

MANAGEMENT OF IRREDUCIBLE HERNIA USING POLYPROPYLENE MESH

By

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ABSTRACT

Background: Incarceration of abdominal wall hernia is a frequent problem. Moreover, using polypropylene mesh in management of acute hernia is infrequently performed.

Objective: To detect the relation between postoperative surgical site infections (SSI) in patients with irreducible abdominal wall hernia using polypropylene mesh in their hernia repair.

Patients and methods: Our study included 30 irreducible abdominal hernia patients even with strangulation and/or obstruction who were managed by polypropylene meshes. This prospective interventional study was conducted at the Department of General Surgery, Al-Zahraa University Hospital from November 2018 to November 2019. All patients, who presented with irreducible, obstructed or strangulated abdominal wall hernias, were included in this study.

Results: Preoperative hernia complications were 66.7% irreducibility only, 3.3% hematoma, 3.3% obstructed, 6.7% strangulated, 20% strangulated obstructed. Presence of toxic fluid in the hernia sac was 23.32%. This study revealed seroma (SSI) in 36.7%. There were significant differences between seroma formation regarding preoperative hernia complications rather than irreducibility ($p=0.013$), presence of toxic fluid in the hernia sac ($p=0.029$). There were high significant relation between seroma (SSI) in cases operated emergency than in cases operated electively ($p<0.001$). Seroma formation was higher in cases with past history of abdominal wall surgery ($p<0.001$).

Conclusion: Seroma formation rates were higher in irreducible strangulated and /or obstructed (urgent cases) hernia repair using polypropylene mesh but controllable, and no deep infection was developed in any case. Therefore, use of polypropylene mesh in acute urgent hernia cases was safe and advisable.

Key words: Irreducible hernia, strangulated hernia, obstructed hernia, surgical site infection.

INTRODUCTION

Hernia is an abnormal extrusion of a viscous or an organ through a defect through the wall of the cavity in which it normally resides (Fitzgibbons *et al.*, 2015). Hernia could be reducible or irreducible. Moreover, irreducible hernias could be obstructed or strangulated hernias or none of them (Onuigbo and Njeze, 2016). High recurrence rates are the most debatable problems in repair of

incarcerated and strangulated hernias without mesh (5–21 %) and high wound infection rates (6–14 %) (Topcu *et al.*, 2013). The rate of surgical site infection (SSI) following hernia repair using mesh ranges from 0% to 14%. In the cases of incarcerated or strangulated hernia repair, the infection rate may reach over 10% (Pandey *et al.*, 2018). In case of incarcerated hernias, there is no blood flow in the viscera in the hernia sac.

Therefore, the outcome of incarcerated bowel is strangulation and necrosis. With prolonged time of necrosis the surgical field presents with cellulitis and is clearly infected (*Liu et al., 2019*). So, classic surgical teaching contraindicates the use of prosthetic repair in the cases of acute incarceration and/or strangulation on the assumption that the use of prosthetics in such situations would be associated with a significantly higher rate of mesh-related complications (*Bessa et al., 2015*). Surgical site infection is the most common complication associated with hernioplasty. Therefore; antibiotic prophylaxis has been used to avoid this complication (*Onuigbo and Njeze, 2016*). There are some studies detected safely use of prosthetic meshes in strangulated acute hernias with acceptable surgical wound infection (*Topcu et al., 2013* and *Pandey et al., 2018*).

The aim of this prospective study was to detect the relation between postoperative surgical site infections (SSI) in patients with irreducible abdominal wall hernia using polypropylene mesh in their hernia repair.

PATIENTS AND METHODS

Study design:

This prospective interventional observational study was conducted in the Department of General Surgery of Al-Zahra University Hospital. Ethical consideration was approved by ethical committee of Al-Azhar Faculty of Medicine (girls) and entailed that: An informed consent was obtained from all participants, Steps, aim of study and potential benefits were discussed and confidentiality of all data were ensured and all patients had the right to withdraw

from the study. The Data collection involving patients was between November 2018 and November 2019.

