

## Role of Abdominal Drain Post Open Appendectomy for Perforated Appendicitis Among acute appendicitis patients admitted to surgical ward in Al-Thawra Modern General Hospital and Al-Kuwait University Hospital from march 2022 to march 2023

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**Abstract:** Background : Acute appendicitis is the most common cause of surgical acute abdomen. Perforation of appendicitis is associated with increase risk of postoperative complications and mortality. Routine peritoneal drainage after appendectomy for perforated appendicitis remains a topic of debate. Objectives: To evaluate the benefit of abdominal drainage post open appendectomy for perforated appendicitis and to study the impact of abdominal drainage on post-operative complications and on length of hospital stay. Methods: A cross-sectional, observational, prospective study was conducted among 85 Patients with perforated appendicitis who underwent open appendectomy Al-Thawra Modern General Hospital and Al-Kuwait University Hospital in Sana'a city from March 2022 to March 2023..Data was analyzed using the statistic package SPSS 23. Results: 85 patients were classified into two groups based on intra-operative insertion of abdominal drainage. There were 50 patients in the drain group compared to 35 patients in the no-drain group. In both groups, majority of patients were male. Most of patients in both groups were in the age group (11-25 years). The main complain of patients was pain, which started around umbilicus, then shifted to right iliac fossa. All patients in both group had tenderness in right iliac fossa. Fever and rebound tenderness were prominent signs in both groups. Leukocytosis was present in 68 % of patients in the drain group compared to 80% in the no drain group. Most of patients in both groups had longer duration of symptoms for three days and more. The tip of appendix was the most common site of perforation in both groups. Surgical site infection occurred in 5 patients (10%) in the drain group compared to 2 patients (5.7%) in the no-drain group. Intra-abdominal abscess occurred in one patient in each the drain group and the no-drain group. Postoperative ileus occurred in one patient in the drain group compared to no patients in the no-drain group.

**Keywords:** Perforated appendicitis, Abdominal drainage, Intra-abdominal abscess.

### دور أنبوب التصريف الجراحي بعد عملية استئصال الزائدة الدودية في حالات التهاب الزائدة الدودية المثقوبة

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**المستخلص:** الخلفية: التهاب الزائدة الدودية الحاد هو السبب الأكثر شيوعاً لحالات البطن الحادة الجراحية. يرتبط التهاب الزائدة بزيادة خطر حدوث مضاعفات ما بعد الجراحة والوفيات. لا يزال التصريف البريتوني الروتيني بعد استئصال الزائدة الدودية في حالة التهاب الزائدة الدودية المثقوبة موضوعاً للنقاش. الأهداف: تقييم فائدة التصريف البطني بعد استئصال الزائدة الدودية المفتوحة لالتهاب الزائدة الدودية المثقوبة ودراسة تأثير التصريف البطني على مضاعفات ما بعد الجراحة وعلى طول مدة الإقامة في المستشفى.

الطرق: تم إجراء دراسة استطلاعية مقطعية على 85 مريضاً يعانون من التهاب الزائدة الدودية المثقوبة الذين خضعوا لعملية استئصال الزائدة الدودية المفتوحة في مستشفى الثورة العام النموذجي ومستشفى الكويت الجامعي في مدينة صنعاء في الفترة من مارس 2022 إلى مارس 2023. تم جمع البيانات وتم تحليلها باستخدام الحزمة الإحصائية SPSS 23. النتائج: تم تصنيف 85 مريضاً إلى مجموعتين على أساس إدخال التصريف البطني أثناء العملية. كان هناك 50 مريضاً في مجموعة التصريف مقارنة بـ 35 مريضاً في مجموعة عدم التصريف. وفي كلا المجموعتين، كانت غالبية المرضى من الذكور. معظم المرضى في كلا المجموعتين كانوا في الفئة العمرية (11-25 سنة). كانت الشكوى الرئيسية للمرضى هي الألم الذي يبدأ حول السرة ثم ينتقل إلى الحفرة الحرقفية اليمنى. جميع المرضى في كلا المجموعتين كان لديهم ألم في الحفرة الحرقفية اليمنى. وكانت الحمى والألم المرتد علامات بارزة في كلا المجموعتين. كانت زيادة عدد الكريات البيضاء موجودة في 68% من المرضى في مجموعة التصريف مقارنة بـ 80% في مجموعة عدم التصريف. كان لدى معظم المرضى في كلا المجموعتين مدة أطول من الأعراض لمدة ثلاثة أيام وأكثر. وكان رأس الزائدة الدودية هو الموقع الأكثر شيوعاً للانتفاخ في كلا المجموعتين. حدثت عدوى في الموقع الجراحي لدى 5 مرضى (10%) في مجموعة التصريف مقارنة بمرضى (5.7%) في مجموعة عدم التصريف. حدث شلل الأمعاء بعد العملية الجراحية لدى مريض واحد في كل من مجموعة التصريف ومجموعة عدم التصريف. حدث شلل الأمعاء بعد العملية الجراحية لدى مريض واحد في مجموعة التصريف مقارنة بعدم وجود مرضى في مجموعة عدم التصريف.

