation and emergency situations necessitate quick surgery to save patient's life. (de Vries Reilingh, T. S. *et al*., 2003)

- **Wound Infection and Sepsis:**

Probably the most common cause of healing delays is wound infection. Bacteria prolong the inflammatory phase and interfere with epithelialization, contraction, and collagen deposition. (Kaira, H. S. *et al*., 2001)

- **Smoking:**

There are a high proportion of smokers present with incisional hernia as reported by other studies of patients with abdominal wall hernias.

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(Sorensen, L. T. *et al*., 2002; Dunne, J. R. *et al*., 2003)

- **Age:**

Elderly patients are more likely to sustain surgical wound rupture and delayed healing than younger patients. (Ashcroft, G. S. *et al*., 1997)

- **Obesity:**

Incisional hernia may occur in obese patient due to increased tension on the abdominal wall provided by the excessive bulk of a thick subcutaneous fat and large omental mass.(Abrahamson, J)

- **Diabetes Mellitus:**

Diabetic patients are susceptible to infection because of an attenuated inflammatory response, impaired chemotaxis, and inefficient bacterial killing. Diabetes mellitus impairs wound healing at all stages of the process.

- **Chronic Obstructive Airways Diseases:**

Mechanical stress due to increase intra-abdominal pressure and increase tension in the abdominal wall by cough appears to have a direct effect on freshly sutured wound especially in patients with pre-existing COAD and elderly smokers. (Savage, A. *et al*., 1994)

- **Malignancy:**

Malignant diseases are associated with anorexia, cachexia, and hypoproteinemia. All these affect the process of wound healing and many contribute to the development of incisional hernia in that patient.

- **Steroids:**

Steroids have a major effect on the inhibition of the inflammatory phase of wound healing (angiogenesis, neutrophils and macrophage migration, and fibroblast proliferation) and the release of lysosomal enzymes.

PATIENTS AND METHODS

A cross-sectional study conducted at Baghdad teaching hospital/ Department of general surgery. Data has been collected from 80 patients (45 cases females and 35 cases males) with incisional hernia during the period from April 2013 to January 2015. The patients included in the study were admitted in our hospital for surgical repair whether elective or emergency condition. They are assessed for the risk factors that are present before, during or after the first surgery which was complicated by incisional hernia.

Data collected from patient's history, discharging notes, and clinical examination. Data include patient factors and wound factors. The patient's related factors include: age, obesity, smoking, diabetes mellitus, COAD, malignancy and steroid use. Wound factors include: wound infection, incision type and circumstances of the first surgery whether elective or emergency.

Wound infection includes surgical site infection that occur postoperatively whether in the hospital or later after discharge described as gross purulent fluid or erythema noted by the surgeon. Obesity was assessed by measuring body mass index and considered present when it's more than 30 kg/m2. Histopathological reports and courses of chemotherapeutic drugs or radiotherapy were used to identify those patients with malignancy. Type of incision: either transverse or vertical (which includes paramedian and midline incisions, upper or lower) which are recognized from the scar. Emergency surgery identified from the operative notes, history of the presentation and history of management in the first surgery. Smoking includes all patients who are smokers. Diabetes mellitus, COAD and steroid use identified by history, chronic disease cards and instructions supplied by the specialized doctors. Also, all patients have been sent for investigations include blood sugar, CXR and ECG.

Biostatic method used in data analysis, using software IBM SPSS statistics, Chi- Square test used for obtaining P value.

Exclusion criteria include recurrent incisional hernia.

RESULTS

In this study 80 patients were included; the incidence of incisional hernia was 35 (43.8%) in males and 45 (56.2%) in females. Male: female ratio was 1:1.2.

Age range was between 24-81 years old; with mean age was 47 years.

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Table 1: Gender distribution of incisional hernia cases.

Gender	No.	%
Female	45	56.2
Male	35	43.8
Total	80	100

Patient's age range 40-49 years had the highest incidence; 25 patients (31.2% of the cases)

Table 2: Age distribution of incisional hernia cases.

