

# Risk Factors for Mesh Related Wound Infection after Ventral Hernia Repair Surgery

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**Abstract:**

**Background:** Mesh infection after hernia repair is a devastating complication. Preoperative prediction of high risk patients may be useful to avoid infections. This study aims at evaluating risk factors for mesh related wound infection in our setting.

**Patients and methods:** This prospective cohort analysis study included 120 patients underwent ventral hernioplasty with polypropylene mesh from October 2009 to February 2013 at Baghdad Teaching Hospital. Clinical data analyzed to determine risk factors of mesh related wound infection.

**Results:** After one year follow up for each of 120; 21 patients (17.5%) developed mesh related wound infection. Predictors of infection were: age  $\geq$  45 years, BMI  $\geq$  35 kg/m<sup>2</sup>, diabetes mellitus, past history of previous surgical repair, presence of more than one sac or defect, defect size larger than 5 cm, type of hernia sac content (small bowel), small bowel anastomoses, and increased duration of surgery.

**Conclusion:** Clinical history and examination preoperatively can predict high risk patients to develop postoperative infection.

**Key word:** ventral hernia , mesh ,wound infection.

*J Fac Med Baghdad*  
2015; Vol.57, No .1  
Received Sept. 2014  
Accepted Feb.2015

**Introduction:**

Abdominal hernia repair is one of the most common procedures in general surgery and the implementation of prosthetic meshes has substantially changed the surgical management of abdominal hernias. At first, the use of mesh prostheses was considered by the surgeons reluctantly due to the high rate of complications [1] and, thus, reserved for specific indications. However, the development of synthetic and biologic materials and surgical training has reduced complication rates [2, 3]. Mesh repairs are currently considered the standard technique for hernioplasty and have a lower recurrence rate and shorter length of stay compared to non-mesh repairs [4-9]. The increasing use of meshes in hernia repairs has introduced the potential for mesh-related complications, including seromas, adhesions, migration of the mesh, and mesh infections [1, 3, 10, 11]. Mesh infection after hernia repair is a devastating complication. Reported incidence ranges from 0 (which has been criticized) in some series to 10.2% in others (even 38.9% in complex, contaminated hernioplasties) [3, 12, 13]. Treatment usually requires administration of systemic antibiotics and reoperation for mesh removal that may lead to hernia recurrence and the need for additional operations [11, 14-19].

**Patients and Methods:**

A prospective cohort analysis study including all patients admitted to; Baghdad teaching hospital / 3<sup>rd</sup> surgical unit for open surgical repair of ventral hernia with polypropylene mesh (on lay technique) during the period from October 2009 to

February 2013. (a group of 120 ventral hernia patients managed with mesh repair followed up for one year for each patient during the period of the study for mesh related wound infection) The tool for data collection was a questionnaire form for filling data about:

Personal Characteristics: Age, gender, BMI (Body mass index) and smoking.

Medical History: Diabetes mellitus, COPD(Chronic Obstructive Pulmonary Disease), uremia, anemia, hypertension and previous cancer diagnosis.

ASA (American Society of Anesthesiologists) (Physical Status Classification System) assessment (annex- 2) [20].

Preoperative assessment: Elective or emergency surgery, site of hernia above or below umbilicus (no umbilical hernias were found in our study) and history of previous surgical repair.

Operative findings: Size of hernia defect, number of defects or sacs, sac contents, need for small bowel anastomoses, method of fixation of mesh continuous or interrupted, type of skin suture prolene or silk, method of skin closure subcuticular or mattress, and use of intraperitoneal and subcutaneous drains.

**Results:**

The study sample is composed of 120 patients operated for mesh repair, 21 patients (17.5%) developed mesh related wound infection. This study found a significant association between age and infection; that infection is higher among patients aged 45 years and older ( $P < 0.05$ , table 1). There was no significant association being male or female and having infection ( $P > 0.05$ ). Infection is significantly associated with body habitus of high body mass index (Obesity II or higher) ( $P < 0.05$ , table

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1). This study found there is no significant association between smoking and wound infection ( $P > 0.05$ ).

