Journal of Medical and Surgical Practice (JMSP)
ISSN: 2664-1704
Vol. 10, No. 2, April – June, 2024

Post-Abdominal Surgery Respiratory Complications at Surgical Wards of Baghdad Teaching Hospital

Dr. Ragheed Hazim Fadhil[1*], Dr. Haidar Monther Abud[2], Dr. Luma Jawad Alwan[3]

12,3.. M.B.Ch.B, D.T.M

* *Corresponding Author* ***ragheed.madrid12@gmail.com***

Original Article

Abstract

Background: *Abdominal surgery often leads to the occurrence of postoperative pulmonary complications (PPCs), which are linked to higher rates of illness and death, as well as longer hospital stays.*

Objective: *The aim of the study was to identify pulmonary complications following abdominal surgical procedures and to identify perioperative risk factors associated with the development of these complications.*

Patients and Methods: *this is a hospitalized-based cross-sectional study. A randomly selected sample of 52 patients who developed pulmonary symptom(s) following abdominal surgical procedures at surgical wards of Baghdad teaching hospital from November 2015 to June 2016. Perioperative records were composed through meeting and char evaluation, and their association with the occurrence of PPCs were analyzed. Cross tabulation and Chi-square test were used to analyze the discrete variables and their relationship to the PPCs while one way ANOVA was used to analyze the continuous variables and their relationship to the PPCs.*

Results: *The following PPCs were identified : 33 pneumonia, 5 acute respiratory failure, 4 basal atelectasis, 3 pleural effusion, 3 pulmonary embolism, 3 exacerbation of COPD or asthma and 1 pulmonary edema. Perioperative risk factors associated with development of PPCs were identified: current smoking history (p value = 0.042), preexisting comorbid disease (p value = 0.001), emergency surgery (p value = 0.045), upper abdominal (p value = 0.012) or both upper/lower abdominal incisions (p value = 0.026), duration of surgery ≥ 3 hours (p value = 0.049) and NG tube placement postoperatively (p value = 0.043).*

Conclusions: *The most common PPC following abdominal surgery is pneumonia. There is no significant difference between laparoscopy and laparotomy in term of PPCs following abdominal surgery. Six perioperative risk factors associated with the occurrence of PPCs following abdominal surgery were identified which are current smoking history, preexisting comorbid diseases, emergency surgery, upper abdominal or both upper/lower abdominal incisions, duration of surgery more*

Keywords: *Pulmonary complications, Post-abdominal surgery, surgical wards, Baghdad teaching hospital*

Received : February, 2024, **Published**: April, 2024

Citation: Fadhil R.H, Abud H.M, Alwan L.J Post-abdominal surgery respiratory complications at surgical wards of Baghdad teaching hospital. JMSP 2024; 10(2): 51-65

1. INTRODUCTION

Abdominal surgery often leads to the occurrence of postoperative pulmonary complications (PPCs), which are linked to higher rates of illness and death, as well as longer hospital stays (1-3). The prevalence of PPCs is well acknowledged, however the stated incidence varies between 9% and 40%. This variability is likely due to differences in research methods across various studies (4-5). Effects of anesthesia and an abdominal incision on pulmonary physiology: Selected great attentions have pondered the problem of postoperative complications. Pasteur, Haldane and Beecher were all convinced of the significance of energetic failure of the lung after abdominal operations with shallow breathing as the major cause of postoperative hypoxia and pulmonary complications (6-8).

Intraoperative and postoperative changes in lung volumes:

Abdominal surgery leads to significant changes in respiratory volumes in all patients, resulting in a decrease in functional residual capacity (FRC) while the closing volume (CV) remains relatively stable (9,10). Atelectasis in the dependent lung regions becomes unavoidable when the lung volume at which the flow from the lower sections of the lungs gets significantly decreased or stops during expiration, probably due to airway closure (known as CV), exceeds the functional residual capacity (FRC). This alteration is especially pronounced in the elderly, individuals who are obese, smokers, and those with pre-existing cardiopulmonary disease. Regardless of the specific anaesthetic medications employed, general anaesthesia often results in a decrease of about 18% in functional residual capacity (FRC), with the sole potential exception being ketamine (11-14). Body posture has an impact on lung volumes. Transitioning from lying down to sitting only marginally increases the vital capacity (CV), but it greatly increases the functional residual capacity (FRC) (15).