Age yr.	20-29	30-39	40-49	50-59	60-69	>70	Total
Males	2	3	12	8	8	2	35
Females	4	9	13	10	6	3	45
Total	6	12	25	18	14	5	80
Percent	7.5	15	31.2	22.5	17.5	6.3	100

In this study the most frequent risk factor was vertical incision which found in 58 cases (72.5 %) followed by emergency surgery in 53 cases (66.2 %), wound infection 42.5%, smoking 40 %, while steroid use and patients with malignant diseases were the least frequent (8.8% and 15% respectively), other factors ranging between 42.2 and 20%.

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Table 3- Types of risk factors

Risk factors	Males 35 (%)	Females 45 (%)	P value	Total 80 (100%)	Percent %
Vertical-incisions Non-vertical incisions	27 8	31 14	0.12	58 22	72.5 27.5
Emergency-surgery Elective surgery	25 10	28 17	0.31	53 27	66.2 33.8
Wound-infection No wound infection	17 18	17 28	0.34	34 46	42.5 57.5
Smokers Non smokers	22 13	10 35	0.001	32 48	40 60
BMI=20-24.9 BMI=25-29.9 BMI=30-34.9 BMI=35-39.9 BMI >40	19 10 4 1 1	12 18 8 5 2	0.09	31 28 12 6 3	38.8 35 15 7.5 3.7
Age<40yr. Age40-59yr. Age>60yr.	5 20 10	13 23 9	0.10	18 43 19	22.5 53.8 23.7
Diabetes No diabetes	10 25	8 37	0.23	18 62	22.5 77.5
COAD No COAD	11 24	5 40	0.09	16 64	20 80
Malignancy No malignancy	5 30	7 38	0.44	12 68	15 85
Steroid-use No steroid use	2 33	5 40	0.26	7 73	8.8 91.2

Patients are grouped according to the number of the factors present in the same patient into 8 groups ranging from 0-7 risk factors. Those with 3 factors were 25 patients (31.3 %) which is the largest group, those with 4 risk factors were 14 patients (17.5%) and patients who had more than 4 risk factors were 14 patients (%17.5), and those with 2 factors and less were patients 27 (33.7%).

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Table 4- Distribution of risk factors among patients

No. of Risk factors	0	1	2	3	4	5	6	7	Total no. of patient
No. of patients	1	8	18	25	14	9	3	2	80
Percent %	1.2	10	22.5	31.3	17.5	11.2	3.8	2.5	100
Vertical incision	0	3	9	20	12	9	3	2	58
Emergency Surgery	0	1	11	18	11	8	3	1	53
Wound infection	0	2	4	8	9	7	2	2	34
Smoking	0	1	3	7	12	5	3	1	32
Diabetes Mellitus	0	0	3	4	5	4	1	1	18
Age > 60 yr.	0	0	3	2	5	5	2	2	19
Obesity	0	1	1	7	2	5	3	1	20
COAD	0	0	2	5	3	2	3	1	16
Malignancy	0	0	0	6	2	2	1	1	12
Steroid use	0	0	1	3	0	1	0	2	7

Among those patients the elective cases were 70 (87.5%) while the emergency cases were 10 (12.5%).

From the 80 patients 10 (12.5%) patients presented as emergency cases, with strangulated incisional hernia or intestinal obstruction where emergency intervention was done and dealing with the content and primary repair by double layer non absorbable sutures, while 70 patients (87.5%) presented as elective ones.

Table 5: Type of incisional hernia presentation.

