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## Review of 87 Patients with Incisional Hernia and its Risk Factors

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### Abstract

**Background:** Incisional hernia is a common complication of abdominal surgeries and more following emergency than elective surgery with many risk factors playing role in its occurrence.

**Objectives:** To show the important risk factors and their relation to the occurrence of incisional hernia in the present cases

**Patients and methods:** Eighty seven patients with incisional hernia who were admitted in the fifth floor (third unit)/department of surgery in Baghdad Teaching Hospital were included in this case series study during the period from Jan 2007 to Jan 2009; they were inquired about their history and were examined for their scars.

**Results:** Seventy eight patients out of 87 (89.6%) patients are presented for elective repair, and 9 patients (10.3%) were presented with complicated incisional hernia undergo emergency surgery. Vertical incision found in 59 patients (67.8%) and emergency surgery had been done in 55 patients (63.2%).

**Conclusion:** Vertical incision and emergency surgery were the more frequent risk factors for incisional hernia in the study. With prolong time interval (between the presentation with incisional hernia & the remedy surgery) for more than 6 years, age >60 years or defect >10cm increases the risk for emergency presentation of incisional hernia.

**Keywords:** Incisional hernia, risk factor

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### Introduction

Between 2% & 11% of patients undergoing laparotomy develop incisional hernia with the following risk factors: It is well documented that transverse incision heals firmly without herniation from three to five times as often as does a **vertical incision** because of anatomical consideration<sup>1</sup>, and the sutures placed perpendicularly to muscle fibers in transverse incisions are more secure and less liable to cut through fascia<sup>2,3</sup>.

The high rates of incisional hernia in emergency surgery were due to many reasons: shock state, hypoxia, improper resuscitation and quick surgery, in addition to the lack of proper sterilization in an emergency setup and some of lack of experience on the part of surgeon also play a role<sup>3</sup>. Probably the most common cause of healing delays is **wound infection**. Bacteria prolong the inflammatory phase and interfere with epithelialization, contraction, and collagen deposition. The endotoxin themselves stimulate phagocytosis and release of collagenase, which contributes to collagen degradation and destruction of surrounding; previously normal tissue<sup>4</sup>. The proportion of **smoking** with incisional hernia was high because of tissue hypoxia<sup>5,6</sup> decreased collagen deposition<sup>7</sup> & degradation of connective tissue<sup>8</sup>.

**Elderly patients** are more likely to sustain surgical wound rupture and delayed healing than younger patients. With aging, collagen undergoes qualitative and quantitative changes<sup>9</sup>. Impaired macrophage activity with reduced phagocytosis<sup>9</sup> protein turnover is reduced<sup>10</sup> reduced vitality in older patient predispose them for wound infection<sup>11</sup>. The underlying factors of the role of **obesity** are rather difficult to pinpoint. The large mass of fat increased retraction of tissues during operation may increase the infection rate<sup>12</sup>. Tissue infiltrated with fat may not be able to hold sutures well<sup>13,14</sup>. The presence of high fat content in the abdominal wall tissue layers makes for the high incidence of seroma and hematoma formation in the wound which

increase tension and lead to impaired local blood supply and wound failure<sup>2,15,16</sup>. O<sub>2</sub> supply of the tissues is less in obese<sup>4</sup>. **Diabetes mellitus** impairs wound healing at all stages of the process. A diabetic patient with associated neuropathy and atherosclerosis is prone to tissue ischemia, repetitive trauma, infection, attenuated inflammatory response, impaired chemotaxis, and inefficient bacterial killing, increases local tissue metabolism. Lymphocyte and leukocyte function is impaired, and there is increased collagen degradation and decreased collagen deposition<sup>17</sup>.

**Chronic obstructive airways diseases** increase the intra-abdominal pressure and the tension set up in the abdominal wall by cough & seems to have a detrimental effect on the freshly sutured laparotomy wound<sup>18</sup>.

**Malignant diseases** are associated with anorexia, cachexia, and hypoproteinemia that affect the process of wound healing<sup>4,17</sup>, & **chemotherapeutic agents** affect healing by attenuate the inflammatory phase of wound healing, decrease fibrin deposition, reduce the synthesis of collagen by fibroblasts, and delay wound contraction<sup>19</sup>. **Steroids** inhibit the inflammatory phase of wound healing and the release of lysosomal enzymes<sup>20</sup>.

### Objective

The objective is to identify the important risk factors for the occurrence of incisional hernia in the present cases.