Concerning associated medical conditions;

Diabetes mellitus showed a significant association with infection ( $P < 0.05$ , table 1).

COPD, uremia, anemia, hypertension, cancer and ASA score had no significant association with mesh related wound infection according to this study ( $P > 0.05$ ).

regarding preoperative surgical factors:

Elective or emergency operations had no significant association with infection ( $P > 0.05$ ).

Site of hernia above or below umbilicus had no significant association with infection ( $P > 0.05$ ).

History of previous surgical repair is significantly associated with infection ( $P < 0.05$ , table 1)

Regarding operative findings:

Presence of more than one defect is also significantly associated with infection ( $P < 0.05$ , table 2). It was significant to find that defect size  $\geq 5$  cm. was associated with mesh infection ( $P < 0.05$ , table 2). There is a significant association between infection and type of contents of the sac that infection increases with presence of small bowel (50%) and less with omentum (15.9%) and preperitoneal fat (11.1%) and less with empty sac (0%) ( $P < 0.05$ , table 2). There was a significant association between small bowel resection and anastomoses and infection ( $P < 0.05$ , table 2). Method of Mesh fixation (continuous or interrupted sutures) had no significant association with infection ( $P > 0.05$ ). Both; type of skin suture and method of skin closure had no significant association with infection ( $P > 0.05$ ). Drains; closed system (Intraperitoneal and subcutaneous) had no significant association with infection ( $P > 0.05$ ). Duration of surgery was significantly longer in infected patients than non-infected patients ( $P < 0.05$ , table 2)

**Table 1: personal characteristics of study sample.**

Variables	Total		Infected		Not		P
	N	N	%	N	%		
Age (year); Mean± SD	45.7±8.3	50.7±8.8	44.6±7.9	0.002			
BMI (kg/m <sup>2</sup> ); Mean± SD	32.4±2.8	35.3±2.9	31.8±2.3	< 0.001			
Diabetes	30	10	33.3	20	66.7	0.008	
Previous Surgical Repair	38	13	34.2	25	65.8	0.001	

**Table 2: Operative characteristics of study sample.**

Variables	Total		Infected		Not		P
	N	N	%	N	%		
<b>Number of Defects</b>							<b>&lt; 0.001</b>
1	107	13	12.1	94	87.9		
> 1	13	8	61.5	5	38.5		
<b>Size of Defect (cm) ; Mean± SD</b>	<b>4.4±0.7</b>	<b>5.1±1.2</b>	<b>4.2±0.4</b>	<b>&lt; 0.001</b>			
<b>Sac Contents</b>							<b>0.014</b>
Empty	4	0	0.0	4	100.0		
Preperitoneal Fat	18	2	11.1	16	88.9		
Omentum	88	14	15.9	74	84.1		
Bowel	10	5	50.0	5	50.0		
Bowel Anastomoses	4	3	75.0	1	25.0	0.017	
<b>Duration of Surgery (minutes); Mean± SD</b>	<b>83.7±14.4</b>	<b>97.6±17.9</b>	<b>80.8±11.7</b>	<b>&lt; 0.001</b>			