We included in this study 30 adult patients (> 18 years old) of both genders who had irreducible abdominal wall hernia including strangulated and obstructed hernia cases repaired using polypropylene mesh. However we excluded complicated hernia cases with gangrenous bowel loop which required resection anastomosis or stoma formation. The incidence of wound infection, mesh-associated complications and hernia recurrence were explained to obtain an informed written consent.

Surgical techniques:

In the preoperative period, hematological and radiological investigations were required. Some cases needed abdomen and pelvic X-ray erect and supine, CT abdomen with IV and oral contrast. Comorbidities were controlled preoperatively. Intraoperative, the hernia sac was opened, viable content was reduced. Hot fomentation was applied on strangulated bowel then the viability of the content was reassessed. Strangulated omentum or adherent to the sac was resected with good hemostasis. The content was irrigated by saline 0.9% especially in the presence of toxic fluid or hematoma in the hernia sac. All inguinal hernia cases, polypropylene mesh were positioned on the posterior wall of the inguinal canal (Fig. 3). Tissue repair was obtained in some inguinal hernia operations and mesh plug in others. In femoral hernia surgery, inguinal approach, mesh plug on the femoral ring and mesh sheet on the posterior inguinal canal wall were performed. While in ventral hernias,

the defect was repaired by proline suture 1/0. Polypropylene mesh beyond the defect by 5cm was fixed onlay using proline 0 sutures. Closure of skin by interrupting or subcuticular sutures was performed (Fig. 4). In all cases, Redivac drain was inserted on the mesh (Fig. 4). Parenteral antibiotic therapy was administered 1 hour preoperatively and continued for one day in elective

operations and 3 days in urgent cases. Urgent cases were discharged on day 3 postoperative while the elective cases on day 1 postoperative. Follow up at the outpatient clinic on day 7, 10, 14 and 21 postoperative for postoperative wound evaluation to detect surgical site infection and appropriate dressing and evacuation of seroma in developing cases.



Figure (1): A case of right strangulated inguinal hernia before opening the hernia sac.

Figure (2): Right strangulated inguinal hernia showed hematoma at the mesentery of small intestine.



Figure (3): Right inguinal hernia with mesh position on the posterior wall.

Figure (4): Right inguinal hernia after suction drain insertion and mattress

Statistical analysis:

Data were collected, revised, coded and entered to the Statistical Package for Social Science (IBM SPSS) version 23. The quantitative data were presented as mean, standard deviations and ranges when their distribution found parametric and median with inter-quartile range (IQR) when their distribution found non

parametric. Also qualitative variables were presented as number and percentages. The comparison between groups regarding qualitative data was done by using Chi-square test. The confidence interval was set to 95% and the margin of error accepted was set to 5%. P-value was considered significant when $P\text{-value} < 0.05$.

RESULTS

During the study period, a total of 30 irreducible abdominal wall hernias were operated using polypropylene mesh. 15 female and 15 male patients represented 50% each. The age ranged from 36-74 years. 10(33.3%) cases were ideal body weight, 18(60%) overweight and 2(6.7%)

were morbid obese. 11(36.7%) cases had Comorbidities included diabetes mellitus (DM) (6(20%), hypertension (HTN) 5(16.7%), ischemic heart disease (IHD) 3(10%), heart failure (HF) 1(33.3%) and chronic obstructive pulmonary disease (COPD) 1(33.3%) (**Table1**).

Table (1): Patients' demographic data

Parameters		Total	No. = 30	
Age	Mean \pm SD		49.57 \pm 9.35	
	Range		36 – 74	
			Total	
			NO.	%
Sex	Females	15	15	50.0%
	Males	15	15	50.0%
BMI	Ideal	10	10	33.3%
	Over weight	18	18	60.0%
	Morbid obese	2	2	6.7%
Co-morbidities	Negatives	19	19	63.3%
	Positive	11	11	36.7%
COPD	Negatives	29	29	96.7%
	Positive	1	1	3.3%
HF	Negatives	29	29	96.7%
	Positive	1	1	3.3%
HTN	Negatives	25	25	83.3%
	Positive	5	5	16.7%
DM	Negatives	24	24	80.0%
	Positive	6	6	20.0%
IHD	Negatives	27	27	90.0%
	Positive	3	3	10.0%

30 cases of irreducible abdominal wall hernia were (7 inguinal (4 right and 3 left), 2 femoral hernia, 2 incisional, 2 epigastric, 16 para-umbilical, 1 para-umbilical and epigastric). Past history of

previous abdominal surgery was present in 10 (33.3%) including 6 recurrent cases. Hernia duration in all cases ranged from 6-36 months (**Table 2**).