2. PATIENTS and METHODS

The target population was composed of 52 randomly selected patients who underwent abdominal surgical procedure and developed respiratory symptom(s) including cough, shortness of breath, chest pain and/or hemoptysis with or without fever at surgical ward of Baghdad teaching hospital, from November 2015 to June 2016. Baghdad teaching hospital is a tertiary care center at Baghdad medical city, Iraq.

Inclusion criteria

1. Any patient with the age equal to or more than 18 years old who underwent abdominal surgical procedure under general anesthesia and developed respiratory symptom(s) as cough, shortness of breath, chest pain or hemoptysis.

2. Patients with chronic respiratory disease are included in study sample.

Exclusion criteria

1. Age less than 18 years

2. Gynecological operations

3. Procedures done under local anesthesia

4. Pregnancy

5. Preoperative evidence of infiltrate, atelectasis or pneumonia by chest radiograph or physician documentation.

Study design

This is a hospital-based cross-sectional study. Relevant demographic and clinical data, including age, gender, smoking habits, and the presence of chronic pulmonary disorders or other concomitant diseases, were collected using a standardised questionnaire. Additionally, a chest x-ray was conducted. The analysis of smoking history included both the length of smoking and the pack-year history of smoking. A current smoker is defined as someone who has smoked at least one cigarette per day for over a year and is currently consuming cigarettes, or who has quit smoking within the past eight weeks. The diagnosis of comorbid diseases depends on patients' history and reviewing patients' records. Operative data (type of surgery whether open or laparoscopic, category of surgery whether emergency or elective, type of operation, surgery duration, incision site whether upper abdominal; upper and lower abdominal or lower abdominal) were obtained through chart review. in the upper abdominal incision, The surgical cut is created along the centerline, starting from the xiphoid region and stopping just above the umbilicus. (16) while in the lower abdominal incision, the incision is made in various sites from the area below the umbilicus to the pubic symphysis. (17)

An investigator gathered data on the frequency of symptomatic postoperative pulmonary complications (PPCs) including general examination and full chest examination (inspection, palpation, percussion and auscultation). Chest x-ray, chest CT scan, chest ultrasound and/or CT

pulmonary angiography were requested to undergo additional analysis if it was recommended by clinical evaluation. These analyses were conducted by an investigator who was not involved in the continuing care of the patients.. The patients followed after consultation (pulmonologist or RCU intensivist). The pulmonary condition diagnosed according to clinical, radiological and laboratory data. There was a direct contact with the surgical ward team.

3. RESULTS

Analyzed data from a total of 52 patients, consisting of (35 males, with a mean age 48.77 ± 12.4 and females 17; mean age 48.88 ± 7.6). Demographic and clinical characteristics of the patients are shown in (**Table 1**). Preexisting comorbid conditions of the patients were shown in (**Table 2**). Open surgery was performed in 44 cases (84.6%), emergency surgery was performed in 39 cases (75%), upper and upper/lower abdominal incisions were achieved in 43 cases (82.7%). For 26 (50%) patients, the time of surgery was ≥ three hours. Postoperative NG tube was placed in 37 patients (71.2%). The operative and postoperative risk factors for development of pulmonary complications are shown in (**Table 3**). Radiological findings of the patients are shown in (**Table 4**). The following pulmonary complications had been reported among the studied group; 33 pneumonia, 5 acute respiratory failure, 4 basal atelectasis, 3 pleural effusion, 3 pulmonary embolism, 3 exacerbation of COPD or asthma and 1 pulmonary edema. Postoperative timing of pulmonary complications (day) was 1.44 ± 1.037 day, however, most complications occurred on the first postoperative day. Postoperative mechanical ventilation duration (days) for patients who developed acute respiratory failure (5 patients) was 9.8 ± 3.7. The frequency of pulmonary complications are shown in (**Table 5**).

The following perioperative risk factors had significant P values (which are less than 0.05) using Chi-square test for discrete variables or using one way ANOVA for continuous variables : current smoking history (P. value = 0.042), preexisting comorbid disease (P. value = 0.001), emergency surgery (P. value = 0.045), upper abdominal (P. value = 0.012) or both upper/lower abdominal incisions (P. value = 0.026), duration of surgery ≥ 3 hours (P. value = 0.049) and NG tube placement postoperatively (P. value = 0.043). as shown in (**Table 6**).