**الكلمات المفتاحية:** التهاب الزائدة الدودية الحادة، التهاب الزائدة المثقوبة، أنبوب التصريف البريتوني.

## Introduction

Acute appendicitis is the most common cause of surgical acute abdomen and appendectomy is considered the most common emergency operation performed worldwide (Sandell et al., 2015).

The life-time risk of acute appendicitis reaches approximately 7-8% (Sartelli et al., 2018). Open appendectomy was first introduced in 1887 by George Thomas Martin and in 1889 by Charles McBurney. Laparoscopic appendectomy was described in 1983 by Kurt Semm and it is now performed for the majority of cases (Cosse et al., 2014).

Mortality rate after appendectomy can range from 0.07 to 0.7% and can reach to 0.5 to 2.4% in patients with perforation (Sartelli et al., 2018). Overall postoperative complication rates ranged between 10 and 19% for uncomplicated Acute Appendicitis and rise to 30% in cases of complicated Acute Appendicitis (Margenthaler et al., 2013).

Perforation of appendicitis is associated with postoperative complications such as intra-abdominal abscess formation, which has been reported to have an incidence as high as 18% in perforated appendicitis with 1–2% after non-perforated appendicitis (Sartelli et al., 2018).

The impact of an abscess on patient outcome is tremendous and directly increases hospital stay and hospital costs. Therefore, prevention of intra-abdominal abscesses after appendectomy is of major importance. Placement of abdominal drains is one of the surgical choices to prevent such complication. In fact, it remains a common practice that is performed by some surgeons especially in cases of perforated appendicitis, in which the gross amount of intra-abdominal spillage is noted.

Routine peritoneal drainage after appendectomy in case of perforated appendicitis remains a topic of debate about whether a prophylactic peritoneal drain is necessary and whether it leads to a better outcome with reduced postoperative complications.

Multiple studies have questioned its benefit and recommended against the use of abdominal drain post complicated appendicitis and found that it led to more complications while other studies found benefits of its use and recommended such practice (Schmidt et al., 2020).

## Study Justification

The challenge of management of perforated appendicitis lies in reducing post-operative morbidity and mortality. The impact of post-operative complications on patient's outcome is tremendous. Therefore, prevention of these complications after appendectomy is of major importance. Placement of abdominal drains is one of the surgical choices to prevent such complications and is a common practice performed by some surgeons. However, this approach is still questionable whether it leads to a better outcome with reduced postoperative complications or worse outcome with increased complications. Our study is intended to answer this question by evaluating the management of perforated appendicitis in Yemeni patients with focus on peritoneal drains and their effects in our set up.

## Objectives

### General Objective

To evaluate the benefit of abdominal drainage post open appendectomy for perforated appendicitis in patients admitted at Al-Thawra Modern General Hospital and Al-Kuwait University Hospital.