Table (2): History regarding hernia and previous abdominal surgeries and hernia type

Parameters		Total	No. (%)
Past history of previous abdominal surgery	No		20 (66.7%)
	Yes		10 (33.3%)
Recurrent	No		24 (80.0%)
	Yes		6 (20.0%)
Hernia duration (months)	Median (IQR)		30 (6 - 36)
	Range		2 – 120
Hernia type	ISH		3 (10.0%)
	PUH		16 (53.3%)
	Indirect IH		4 (13.3%)
	Incsional		2 (6.7%)
	EH		2 (6.7%)
	FH		2 (6.7%)
	PUH+EH		1 (3.3%)

Preoperative hernia complications were 20 (36.7%) irreducible only, 1 (3.3%) irreducible with hematoma, 1 (3.23%) irreducible with intestinal obstruction only, 2 (6.7%) irreducible with strangulated contents only, and 6 (20%)

irreducible with obstructed and strangulated contents. 18 (60%) of hernias contained omentum, 4 (13.3%) contained bowel loops, while 8 (26.7%) contained both omentum and bowel loops (**Table 3**).

Table (3): Preoperative hernia condition and its contents

Parameters		Total	No.	%
Preoperative hernia complications with irreducibility	No		20	66.7%
	Hematoma		1	3.3%
	Obstruction		1	3.3%
	Strangulation		2	6.7%
	Obstruction and strangulation		6	20.0%
Content	Omentum		18	60.0%
	Intestine		4	13.3%
	Omentum and intestine		8	26.7%

Toxic fluid in the hernia sac existed in 7 cases (23.32%) which were detected by superficial ultrasound preoperatively, 10

(33.3%) cases were operated emergency and 20 (66.7%) cases were operated electively (**Table 4**).

Table (4): Presence of toxic fluid and emergency and elective cases

Parameters	Total	No.	%
Toxic fluid		7	23.3%
Emergency		10	33.3%
Elective		20	66.7%

11(36.7%) cases developed seroma, 8/11 (72.7%) emergent cases, 3/11 (27.3%) elective cases. No other postoperative wound complications were found such as pus formation, wound dehiscence or mesh rejection. The study revealed that there were highly

statistically significant differences between seroma groups regarding cases operated emergency or electively ($p < 0.001$) for each and in the presence of toxic fluid in the hernia sac ($p = 0.029$) (Table 5).

Table (5): Relation between postoperative wound complications (seroma) regarding toxic fluid, emergency and elective cases and preoperative hernia complications

Complications		No Post-operative wound complications group		Post-operative wound complications group		P-value
		No.	%	No.	%	
Toxic fluid	No	17	89.5%	6	54.5%	0.029
	Yes	2	10.5%	5	45.5%	
Emergency	No	17	89.5%	3	27.3%	< 0.001
	Yes	2	10.5%	8	72.7%	
Elective	No	2	10.5%	8	72.7%	< 0.001
	Yes	17	89.5%	3	27.3%	

There was statistically significant difference between post-operative wound complication (seroma) groups regarding, preoperative hernia complications rather than irreducibility ($p = 0.013$) and highly

statistically significant difference between postoperative wound complication regarding past history of previous abdominal surgery ($p = 0.001$) and hospitalization time ($p = 0.002$) (Table 6).