Table 1. Demographic data of patients in the study

Variable		
Age (years) (mean ± SD)		48.8 ± 11
Sex n (%)	Male	35 (67.3)
	Female	17 (32.7)
Smoking history n (%)	Current smoker	34 (65.4)
	Former smoker	7 (13.5)
	Non-smoker	11 (21.2)
*Duration of smoking (mean ± SD) year		13.63 ± 11
*Pack years of smoking (mean ± SD)		15.38 ± 12.64

*For current smokers
SD: standard deviation

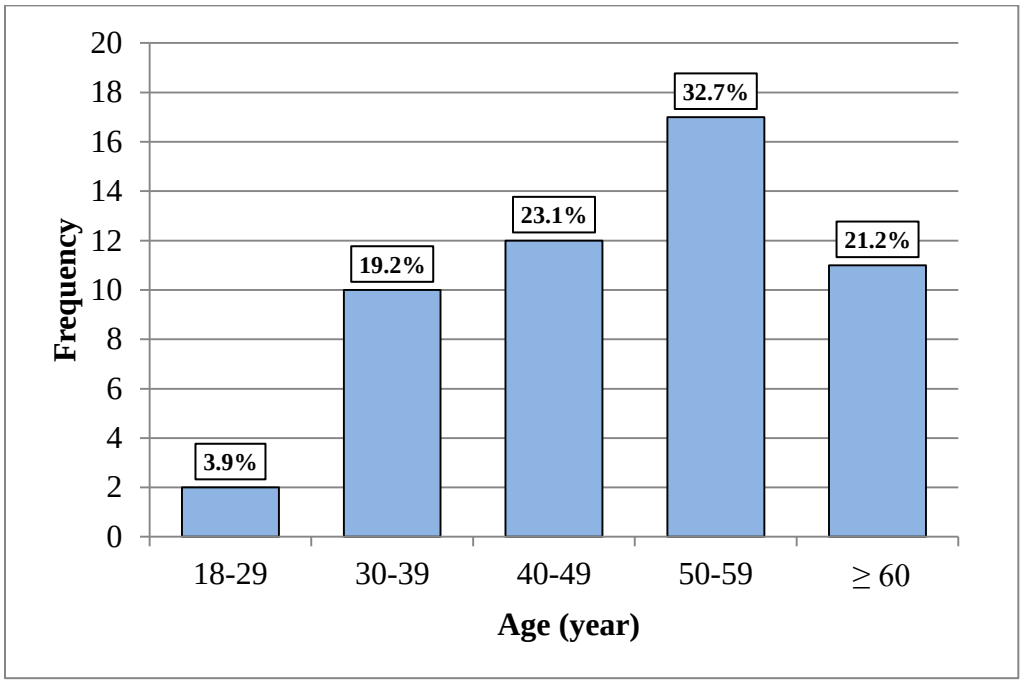

Figure 1. Frequency and proportional distribution of the studied group according to age group

Table 2. Frequency distribution of patient's comorbidities associated with the development of post abdominal surgery pulmonary complications

Disease	No.	%
History of IHD	1	1.9
History of Chronic steroid use	1	1.9
History of DVT	1	1.9
History of CHF	1	1.9
History of asthma	2	3.8
History of hypertension	5	9.6
History of COPD	6	11.5
History of DM	11	21.2
No comorbid disease	24	46.2
Total	52	100.0

Table 3. Frequency of operative and postoperative risk factors for the development of pulmonary complications abdominal surgery.

Factor		No.	%
Type of surgery	Open	44	84.6
	laparoscopic	8	15.4
Category of surgery	Emergency surgery	39	75
	Elective	13	25
Incision site	Upper abdominal	23	44.2
	Upper/lower abdominal	20	38.5
	Lower abdominal	9	17.3
Type of operation	Laparotomy for shell injury	10	19.2
	Bowel obstruction laparotomy	8	15.4
	Perforated peptic ulcer surgery	6	11.5
	Cholecystectomy	5	9.6
	Inguinal hernia surgery	5	9.6
	Appendectomy	4	7.7
	Sleeve gastrectomy	4	7.7
	Splenectomy	4	7.7
	Removal of liver hydatid cyst	2	3.8
	Pancreatectomy	2	3.8
	Partial colectomy	2	3.8
Surgery duration, hours.	< 3 hours.	26	50.0
	≥ 3 hours.	26	50.0
	Mean ± SD	2.62 ± 0.889	-
Postoperative NG tube placement		37	71.2
Duration of postoperative NG tube insertion (days) (mean ± SD).		2.08 ± 1.01	-

Table 4. Radiological findings frequency of patients with pulmonary complications following abdominal surgery.