### Specific Objectives

The study was conducted to :

1. Study the impact of abdominal drainage on post-operative complications.
2. Determine incidence of post-operative complications
3. Determine the the relationship between the abdominal drainage and the patient's length of stay in the hospital

## Methodology

### Study design

Cross sectional prospective study

### Study population , site and duration

Patients with perforated appendicitis who underwent open appendectomy at Al-Thawra Modern General Hospital and Al-Kuwait University Hospital in Sana'a city from March 2022 to March 2023

### Sample size

All patients who were admitted to the hospital during this period from March 2022 to March 2023 and who fulfill the inclusion criteria. The total number of patients was 85 patients.

### Inclusion criteria

Patients who underwent open appendectomy and diagnosed as perforated appendicitis identified during operation.

### Exclusion criteria

1. Patients with normal appendix at operation
2. Patients with uncomplicated appendicitis
3. Patient with perforated appendicitis with diffuse peritonitis
4. Patients with appendicular mass or appendicular tumor
5. Patients who needed conversion to laparotomy or bowel resection and anastomosis

### Data collection

Data was collected from all patients and their files in predesigned questionnaire, and consents were obtained from patients. Data collected included personal data (i.e age, sex, co-morbidity), clinical Presentation (i.e Abdominal pain, Vomiting , Nausea, Anorexia, Fever), examination findings (i.e Right iliac fossa tenderness, Rebound tenderness, Diffuse tenderness, Rigidity), investigation findings (i.e CBC , Ultrasounds) , procedures performed ( i.e Simple ligation, Purse string, Interrupted cecal suturing, Drain placement), post-operative complications (i.e Post-operative ileus, Intra-abdominal abscess collection, Surgical site infection ) and Total length of hospital stay. Patients were followed up for one month for any symptoms or signs of post-operative complications and control abdominal ultrasonography was obtained in all patients to confirm the presence or absence of intra-abdominal abscess collection.

### Data analysis:

The data was entered and analyzed using the statistic package for social science SPSS version 23 and presented using tables and graphs (Pie charts and Bar charts). Qualitative variables were expressed as frequency and percentage. Quantitative variables were expressed as mean and standard deviation (SD) as the data was normally distributed. Chi-square, Chi-square with Yate correction and Fisher's exact tests were used to show the significance of association between data variables. Independent T-test was used to determine the difference in mean score between the groups for the normally distributed quantitative variables. P- Value of less than 0.05 was considered statistically significant.

### Ethical Approval

An ethical approval was obtained from a locally recognized committee, the Yemeni board for medical specializations. Written consent in Arabic was obtained from each patient confirming his/her agreement to be enrolled in registry. Patients 'name or identity was not identified in any shape or form in any of the publications or presentations that arise from this registry.

## Results

### Distribution of patients according to sex

The study was conducted among 85 Patients with perforated appendicitis who underwent open appendectomy at Al-Thawra Modern General Hospital and Al-Kuwait University Hospital in Sana'a city. Patients were classified into two groups based on intra-operative insertion of abdominal drainage. There were 50 patients in the drain group compared to 35 patients in the no-drain

group. In the drain group, 31 patients (62%) were male and 19 patients (38%) were female while in the no-drain group, 25 patients (71.4%) were male and 10 (28.6%) were female as shown in table (1)

**Table (1): Distribution of patients according to sex**

Variables	Drain group		Non- drain		
	N	%	N	%	
<b>Total number</b>	50		35		
<b>Gender</b>	<b>Male</b>	31	62	25	71.4
	<b>Female</b>	19	38	10	28.6

#### Distribution of patients according to age

The mean age of patients in the drain group was 27 years with a standard deviation of 13.6 years compared to mean age in the no-drain group of 25 years with standard deviation of 11.4 years. 20 patients (40%) in the drain group were in the age group (11-25 years) followed by 13 patients (36%) in the age group (26-40 years) and 5 patients (10%) in the age group (less than 10 years). In the no-drain group, 18 patients (51%) were in the age group (11-25 years) followed by 12 patients (34.3%) in the age group (26-40 years) and 2 patients (5.7 %) in the age group (41-55 years) and the age group less than 10 years as shown in table (2) .