Type of surgery	Total number	Percent %
Emergency surgery	10	12.5
Elective surgery	70	87.5
Total	80	100

DISCUSSION

Type of Incision:

Vertical incision constitutes 72.5% of patients in our study. Incisional hernia was more common following vertical incision than transverse incision. (Yahchouchy-Chouillard, E. *et al*., 2003; Adesunkanmi, A. R. K. *et al*., 1999; Allen, D. B. *et al*., 1997)

Grantcharov noticed that transverse incisions in abdominal surgery are based on better anatomic and surgical principles than vertical incisions and should be preferred. (Barker, D. E. *et al*., 2000)

A number of retrospective clinical studies and a meta-analysis have concluded that the transverse incision is superior to the vertical incision with regard to long-term and short-term outcomes,

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including postoperative pain, pulmonary complications, and frequencies of incisional hernia and burst abdomen. However, the vertical incision is still the most commonly performed incision in general surgery. (Reidel, M. A. *et al*., 2003)

Emergency Surgery:
We found in this study that incisional hernia is associated with emergency trauma cases. Emergency surgeries were frequent and in the order of 66.2% of the patient population. Cait *et al* observe that incisional hernia rate was to be 12% in emergency and 4% in elective laparotomies. (Col, C. *et al*., 1998) Hanif, *et al*., report almost similar rate, and they are together with Adesunkanmi, *et al*., & Bucknall, *et al*., consider emergency surgeries as a significant risk factor for incisional hernia formation later. (Adesunkanmi, A. R. K. *et al*., 1999; Hanif, N. *et al*., 2000; Bucknall, T. E. *et al*., 1982) While Dr. Falih A & Dr. Yasser A. did not highlight this factor. (Yasser, A.R. *et al*., 1982)

Wound Infection and Sepsis:
In our study wound infection was present in 42.5 % of all patients. Bucknall *et al* in their study found incisional hernia in up to 23% of those with postoperative wound infection. (Bucknall, T. E. *et al*., 1982)

The septic complication may range from cellulitis, fasciitis and tissue necrosis on either side of the incision, caused by chronic sepsis around sutures such as braided silk. The inflammation and edema produce weakened wound. Sutures then tear and pull out through such wounds underthestrainofintra-abdominalpressure.(Bucknall, T. E. *et al*., 1982) Dr.FalihA.&YasserA. found 40% of laparotomies complicated by wound infection develop incisional hernia later and so that wound infection is significantly associated with incisional hernia formation. (Yasser, A.R. *et al*., 2004) These publications have statistically support wound infection as a risk factor of recurrence. Adesunkanmi *et al* found that 86.4% of patients developing incisional hernia had wound infection. (Adesunkanmi, A. R. K. *et al*., 1999)

Smoking:
Smoking was frequent in our patients and constitutes 40 % of the total number; in addition, it was significantly associated with gender as we found (Yasser, A.R. *et al*., 1982) of male patients were smokers and females were 10 patients. Also smoking was statistically significant as a risk factor (P value < 0.001). Sorensen *et al* in their study found that smokers have four folds higher risk of incisional hernia than non-smokers and they considered this high incidence according to the long term follow up. (Kirkeby, M. D. *et al*., 2005)

Age:
Incisional hernia cases were 53.8 % in the middle age while advancing age was frequent in our patients, it constitutes 23.7% of the total. Mathonnet *et al* found the mean age was 61.3 year. (Mathonnet, M. *et al*., 1998)

In our study it was 47 years which was lower than the studies above. The explanation is that in our country this age is exposed to emergency surgery more than other ages because of terrorism.

Wound healing is usually slower and less solid in the geriatric patients, as protein turnover is reduced with advancing ages; in addition, reduced vitality of the tissue in the older patients predisposes them for wound infection which is a significant predisposing factor for the development of wound failure. (Abrahamson, J. *et al*)

Obesity:
In our study we noticed that obesity is present in 26.2 % of our patients, while some references report it as strong risk factor especially morbid obesity. (Cuschieri, A. *et al*., 2008) Obesity is one of the leading causes of occurrence of incisional hernia. The bulk related to the fatty omentum and excessive subcutaneous tissue provides increase in strain on the wound during early healing. Many of those individuals are associated with loss of muscle mass and tone, therefore possess inadequate strength at the fascial level to compensate for the added strain. (Cuschieri, A. *et al*., 2008)