### Patients and methods

A case series study conducted at the Medical City\ Baghdad Teaching Hospital during the period from January 2007 to January 2009. The study enrolled with 110 patients; 23 patients were lost. The remaining 87 patients included in the study, were admitted in the hospital for surgical repair; whether elective or emergency. Elective repair was done by

onlay mesh repair while emergency repair were done by double layer closure with non absorbable Nylon/loop no. 2. They were assessed for the risk factors that are present before, during or after the first surgery which was complicated by incisional hernia. A total of 87 patients are included in the study. The age range is between 23 years & 82 years. Normal weight (Body mass index BMI: 20-25) were 35 patients, overweight (BMI: 26-29) were 32 patients, obese (BMI: 30-34) were 10 patients, severely obese (BMI: 35-49) were 7 patients and super obese (BMI:  $\geq 50$ ) were 3.

Smokers were 32 patients & non smokers were 55 patients. Diabetic patients were 19 patients & non diabetic patients were 68. Chronic obstructive airway diseases were 16 patients only. Patients with malignancy were 12 patients. Steroid users were 8 patients.

Wound infection appears in 35 patients. Vertical incisions were in 59 patients, while non vertical incisions were 28 patients. Emergency surgeries were done in 55 patients and elective surgeries were done in 32 patients.

## Results

A total of 87 patients are included in the study. Males were 38 (43.6%) while females were 49 (56.3%), a male: female ratio of 1:1.2. Age range is between 23-82 years, a mean age of 48 years [Table 1].

The total risk factors analyzed were 10 factors; vertical incision and emergency surgery were the most frequent risk factors (67.8% and 63.2% respectively), steroid use & patients with malignant

diseases were the least frequent (9.2% and 13.8% respectively) other factors ranging between 18.4% and 40.2% [Table 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 are 27 patients (31%) which is the larger group, patients with 2 risk factors were 19 (21.8%), those who have 4 risk factors were 15 patients (17.2%) and patients with more than 4 risk factors were 16 patients (18.4%), while those with  $< 2$  risk factors were only 10 patients (11.4%), [Table 3].

The types of surgical procedures complicated by hiatus hernia in this study were listed in [Table 4], the commonest was the abdominal trauma.

From the 87 patient 9 patients presented as emergency cases, with strangulated incisional hernia or intestinal obstruction, on which emergency intervention were done, dealing with the content and primary repair by double layer non absorbable sutures, while 78 patients presented as elective cases.

The risk factors are analyzed for elective and emergency presentation groups and reveal that: time interval  $> 6$  years, age  $> 60$  years and defect size  $> 10$  cm have 13.2, 11.7, and 3.5 respectively times of increasing risk of emergency presentation which is statistically significant, while some other factors although were statistically not significant have more than one time increased risk: Vertical incision (3.8), diabetes mellitus (1.8), emergency surgery (1.2). Other factors show no increased risk [Table 5].

**Table 1:** Age distribution of incisional hernia cases.

| Age group              | Male |      | Female |      | Total |      |
|------------------------|------|------|--------|------|-------|------|
|                        | No.  | %    | No.    | %    | No.   | %    |
| Young age(20-39)yr     | 11   | 12.6 | 9      | 10.3 | 20    | 22.9 |
| Middle age(40-59)yr    | 18   | 20.7 | 27     | 31   | 45    | 51.7 |
| Old age( $\geq 60$ )yr | 9    | 10.3 | 13     | 15   | 22    | 25.3 |
| Total                  | 38   | 43.6 | 49     | 56.3 | 87    | 100  |

**Table 2:** Risk factors distribution of incisional hernia cases

| Risk Factors           | Males<br>38<br>(43.6%) | Females<br>49<br>(56.3%) | P value   | Total<br>87<br>(100%) | Percent<br>% |
|------------------------|------------------------|--------------------------|-----------|-----------------------|--------------|
| Vertical incisions     | 29                     | 30                       | 0.14      | 59                    | 67.8         |
| Non vertical incisions | 9                      | 19                       | [NS]      | 28                    | 32.2         |
| Emergency surgery      | 25                     | 30                       | 0.17[NS]  | 55                    | 63.2         |
| Elective surgery       | 13                     | 19                       |           | 32                    | 36.7         |
| Wound infection        | 17                     | 18                       | 0.45[NS]  | 35                    | 40.2         |
| No wound infection     | 21                     | 31                       |           | 52                    | 59.7         |
| Non smokers            | 16                     | 39                       |           | 55                    | 63.2         |
| $< 10$ cigarettes/day  | 2                      | 7                        | $< 0.001$ | 9                     | 10.3         |
| 10-29 cigarettes/day   | 6                      | 2                        | [S]       | 8                     | 9.2          |
| $> 30$ cigarettes/day  | 14                     | 1                        |           | 15                    | 17.2         |
| BMI 20-24.9            | 22                     | 13                       | 0.017     | 35                    | 40.2         |
| BMI 25-29.9            | 12                     | 20                       | [S]       | 32                    | 36.8         |
| BMI 30-34.9            | 3                      | 7                        |           | 10                    | 11.5         |