**Table (2): Distribution of patients according to age**

Variables	Drain group		Non- drain		
<b>Total number</b>	50		35		
<b>Minimum age</b>	6		9		
<b>Maximum age</b>	62		56		
<b>Mean age</b>	27		25		
<b>Standard Deviation</b>	13.6		11.4		
<b>Age groups in years</b>		N	%	N	%
	<b>Less than 10 years</b>	5	10%	2	5.7%
	<b>11-25</b>	20	40%	18	51%
	<b>26-40</b>	18	36%	12	34.3%
	<b>41-55</b>	4	8%	2	5.7%
	<b>&gt; 55 years</b>	3	6%	1	2.9%

#### Distribution of patients according to clinical presentation

37 patients (74%) in the drain group presented with pain which started around umbilicus then shifted to right iliac fossa and 13 patients (26 %) presented with pain localized to right iliac fossa. In the no-drain group, 27 patients (77.1%) presented with shifting pain and 8 patients (22.9%) presented with localized pain to right iliac fossa.

In the drain group, 45 patients (90%) had fever, 37 patients (74%) had nausea, 17 patients (34%) had vomiting, 39 patients (78%) had anorexia. In the no-drain group, 30 patients (85.7%) had fever, 28 patients (80%) had nausea, 7 patients (20%) had vomiting and 30 patients (85.7%) had anorexia.

On examination, 50 patients (100%) in the drain group had tenderness in right iliac fossa and 42 patients (84%) had rebound tenderness. In the no-drain group, 35 patients (100%) had tenderness in right iliac fossa and 33 patients (94.3%) had rebound tenderness.

34 patients (68%) in the drain group had leukocytosis, 37 patients (74%) had neutrophilia and 29 patients (58%) had sonographic findings of perforation of appendix. In the no-drain group, 28 patients (80%) had leukocytosis, 30 patients (85.7%) had neutrophilia and 26 patients (74.3%) had sonographic findings of perforation. Table (3) shows the clinical and para-clinical findings of patients in both groups.

**Table (3): Distribution of patients according to clinical presentation**

Variables	Drain group		Non- drain	
	N	%	N	%
Shifting pain	37	74	27	77.1
Localized pain to RIF	13	26	8	22.9
Fever	45	90	30	85.7
Nausea	37	74	28	80
Vomiting	17	34	7	20
Anorexia	39	78	30	85.7
Tenderness in RIF	50	100	35	100
Rebound tenderness	42	84	33	94.3
Leukocytosis > $10 \times 10^3$	34	68	28	80
Neutrophilia > 70%	37	74	30	85.7
US supporting perforation	29	58	26	74.3

**Distribution of patients according to duration of symptoms**

The mean duration of symptoms before presenting to hospital was 4.3 days with standard deviation of 1.6 days in the drain group and 4.75 days with standard deviation 1.2 days in the no drain group.

Most of patients in both groups had longer duration of symptoms more than three days. 33 patients (66%) in the drain group and 25 patients (71.4%) in the no-drain group had duration of symptoms for three days and more while 17 patients (34%) in the drain group and 10 patients (28.6%) in the no-drain group had duration of symptoms less than three days as shown in table (4).

**Table (4): Distribution of patients according to duration of symptoms**

Variables	Drain group		Non- drain		
	N	%	N	%	
Minimum duration	1		1		
Maximum duration	7		6		
Mean	4.30		4.75		
Standard Deviation	1.6		1.2		
Duration of symptoms					
	< 3 days	17	34	10	28.6
	≥ 3 days	33	66	25	71.4

**Distribution of patients according to site of appendix perforation**

The tip of appendix was the most common site of perforation in both groups accounted for 27 patients (54%) in the drain group compared to 22 patients (62.9%) in the no-drain group. Perforation in the middle part was found in 18 patients (36%) in the drain group compared to 11 patients (34.3%) in the no-drain group. 5 patients (10%) in the drain group had appendix perforation at the base compared to 2 patients (5.7%) in the no-drain group as shown in table (5).