Table (6): Relation between postoperative wound complications (seroma) regarding preoperative hernia complications with irreducibility, past history of previous abdominal surgery and hospitalization time

Complications		No Post-operative complications group		Post-operative complications group		P-value
		No.	%	No.	%	
Preoperative hernia complications with irreducibility	No	16	84.2%	4	36.4%	0.013
	Hematoma	1	5.3%	0	0.0%	
	Obstruction	1	5.3%	0	0.0%	
	Strangulation	0	0.0%	2	18.2%	
	Obstruction and strangulation	1	5.3%	5	45.5%	
Past history of previous abdominal surgery	No	18	94.74%	2	18.2%	< 0.001
	Yes	1	5.26%	9	81.8%	
Hospitalization time (day)	Median (IQR)	1 (1 - 1)		3 (1 - 4)		0.002
	Range	1 - 5		1 - 7		
	Range	10 - 21		14 - 21		

Whereas, there was no statistically significant differences between seroma formation regarding the following age ($p = 0.944$), sex ($p = 0.256$) and BMI

($p = 0.155$) (Table 7) comorbidities ($p = 0.447$) including (COPD ($p = 0.439$), HF ($p = 0.439$), HTN ($p = 0.865$), DM ($p = 0.850$) and IHD ($p = 0.256$)) (Table 8),

HB (p=0.261) and TLC level (p=0.199), hernia duration (p=0.273), recurrent hernias (p=0.256) and hernia type (p=0.85), hernia contents (p=0.82), time of drain removal (p=0.164) (Table 9).

Table (7): Relation between postoperative wound complications (seroma) regarding age, sex and BMI

Complications Parameters		No Post-operative wound complications group	Post-operative wound complications group	P-value
		No. =19	No. = 11	
Age	Mean ± D	49.47 ± 6.95	49.73 ± 12.91	0.944
	Range	37 – 62	36 – 74	
Sex	Females	8 (42.1%)	7 (63.6%)	0.256
	Males	11 (57.9%)	4 (36.4%)	
BMI	Ideal	7 (36.8%)	3 (27.3%)	0.155
	Over weight	12 (63.2%)	6 (54.5%)	
	Morbid obese	0 (0.0%)	2 (18.2%)	

Table (8): Relation between postoperative wound complications (seroma) regarding comorbidities and COPD, HF, HTN, DM and IHD

Complications Parameters		No Post-operative complications group		Post-operative complications group		P-value
		No.	%	No.	%	
Co-morbidities	Negative	13	68.4%	6	54.5%	0.447
	Positive	6	31.6%	5	45.5%	
COPD	Negative	18	94.7%	11	100.0%	0.439
	Positive	1	5.3%	0	0.0%	
HF	Negative	18	94.7%	11	100.0%	0.439
	Positive	1	5.3%	0	0.0%	
HTN	Negative	16	84.2%	9	81.8%	0.865
	Positive	3	15.8%	2	18.2%	
DM	Negative	15	78.9%	9	81.8%	0.850
	Positive	4	21.1%	2	18.2%	
IHD	Negative	18	94.7%	9	81.8%	0.256
	Positive	1	5.3%	2	18.2%	

Table (9): Relation between postoperative wound complications (seroma) regarding Hb, TLC, recurrent hernia cases, hernia duration, hernia type and hernia content

Parameters \ Complications		No Post-operative complications group	Post-operative complications group	P-value
		No. = 19	No. = 11	
Hb	Mean \pm D	13.53 \pm 1.81	12.64 \pm 2.42	0.261
	Range	11 – 17	9 – 17	
TLC	Mean \pm D	7.36 \pm 2.68	8.69 \pm 2.57	0.199
	Range	4 – 13.6	6 – 14.9	
Recurrent	No	14 (73.7%)	10 (90.9%)	0.256
	Yes	5 (26.3%)	1 (9.1%)	
Hernia duration (months)	Median (IQR)	24 (6 - 36)	36 (24 – 60)	0.273
	Range	2 – 84	2 – 120	
Hernia type	ISH	2 (10.5%)	1 (9.1%)	0.853
	PUH	9 (47.4%)	7 (63.6%)	
	Indirect IH	3 (15.8%)	1 (9.1%)	
	Incisional	2 (10.5%)	0 (0.0%)	
	EH	1 (5.3%)	1 (9.1%)	
	FH	1 (5.3%)	1 (9.1%)	
	PUH+EH	1 (5.3%)	0 (0.0%)	
Content	Omentum	12 (63.2%)	6 (54.5%)	0.821
	Intestine	2 (10.5%)	2 (18.2%)	
	Omentum and intestine	5 (26.3%)	3 (27.3%)	