Radiological findings		No.	%
Patchy infiltration or consolidation	RLL	13	25.0
	RML	3	5.8
	LLL	7	13.5
	LML	1	1.9
	Bilateral	2	3.8
	RML + RLL	7	13.5
Collapse	Right basal lobe	2	3.8
	Left basal lobe	1	1.9
	Bilateral basal lobes	1	1.9
Vascular disorder (pulmonary embolism)		3	5.8
Pleural effusion		3	5.8
Hyperinflation		3	5.8
Bilateral infiltration		6	11.5
Total		52	100.0

*RLL : right lower lobe , RML : right middle lobe , LLL : left lower lobe , LML : left middle lobe

Table 5. Frequency of pulmonary complications following abdominal surgery.

Diagnosis	No.	%
Pneumonia	33	63.5
Pleural effusion	3	5.8
Basal atelectasis	4	7.7
Acute respiratory failure	5	9.6
Pulmonary embolism	3	5.8
Pulmonary edema	1	1.9
Exacerbation of COPD or asthma	3	5.8
Total	52	100.0
Mean timing of incident complication = 1.44 ± 1.037 day		

Table 6. P. values for perioperative risk factors associated with the development of PPCs following abdominal surgery.

Variable		P. value
Age		0.236
Gender		0.570
Smoking history		0.042
	Current smoker	0.042
	Former smoker	0.211
	Non-smoker	0.661
Duration of smoking for current smokers		0. 121
Duration of smoking for former smokers		0.410
Comorbid disease		0.001
Type of surgery		0.756
Category of surgery		0.045
	Emergency	0.045
	Elective	0.223
Type of operation		0.860
Incision site		0.038
	Upper abdominal	0.012
	Upper/lower abdominal	0.026
	Lower abdominal	0.131
Duration of surgery		0.045
	< 3 hours	0.092
	≥ 3 hours	0.049
NG tube insertion postoperatively		0.043
Duration of NG tube insertion postoperatively		0.340

4. DISCUSSION

Our results show that current smoking history, preexisting comorbid diseases, emergency surgery, upper abdominal or both upper/lower abdominal incisions, duration of surgery more than or equal to three hours and NG tube placement postoperatively are associated with increased risk of developing postoperative pulmonary complications (PPCs) in patients undergoing abdominal surgery. The present study showed that current smoking history is associated with increased PPCs (p value = 0.042) and this is also confirmed in other studies (18–24). Long-term exposure to cigarette smoke causes significant physiological changes that can affect how the body responds to medical procedures before and after surgery. This can increase the risk of complications and death during the perioperative period, mostly due to the negative impact of smoking on the cardiovascular and respiratory systems. The expression represents a mathematical equation. Smokers may experience higher levels of carboxyhemoglobin due to factors such as the specific brand of cigarette they use, the depth of inhalation, the number of puffs taken, and the level of ventilation during smoking (25). Smokers typically have carboxyhemoglobin levels ranging from 3% to 15%. This leads to a decrease in the amount of haemoglobin available to bind with oxygen, resulting in lower arterial oxygen content. Additionally, the oxygen-hemoglobin saturation curve is shifted to the left, making it easier for oxygen to bind to hemoglobin but more difficult for it to be released in the tissues. Studies have demonstrated that smoking leads to an elevation in carboxyhemoglobin levels during surgery, even after the start of artificial breathing (26). Numerous researchers have recorded that the most favorable timeframe for refraining from a certain activity is 8 weeks before a surgical procedure, as this specific amount of time without engaging in the activity is linked to a reduced occurrence of lung-related complications, improved healing of wounds, and a shorter duration of stay in the Intensive Care Unit (ICU) (22). In our study we found that preexisting comorbid disease is a risk factor for developing PPCs (p value = 0.001) and other studies have shown a correlation between COPD, asthma and PPC (27). Diabetes has been reported in the literature as a risk factor for infectious complications (28) and for infectious PPCs such as pneumonia, as in our study. Preexisting comorbid diseases has been reported as risk factor for PPCs (29). Our study showed that emergency surgery increases the risk for developing PPCs (p value = 0.045). PPCs have been