**Table (5): Distribution of patients according to site of appendix perforation**

Variables	Drain group		Non- drain	
	N	%	N	%
<b>Site of perforation</b>				
Tip of appendix	27	54	22	62.9
Mid part of appendix	18	36	11	31.4
Base of appendix	5	10	2	5.7

**Distribution of patients according to operative procedure**

Simple appendectomy with base ligation was performed 47 patients (94%) in the drain group compared to 35 patients (100%) in the no-drain group. Purse string around appendicular stump was performed in 20 patients (40%) in the drain group compared to 12 patients (34.3%) in the no-drain group. 3 patients (6%) in the drain group had interrupted cecal sutures as shown in table (6).

**Table (6): Distribution of patients according to operative procedures**

Variables	Drain group		Non- drain	
	N	%	N	%
<b>procedure</b>				
Simple appendectomy with base ligation	47	94	35	100
Purse string	20	40	12	34.3
Interrupted cecal sutures	3	6	0	0

**Distribution of patients according to complications****Table (7): Distribution of patients according to complications**

Variables	Drain group		Non- drain		P-value
	N	%	N	%	
<b>Complications</b>					
Surgical site infection	5	10	2	5.7	0.261
Intra-abdominal abscess	1	2	1	2.9	0.375
Postoperative ileus	1	2	0	0	0.145
<b>Total complications rate</b>	<b>7</b>	<b>14</b>	<b>3</b>	<b>8.6</b>	<b>0.116</b>

Surgical site infection occurred in 5 patients (10%) in the drain group compared to 2 patients (5.7%) in the no-drain group. Intra-abdominal abscess occurred in 1 patients (2%) in the drain group compared to 1 patient (2.9%) in the no-drain group which was not statically significant between both groups with p-value = 0.375. One patient only developed postoperative ileus which was in the drain group only. No fecal fistula or mortality occurred in both study groups. Total complication rate was 14% in the drain group compared to 8.6% in the no drain group as shown in table (7).

**Distribution of patients according to length of hospital stay**

The minimum hospital stay was two days in the drain group compared to one day in the no-drain group. The maximum hospital stay was eight days in the drain group compared to five days in the no-drain group. The mean length of hospital stay of patients in the drain group was 5 days with a standard deviation of 2.4 days compared to mean length of hospital stay in the no-drain group of 3 days with standard deviation of 1.6. 18 patients (36%) in the drain group had hospital stay of three or less than three days compared to 27 patients (77.1%) in the no-drain group while 32 patients (64%) in the drain group had hospital stay of more than three days compared to 7 patients (20%) in the no-drain group which was statically significant with p-value = 0.025 as shown in table (8).

**Table (8): Distribution of patients according to length of hospital stay**

Variables	Drain group		Non- drain		P-value	
Minimum length	2		1		0.142	
Maximum length	8		5			
Mean	5		3			
Standard Deviation	2.4		1.6			
length of hospital stay		N	%	N	%	0.025
	≤ 3 days	18	36%	27	77.1	
	> 3days	32	64%	7	20	

## Discussion

The study was conducted among 85 Patients with perforated appendicitis who underwent open appendectomy at Al-Thawra Modern General Hospital and Al-Kuwait University Hospital in Sana'a city. Patients were classified into two groups based on intra-operative insertion of abdominal drainage. There were 50 patients in the drain group compared to 35 patients in the no-drain group. There were no significant differences between both groups in terms of age, sex, and clinical presentations.

Our study showed that most patients with perforated appendicitis in both groups had longer duration of symptoms more than three days. 33 patients (66%) in the drain group and 25 patients (71.4%) in the no-drain group had duration of symptoms for three days and more. The mean duration of symptoms before presenting to hospital was 4.3 days in the drain group and 4.75 in the no drain group.

This finding was consistent with previous belief that delayed presentation to hospital with delayed in early and proper diagnosis and management of acute appendicitis is one of the important cause of complicated appendicitis including perforation.