DISCUSSION

According to the Center for Disease Control and Prevention (CDC) classification of surgical wound, incarcerated irreducible hernias were considered as class I (clean), strangulated hernias with no bowel resection as class II (clean contaminated), but with bowel resection as class III (contaminated) (Emile *et al.*, 2017). The presence of strangulation restricted the use of mesh (Tulloh and Nixon 2018). However, there are some studies used synthetic non-absorbable meshes in clean-contaminated and others in dirty contaminated fields (Topcu *et al.*, 2013) and (Pandey *et al.*, 2018). Our study showed all wound types were class 1 and class 2.

Nieuwenhuizen *et al.* (2011) showed in the univariate analysis, significant rates of

wound infection in female patients, overweight patients and patients with umbilical hernias. Matsumoto *et al.* (2018) showed that no significant difference in seroma formation regarding hernia anatomy. Pandey *et al.* (2018) reported that there were no significant relations between SSI (either wound infection or seroma) regarding hemoglobin level or TLC level. Tatar *et al.* (2016) reported that the SSI occurred more frequently in patients with comorbidities.

This study found a significant relation between seroma formation and previous abdominal wall surgery including recurrent cases. Adhesions through the anterior abdominal wall prolongs the time of operation which increases the risk of seroma development.

Venara et al. (2014) reported that there was no significant relation between SSI and hernia content (omentum or small intestine).

Dai et al. (2014) detected that there was no significant relation between incisional complication and history of abdominal wall surgery.

Cheng et al. (2017) showed that pooled analyses in general surgery sub-group, reported a statistically significant association between operative time and SSI. *Loftus et al. (2017)* found SSI rates were significantly higher in patients who had CT evidence of fluid in the hernia sac. *Matsumoto et al. (2018)* found the relation between strangulated hernia and seroma group was significantly high.

CONCLUSION and RECOMMENDATIONS

Seroma formation was higher in irreducible strangulated and obstructed hernia repair using polypropylene mesh but with acceptable wound infection. Therefore, the use of polypropylene mesh in acute incarcerated and /or strangulated hernia cases was safe and advisable.

CONFLICTS OF INTEREST

The authors declare that there were no conflicts of interest regarding the publication of this paper.

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علاج الفتق الغير مرتجع باستخدام شبكة البولوي بروبيلين

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خلفية البحث: الفتق الغير مرتجع له مضاعفات متكررة وشائعة ومع ذلك فإن استخدام شبكة البولوي بروبيلين في هذه الحالات غير شائع.

الهدف من البحث: تقييم حالات العدوى للجرح ما بعد جراحة إصلاح الفتق وتركيب شبكة البولوي بروبيلين في حالات الفتق الغير مرتجع بجدار البطن.

المرضى و طرق البحث: شملت الدراسة ثلاثين حالة يعانون من فتق غير مرتجع بجدار البطن وبعض من هذه الحالات لديهم اختناق او انسداد بالأمعاء مع عدم ارتجاع الفتق وتم استخدام شبكة البولوي بروبيلين عند اجراء الجراحة لهم. وتمت هذه الدراسة بقسم الجراحة العامة بمستشفى الزهراء الجامعي في الفترة من نوفمبر 2018 الى نوفمبر 2019.

نتائج البحث: كانت هناك دلالة احصائية عالية في وجود عدوى ما بعد الجراحة (أحد عشر حالة) بين حالات الفتق الغير مرتجع والمصابة بمضاعفات اخرى قبل الجراحة مثل الاختناق و الانسداد المعوي والتي تم اجراؤها كحالات طوارئ، كما وجد دلالة إحصائية عالية في الحالات المصابة لوجود سائل بكيس الفتق والحالات التي لديها تاريخ مرضي بجراحة سابقة بجدار البطن.

الاستنتاج: ينصح باستخدام شبكة البولوي بروبيلين في حالات الفتق الغير مرتجع بطريقة آمنة.