|                                       |    |    |              |    |      |
|---------------------------------------|----|----|--------------|----|------|
| BMI 35-39.9                           | 0  | 7  |              | 7  | 8    |
| BMI >40                               | 1  | 2  |              | 3  | 3.4  |
| Age <40 yr.                           | 6  | 15 | 0.22<br>[NS] | 21 | 24.1 |
| Age 40-59 yr.                         | 21 | 25 |              | 46 | 52.9 |
| Age >60 yr.                           | 11 | 9  |              | 20 | 23   |
| Diabetes                              | 10 | 9  | 0.37[NS]     | 19 | 21.8 |
| No diabetes                           | 28 | 40 |              | 68 | 78.1 |
| Chronic obstructive airway disease    | 8  | 8  | 0.44[NS]     | 16 | 18.4 |
| No Chronic obstructive airway disease | 30 | 41 |              | 71 | 81.6 |
| Malignancy                            | 4  | 8  | 0.44[NS]     | 12 | 13.8 |
| No malignancy                         | 34 | 41 |              | 75 | 86.2 |
| Steroid use                           | 2  | 6  | 0.26[NS]     | 8  | 9.2  |
| No steroid use                        | 36 | 43 |              | 79 | 90.8 |

**Table 3:** The groups of patients according to the number of risk factors they have

| No. of Risk Factors                | 0   | 1    | 2    | 3  | 4    | 5    | 6   | 7   | Total Patients with Risk Factor |
|------------------------------------|-----|------|------|----|------|------|-----|-----|---------------------------------|
| No. of patients                    | 1   | 9    | 19   | 27 | 15   | 10   | 4   | 2   | 87                              |
| Percent %                          | 1.1 | 10.3 | 21.8 | 31 | 17.2 | 11.5 | 4.6 | 2.3 | 100                             |
| Vertical incision                  | 0   | 3    | 9    | 21 | 10   | 10   | 4   | 2   | 59                              |
| Emergency Surgery                  | 0   | 1    | 12   | 18 | 11   | 8    | 4   | 1   | 55                              |
| Wound infection                    | 0   | 2    | 4    | 8  | 10   | 7    | 2   | 2   | 35                              |
| Smoking                            | 0   | 1    | 3    | 7  | 12   | 5    | 3   | 1   | 32                              |
| Diabetes Mellitus                  | 0   | 0    | 3    | 4  | 5    | 4    | 2   | 1   | 19                              |
| Age>60                             | 0   | 1    | 3    | 2  | 5    | 5    | 2   | 2   | 20                              |
| Obesity                            | 0   | 1    | 1    | 7  | 2    | 5    | 3   | 1   | 20                              |
| Chronic obstructive airway disease | 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    | 2    | 0   | 2   | 8                               |

**Table 4:** Types of surgical procedures complicated by incisional hernia in patient population.

| Type of previous surgical intervention (leading to the present hernia) (No.=87) | Number of patients | %          |
|---------------------------------------------------------------------------------|--------------------|------------|
| 1. Cholecystectomy                                                              | 7                  | 8          |
| 2. Liver Hydatid cyst                                                           | 12                 | 13.8       |
| 3. Liver abscess                                                                | 1                  | 1.1        |
| 4. Pyelolithotomy                                                               | 2                  | 2.3        |
| 5. Nephrectomy                                                                  | 1                  | 1.1        |
| 6. Appendectomy                                                                 | 5                  | 5.7        |
| 7. Intestinal obstruction                                                       | 12                 | 13.8       |
| 8. Perforated DU                                                                | 7                  | 8          |
| 9. Anti-ulcer surgery                                                           | 3                  | 3.4        |
| 10. Closure colostomy                                                           | 4                  | 4.6        |
| 11. Abdominal trauma (penetrating or blunt)                                     | 18                 | 20.7       |
| 12. Ovarian tumor                                                               | 1                  | 1.1        |
| 13. Hysterectomy                                                                | 3                  | 3.4        |
| 14. Ectopic pregnancy                                                           | 2                  | 2.3        |
| 15. Caesarian section                                                           | 4                  | 4.6        |
| 16. Splenectomy                                                                 | 1                  | 1.1        |
| 17. Acute abdomen of unknown reason                                             | 4                  | 4.6        |
| <b>Total</b>                                                                    | <b>87</b>          | <b>100</b> |