**Discussion:**

Wound infection continues to represent a major medical problem and it is of major concern when implants are used [21]. Infection rate in our study was (17.5 %) which is high in comparison to rates found in similar studies with rates varied from 4.8% to 22% by Bueno LJ et al [22], Stermitzer S et al [23], Swenson BR et al [24], Peterson S et al [25], Buckminster Farrow et al [26] and Dimitrios Xourafas et al [27]. Patients aged older than 45 years are more prone to have infection, this is a fact stated in Townsend et al [28], and F. Charles Brunicaudiet al [29] textbooks, and a finding of Stermitzer S. et al [23], Utsumi Met al [30], Cheadle W Get al [31], and Mavros MN, et al [32]. Gender is not a significant association with mesh related infections; this finding goes with Norman S. Williams et al [33] and F. Charles Brunicaudiet al [34] textbooks. It is a finding as well of Bueno LJ et al [22] and Stermitzer S. et al [23] may be due to no physiological differences between them. Infection is significantly associated with Obesity II or higher body habitus according to this study. This is stated in Bueno LJ et al [22], Stermitzer S. et al [23], Townsend et al [28], Cheadle WG et al [31], Mavros MN, et al [32], Norman S. Williams et al [33], F. Charles Brunicaudiet al [34] and Vivian M. Sanchez et al [35] studies. This study found there is no significant association between smoking and mesh related wound infection this finding agreed with Stermitzer S. et al [23]; smoking is a risk factor to this type of infection according to Townsend et al [28], Cheadle WG et al [31], Norman S. Williams et al [33] and F. Charles Brunicaudiet al [34], and this variation could be attributed to sampling error or insufficient sample size. Diabetes showed a significant association with infection this finding agreed with Bueno LJ et al [22], Townsend et al [28], Cheadle WG et al [31], Norman S. Williams et al [33] and F.

Charles Brunicaardi et al<sup>[34]</sup>. While Townsend et al<sup>[28]</sup>, Norman S. Williams et al<sup>[33]</sup>, F. Charles Brunicaardi et al<sup>[34]</sup> and Vivian M. Sanchez et al<sup>[35]</sup> state there is a significant influence of COPD, uremia, anemia, ASA score, and cancer; this study could not verify the true effect of these factors due to insufficient sample size, this is also a common finding with Stermitzer S. et al<sup>[23]</sup>. Elective or emergency operations had no significant association with infection according to this study. This is in common with Bueno LJ et al<sup>[22]</sup>, Dimitrios Xourafas et al<sup>[27]</sup> and Mavros MN, et al<sup>[32]</sup> but differ from and Finan K.R. et al<sup>[38]</sup> who found that emergency surgery is a significant risk factor for mesh related wound infection. Presence of previous surgical repair is significantly associated with infection; this is a finding of this study as well F. Charles Brunicaardi et al<sup>[34]</sup>, Dean T. et al<sup>[36]</sup> and Haridas M. et al<sup>[37]</sup>. Presence of more than one defect is also significantly associated with infection, this agreed with Karan Vir Singh Rana et al<sup>[39]</sup>. It was significant to find that patients with infected wound had larger defect size than non-infected patients. This is a similar finding in Dimitrios Xourafas et al<sup>[27]</sup>, and differs from Stermitzer S. et al<sup>[23]</sup>, and Buckminster Farrow et al<sup>[26]</sup>. Sac contents of small bowel or omentum increase the probability of mesh related wound infection, up to investigators knowledge no previous study mentioned sac contents as a risk factor for mesh related wound infection. Bowel anastomoses according to this study increase infection likelihood, this finding goes with Norman S. Williams et al<sup>[33]</sup> and Finan K.R. et al<sup>[38]</sup>. Intraperitoneal and subcutaneous drains had no significant association with infection this differs from Dimitrios Xourafas et al<sup>[27]</sup> which described them as risk factors for infection. Duration of surgery was significantly longer in infected patients this is a common finding in Bueno LJ et al<sup>[22]</sup>, Stermitzer S. et al<sup>[23]</sup>, Cheadle WG et al<sup>[31]</sup>, Mavros MN, et al<sup>[32]</sup> F. Charles Brunicaardi et al<sup>[34]</sup> and Vivian M. Sanchez et al<sup>[35]</sup>.

### Conclusions:

The main findings of this study is that advanced age, obesity, diabetes mellitus, presence of previous surgical repair, presence of more than one defect, wider defects, and longer duration of surgery, sac contents (small bowel) and bowel anastomoses are risk factors for developing mesh infection after hernioplasty. Clinical history and examination preoperatively can predict high risk patients to develop postoperative infection.

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