identified as a potential danger associated with emergency surgery, according to literature reports (29). It has been noted that emergency surgery has a higher incidence of illness and death compared to elective surgeries (30,31). The urgent nature of the treatment has also been independently linked to increased incidence of postoperative pneumonia and respiratory failure (32,33). Previous studies have already shown that undergoing an upper abdominal incision increases the incidence of postoperative pulmonary complications (PPCs) (34, 35). Our study showed that also upper abdominal incision (p value = 0.012) or both upper/lower abdominal incision (p value = 0.026) is a predisposing factor for PPCs surgery (36). Diaphragm dysfunction caused by upper abdominal surgery has been recognised as a significant contributor to the occurrence of postoperative pulmonary complications (37). The pulmonary dysfunction that occurs after open upper abdominal surgery is marked by a persistent reduction in lung volumes, resulting in the formation of atelectasis (collapsed lung) and low oxygen levels in the blood (hypoxemia) (38). Several studies (39 – 41) have shown that longer operation duration was a significant predictor of postoperative complications (PPCs). The risk of PPCs increased with each extra minute of operating time, regardless of other factors. and our study confirmed this finding (p value = 0.049) and this is well supported by literature review (42, 43). Our study, similar to previous research, demonstrated that the installation of a nasogastric (NG) tube after surgery raises the likelihood of postoperative pulmonary complications (PPCs) with a statistically significant p-value of 0.043. These data indicate that nasogastric decompression should only be performed when deemed required based on clinical reasons (44), resulting in a decrease in postoperative pulmonary complications (PPCs) (45). NG tubes may disrupt the coughing mechanism, resulting in the buildup of bronchial secretions that provide an environment conducive to bacterial growth. Postoperative pneumonia has a prevalence ranging from 9% to 40% among patients who have undergone surgery. It is the third most frequent type of infection that occurs after surgery in hospitals, following urinary tract and wound infections (46). Therefore, in this investigation, postoperative pneumonia was identified as the most prevalent postoperative pulmonary complication, accounting for 63.5% of cases. This finding aligns with the research undertaken by Kanat et al. (47), Gerard et al. (48), and Brooks (46), which identified pneumonia as the primary postoperative pulmonary complication (PPC) in their studies. One potential explanation for the higher occurrence of

postoperative pneumonia in our study, could be related to aspiration of gastric content (aspiration pneumonitis) during the operation as the majority of pneumonia cases occurred in the lower lobe(s) (81.8%). Research has indicated that between 40 to 60% of patients who are able to walk around would be classified as "high risk" for aspiration pneumonitis based on conventional criteria (gastric volume over 25 ml with a pH level below 2.5), even after fasting overnight (49). In this study, we found no statistically significant difference between laparotomy and laparoscopy (p value = 0.756). However, it is worth noting that only eight patients (15.4%) underwent laparoscopic surgery. The literature lacks a consensus regarding the benefits of laparoscopy in relation to postoperative pulmonary complications (PPCs). While laparoscopy minimises direct damage to respiratory muscles, it also leads to an increase in pulmonary resistance due to pneumoperitoneum, potentially resulting in hypercapnia during surgery (50-53). One study demonstrated a higher incidence of PPCs in males compared to girls (54), however our analysis found no significant disparity between genders in terms of developing PPCs (p value = 0.570).

5. CONCLUSIONS

1. The most common PPC following abdominal surgery is pneumonia.
2. There is no significant difference between laparoscopy and laparotomy in term of PPCs following abdominal surgery.
3. Six perioperative risk factors associated with the occurrence of PPCs following abdominal surgery were identified which are current smoking history, preexisting comorbid diseases, emergency surgery, upper abdominal or both upper/lower abdominal incisions, duration of surgery more than or equal to three hours and NG tube placement postoperatively.

Ethical Clearance:

Ethical issues were taken from the research ethics committee. Informed consent was obtained from each participant. Data collection was in accordance with the World Medical Association (WMA) declaration of Helsinki for the Ethical Principles for Medical Research Involving Human Subjects, 2013 and all information and privacy of participants were kept confidentially.

Conflict of interest: Authors declared none

Funding: No funding agency, organization or third parties

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