**Table 5:** Risk factors distribution with emergency presentation of incisional hernia.

| Risk factors                       |              | Total No. | Emergency Presentation No. % |      | P-value   | PR          | 95% CI for PR         |
|------------------------------------|--------------|-----------|------------------------------|------|-----------|-------------|-----------------------|
| Type of incision                   | Vertical     | 59        | 8                            | 13.6 | 0.15[NS]  | 3.8         | 0.5-28.9              |
|                                    | Non-vertical | 28        | 1                            | 3.6  |           |             |                       |
| Type of surgery                    | Emergency    | 55        | 6                            | 9.4  | 0.57[NS]  | 1.2         | 0.3-4.3               |
|                                    | Elective     | 32        | 3                            | 10.9 |           |             |                       |
| Wound infection                    | Yes          | 35        | 4                            | 11.4 | 0.53[NS]  | 1.2         | 0.3-4.1               |
|                                    | No           | 52        | 5                            | 9.6  |           |             |                       |
| Smoking                            | Yes          | 32        | 4                            | 12.5 | 0.44[NS]  | 1.4         | 0.4-4.8               |
|                                    | No           | 55        | 5                            | 9.1  |           |             |                       |
| Obesity                            | Yes          | 20        | 1                            | 5.0  | 0.43[NS]  | 2.4         | 0.3-18                |
|                                    | No           | 67        | 8                            | 11.9 |           |             |                       |
| Age group                          | <60          | 67        | 2                            | 2.6  | <0.001[S] | 11.7        | 2.6-52                |
|                                    | >60          | 20        | 7                            | 35.0 |           |             |                       |
| Diabetes melitus                   | Yes          | 19        | 6                            | 15.8 | 0.31[NS]  | 1.8         | 0.5-6.5               |
|                                    | No           | 68        | 3                            | 8.8  |           |             |                       |
| Chronic obstructive airway disease | Yes          | 16        | 1                            | 6.3  | 0.48[NS]  | 0.6         | 0.1-4.1               |
|                                    | No           | 71        | 8                            | 11.3 |           |             |                       |
| Malignancy                         | Yes          | 12        | 1                            | 8.3  | 0.64[NS]  | 0.8         | 0.1-5.7               |
|                                    | No           | 75        | 8                            | 10.7 |           |             |                       |
| Steroid use                        | Yes          | 8         | 0                            | 0    | 0.40[NS]  | **          | ****                  |
|                                    | No           | 79        | 9                            | 11.4 |           |             |                       |
| Time interval                      | <1yr.        | 37        | 1                            | 2.7  | <0.001[s] | 3.1<br>13.2 | 0.3-28.3<br>1.7-103.4 |
|                                    | 1-5yr.       | 36        | 3                            | 8.3  |           |             |                       |
|                                    | >6yr.        | 14        | 5                            | 35.7 |           |             |                       |
| Size of defect                     | <10cm        | 71        | 5                            | 7.0  | 0.04[s]   | 3.5         | 1.1-11.6              |
|                                    | >10cm        | 16        | 4                            | 25   |           |             |                       |

## Discussion

Emergency presentation of incisional hernia is associated with increasing morbidity and mortality<sup>21, 22, 23, 24, 25, 26</sup>. This may be due in part of shock state, hypoxia, improper resuscitation, prolonged interval between insult & intervention, and may be due to lack of proper sterilization in emergency setup or lack of experience of the surgeon in other part. In this study we notice that delayed presentation for more than one year has a high risk of emergency presentation which is in agreement with what Mark Daveis<sup>27</sup> concludes in his study.

In this study aging plays a role in emergency presentation, as this was agreed with Mark, Ohene & Kulah B<sup>28, 29</sup> (from Turkey).

As most incisional hernia posses wide neck & so less liability to strangulation; but with increase the size of the defect in long standing incisional hernia increase the risk of emergency presentation and strangulation in one or more of the sacules & adhesions of the bowel.

Risk factors for incisional hernias are **vertical incisions** which constitute 67.8% of the present study; this was similar to what was seen by another study done by Fali A. & Yasser A. in the same hospital previously<sup>2</sup>. Grantcharov felt that transverse incisions in abdominal surgery are based on better anatomic and surgical principles than vertical incisions and should be preferred<sup>30</sup>. However, the vertical incision is still the most commonly

performed incision in general surgery. Blomsted et al in a review of 279 Cholecystectomy incisions reported 13.6% incidence of hernia following midline incisions versus 3.6% incidence following oblique sub-costal incision<sup>11</sup>.