Some studies blame obesity as a risk factor of incisional hernia and also for recurrence after repair of such hernias. (Kaira, H. S. *et al*., 2001; Yahchouchy-Chouillard, E. *et al*., 2003) Dr. Falih A. &Yasser A. found that 50% of obese patients who sustained laparotomy later developincisionalhernia. (Yasser, A.R. *et al*., 1982)

Ellis and his group found a threefold increase in incisional hernia and recurrence of incisional hernia in obese patients.(Bucknall, T. E. *et al*., 1982)

Other workers dispute obesity as a significant causative factor of incisional hernia. Adesunkanmi *et al* did not find the role of obesity as a significant

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causative factor. (Adesunkanmi, A. R. K. *et al*., 2008) Devlin & Newsome, *et al*., have conflicting reports of obesity and age as etiological factor. (Newsome, H. H. *et al*., 1996)

Diabetes Mellitus:
The risk of infection in the wounds of diabetic patient approaches fivefold than in non- diabetic. Impaired circulation secondary to large and small occlusive disease with hyperglycemia and intermediary metabolism is major factors. (Maingot, R, 1980)

Diabetes mellitus was frequent in our patients, the study shows that DM presented in (Yasser, A.R. *et al*., 1982).5% of patients; Dr. Falih A & Yasser A. found that is diabetes mellitus is a significant risk factor for developing incisional hernia in patients undergoing abdominal surgeries. (Yasser, A.R. *et al*., 1982)

Chronic Obstructive Airway Disease:
COAD includes chronic bronchitis and asthma was noticed in 20 % of our patients.

Mechanical stress due to increased intra-abdominal pressure and increased tension set up in the abdominal wall by cough seems to have a detrimental effect on the freshly sutured laparotomy wound especially in patient with pre-existing chronic obstructive airway disease and elderly smoker patients.(Bucknall, T. E. *et al*., 1982; Maingot, R, 1980; Mc Quarrie, D. G, 1992)

Dr. Falih A & Dr. Yasser A. noticed a statistically significant relationship between post-operative pulmonary complications and the development of incisional hernia later. (Yasser, A.R. *et al*., 1982) Bucknall *et al* consider it together with cigarette smoking as significant factors. (Bucknall, T. E. *et al*., 1982)

Malignancy:
In this study malignancy was less frequent risk factor and was present in only 15 % of the patient population. Bucknall, T.E; Manninen M.J. & Mudge, M. considers it together with malnutrition, uremia, jaundice, steroid use and immunosuppressive therapy as a less significant risk factor for incisional hernia. (Bucknall, T. E. *et al*., 1982; Manninen, M. J. *et al*., 1991)

Anstead G M noticed that the delay in the use of chemotherapeutic drugs for 2 weeks post-operatively appears to lessen the wound healing impairment. This is seen when extravasations of chemotherapeutic agent occur and associated with tissue necrosis, marked ulceration, and protracted healing at the affected site. (Anstead, G. M, 1998)

Steroid Use:
In our study we noticed that patients who were on steroid therapy at first surgery are infrequently present (only 8.8%). Greenall *et al*, Read *et al*, and Makela *et al* in their studies considered corticosteroid as patient- related risk factor of incisional hernia formation.[31] Bucknall *et al* links steroid use as a risk factor for incisional hernia with advancing age, diabetes mellitus, cigarette smoking, and obesity. (Bucknall, T. E. *et al*., 1982)

CONCLUSIONS

1. Vertical incisions and emergency operations in the first surgery are more frequent factors that predispose to incisional hernia.
2. The presence of multiple risk factors at the first operation increasing the incidence of developing incisional hernia.
3. Smoking was statistically significant risk factor

RECOMMENDATIONS

1. It is advisable to use transverse incisions whenever possible.
2. Every attempt should be made for early diagnosis and management of wound infection and dehiscence, and early suturing of the wound is advisable to avoid future herniation.
3. It is recommended to establish health education regarding the risk of smoking on general health and on wound healing.
4. Controlling diabetes and poor metabolism with regular medical care and dietary changes as recommended.
5. Optimize the patient's pulmonary function status and treat any existing respiratory tract infection before going to surgery.

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