Similar findings were reported in previous studies such as Kidwai et al. which reported that median time of presentation to the hospital after the onset of symptoms in patients who had perforated appendicitis was (6.47±2.13) days and ranged between 3 to 10 days (Kidwai et al., 2018). Papandria et al. also reported that greater delay before appendectomy was associated with increased perforation risk (Papandria et al., 2013).

The tip of appendix was the most common site of perforation in both groups accounted for 27 patients (54%) in the drain group compared to 22 patients (62.9%) in the no-drain group. This was similar to multiple previous studies which showed that the tip of appendix is the most common site of perforation of appendix (Kidwai et al., 2018)

Our study showed that surgical site infection was more common among patients in the drain group which occurred in 5 patients (10%) compared to 2 patients (5.7%) in the no-drain group. This can be justified that drains require frequent handling during dressing, emptying of drain bags and mobilization of patients which may enhance contamination of wounds. Drains also provoke inflammatory reactions which encourage infections specially in the presence of gut contaminants in perforated appendicitis. However these findings were not statically significant with p-value= 0.261.

Multiple previous studies showed similar findings compared to our study. Beek et al, Schmidt et al. and Abdulhamid et al. showed no significant differences between both groups (drainage and non-drainage groups) in terms of development of post-operative wound infection (Beek et al., 2015; Abdulhamid et al., 2018; Schmidt et al., 2020)

One patients in both the drain group and the no-drain group had intra-abdominal abscess and no statically significant differences regarding the incidence of intra-abdominal abscess formation was found between both groups with p-value = 0.375. This was similar to previous study performed by Beek et al. which showed that even intra-abdominal abscess incidence was reduced among patients in the drain group, no statically significant difference was observed between both groups (Beek et al., 2015).

Schmidt et al. also showed that there were no statistically significant differences between the groups in the rate of intra-abdominal abscess formation (Schmidt et al., 2020).

Our study showed that 36% of patients in the drain group had hospital stay of three or less than three days compared 77.1% of patients in the no-drain group however 64% of patients in the drain group had hospital stay of more than three days compared to 20% of patients in the no-drain group which was statically significant with p-value = 0.025.

Our study showed that the mean length of hospital stay was increased among patients in the drain group which was 5 days with a standard deviation of 2.4 days compared to mean length of hospital stay in the no-drain group of 3 days with standard deviation of 1.6 days. This increase in length of hospital stay in the drain group can be justified that surgeons usually tend to follow up drain output in a daily basis and some tend to obtain control ultrasonography to confirm that no residual fluid collection was left intra-abdominal which subsequently lead to delay in removing drains and patients discharge from hospital. Our study finding was different to Beek et al which showed that no significant difference was found concerning duration of hospital stay between both groups (Beek et al., 2015).

However, other studies showed similar results compared to our findings such as Schmidt et al. which reported that drain placement was associated with an increase in length of hospital stay (Schmidt et al., 2020).

## Conclusion

Perforation of appendix is a common complication of acute appendicitis which requires early diagnosis and management of acute appendicitis. Perforated appendicitis occurs more in male patients and majority are in the young group. The common presentation of patients with perforated appendicitis included right lower abdominal pain, nausea, anorexia, fever and right iliac fossa tenderness. Ultrasound can be of great help in diagnosis of acute perforated appendicitis. Delayed in presentation to hospital after symptoms of acute appendicitis begin is associated with increased risk of perforation. The most common site of perforation of appendix is at the tip of appendix. No significant advantage was found between the use of abdominal drainage during open appendectomy and incidence of post operative surgical site infection or intra-abdominal abscess. Use of abdominal drainage during open appendectomy for perforated appendicitis was significantly associated with increase length of hospital stay.

## Recommendations

- Early diagnosis and proper management of acute appendicitis to prevent the risk of developing perforated appendicitis.
- Identification of patients with high risks of developing perforated appendicitis to prevent complications.
- Considering radiological findings of appendicular perforation when evaluation patients with acute appendicitis.
- Close and strict follow up of patients treated with conservative approach to early detection and early management of complication.
- Our study findings supported by multiple other studies recommend against the routine use of abdominal drainage for perforated appendicitis and encourage for further large randomized multi-centric prospective studies.

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