In the present study the incisional hernias that are associated with **emergency surgeries** which were performed for acute abdomen cases or abdominal trauma cases were frequent and in the order of 63.2% of the patient population.

Cavit et al observe that incisional hernia rate was to be 12 % in emergency and 4 % in elective laparotomies<sup>31</sup>. Hanif et al reported 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<sup>32, 33, 34</sup>.

**Wound infection & sepsis** is the most important causative factor in over 50% of cases of post operative hernias developing within one year after the operation<sup>33, 35, 36</sup>.

In the present study wound infections were present in 40.2% of all patients. Bucknall et al in their study found incisional hernia in up to 23% of those with post operative wound infection<sup>34</sup>.

Fali A. & Yasser A. found 40% of laparotomies complicated by wound infection develop incisional hernia later on<sup>2</sup>. George & Ellis found a significantly higher number of patients with recurrent incisional hernia after infection<sup>37</sup>. Van der Linden<sup>38</sup> has

statistically support wound infection as a risk factor of recurrence. Adesunkanmi et al found 86.4% of patients developing incisional hernia had wound infection<sup>33</sup>.

**Smoking** was frequent in our patients and constitutes 36.8% of the total in addition it was significantly associated with gender. Sorensen et al in their study found that smokers have four folds higher risk of incisional hernia than nonsmokers and they consider this high incidence to the long follow up<sup>39</sup>.

**Age** is another important risk factor of incisional hernia cases in the present study; it is about 51.6% in the middle age while in advancing age constitutes 25.3% of the total. Bhopal et al in their study of 30 patients with incisional hernia found that the mean age was 42 years<sup>40</sup>. While Mathonnet et al found the mean age was 61.3 years<sup>41</sup>. In the present study it is 48 years.

In the present study **obesity** is present in 23% of the patients. While some references reported as a strong risk factor especially the morbid obesity<sup>42</sup>. Falihi A. & Yasser A. found that 50% of obese patients who sustained laparotomies later develop incisional hernia<sup>2</sup>. Ellis et al found a threefold increase in incisional hernia and recurrence of incisional hernia in obese patients<sup>34</sup>. Other workers dispute obesity as a significant causative factor of incisional hernia, Adesunkanmi et al Devlin & Newsome et al.<sup>33</sup>.

**Diabetes Mellitus** was 21.8 in the present study; Falihi A. & Yasser A were found that diabetes mellitus is a significant risk factor for developing incisional hernia in patients undergoing abdominal surgeries<sup>2</sup>.

**Chronic obstructive airway disease** which includes chronic bronchitis and asthma was noticed in 18.4% of the present study. Falihi A. & Yasser A. noticed a statistically significant relationship between postoperative pulmonary complications and the development of incisional hernia later<sup>2</sup>. Bucknall et al consider it together with cigarette smoking as significant factors<sup>34</sup>.

In the present study **malignancy** was the less frequent risk factor and present in only 13.8% of the patient population. Bucknall T.E. Manninen M.J. & Mudge M. considered it together with malnutrition, uremia, jaundice, steroid use and immunosuppressive therapy as a less significant risk factor for incisional hernia<sup>13, 34, 43</sup>. Anstead G M noticed that delay in the use of **chemotherapeutic drugs** for about 2 weeks post injury appears to lessen the wound healing impairment<sup>44</sup>.

In the present study, patients who were on **steroid therapy** in the first surgery are infrequently present. Greenall et al, Read et al, and Makela et al in their studies considered corticosteroid as patient related risk factor of incisional hernia formation<sup>45,46,47</sup>. Buknall et al linked steroid use as a risk factor for postoperative ventral hernia with: advancing age, diabetes mellitus, cigarette smoking, and obesity<sup>34</sup>.

## Conclusions

- 1-Patients with longstanding incisional hernia & those with age more than 60 years have a higher risk of emergency presentation of incisional hernia in which the surgery may be prolonged and associated with increasing morbidity. So surgery is indicated early.
- 2-Vertical incisions and emergency surgery in the first surgery are more frequent factors that predispose to incisional hernia.
- 3-The presence of multiple risk factors in the first surgery increases the incidence of developing incisional hernia.

## Recommendations

- 1- Early elective repair of incisional hernia is recommended.
- 2- Minimize the use of vertical incision for strict indication.
- 3- Following the correct principle of surgery.
- 4- Special attention is requiring for obese patients and weight reduction is vital prior to surgery is advised especially in emergency and abdominal wall closure by the use of prophylactic antibiotics, avoiding shock state during surgery, non tension technique closure, avoiding dead space, haematoma & seroma by efficient drainage system & the use of non absorbable suture closure leaving the wound opened & using Bagota bag when tension cannot be avoided.

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