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**RADIOLOGICAL MANIFESTATIONS OF
POSTOPERATIVE PULMONARY COMPLICATIONS
AFTER ABDOMINAL SURGERY**

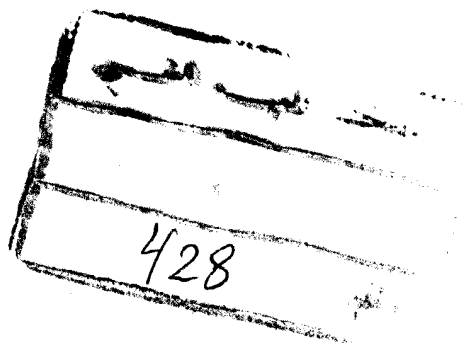
THESIS

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BY

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INTRODUCTION

INTRODUCTION

Pulmonary complications are the largest single cause of morbidity and prolonged hospitalization after major abdominal surgery. It is the second most common cause of postoperative deaths in patients older than 60 years(1).

The postoperative pulmonary complications are still representing a major problem in the postoperative period despite advances in preoperative care, anaesthetic techniques and postoperative management(2). This is possibly because operative treatment is now used for patients who were considered unfit for surgery in the past on the ground of their pulmonary disability(3).

The pulmonary complication can be defined as any change in the postoperative chest radiograph that was not present in the preoperative radiograph(4).

Incidence of postoperative pulmonary complications:

Latimer and his co-workers studied postoperative pulmonary complications in different series and they found that the incidence ranged from 0.1 to 70%. This very wide range is dependent on the author's method of study of the pulmonary complications(5).

Classification of abdominal surgery:-

- * Abdominal surgery can be classified into:-
 - Upper abdominal surgery which includes gastro-duodenal, hepatobiliary, splenic and pancreatic surgery.
 - Lower abdominal surgery which includes appendicectomy, intestinal, colonic and genitourinary surgery⁽⁶⁾.
- * Another classification of abdominal is surgery according to the method of surgical approach whether intraperitoneal or retroperitoneal. The retroperitoneal area of the abdomen can be defined as the area between the parietal peritoneum and the inner most surface of the entire abdominal and pelvic cavities⁽⁷⁾.
- * Some structures which can be approached surgically via the retro-peritoneum are:- adrenal glands , kidneys , ureters, urinary bladder, renal artery and vein, lumbar sympathetic chain and groin hernias⁽⁷⁾.

ANAESTHESIA FOR ABDOMINAL SURGERY:-

- Requirements for general anaesthesia in abdominal surgery:

1. Unconsciousness with complete absence of awareness.
2. Prevention of gastric contents from entering the glottis.
3. Suppression of reflex responses to surgical stimuli.
4. Good relaxation of anterior abdominal wall.
5. Reasonably rapid return of the consciousness and the upper respiratory tract reflexes⁽⁸⁾.

Factors related to anaesthesia that influence postoperative pulmonary complications:-

Postoperative pulmonary complications have been shown to be as frequent after spinal analgesia as after general anaesthesia⁽³⁾.

The termination of anaesthesia with gas of low solubility such as the room air has no effect on the occurrence of postoperative pulmonary complications⁽⁹⁾.

During general anaesthesia, mechanical or chemical stimuli such as an oral airway, endotracheal tube, ether or neostigmine can induce an increase of salivary and bronchial secretions. Atropine results in the production of tenacious viscid sputum which is difficult to expectorate. These factors predispose to postoperative pulmonary complications^(3,10).

Patients received excessive amounts of anaesthetic agents and adjuvants when returned to the surgical ward without having fully regained their protective reflexes, this state together with the hazards of regurgitation following abdominal surgery increase the possibility of aspiration pneumonia⁽¹¹⁾.

TYPES OF POSTOPERATIVE PULMONARY COMPLICATIONS

- Atelectasis.
- Simple bronchitis.
- Pneumonia.
- Aspiration of gastric contents (Aspiration pneumonitis).
- Lung abscess.
- Subphrenic abscess.
- Pulmonary embolism.
- Pleural effusion.
- Pneumothorax.
- Pulmonary oedema.
- Adult respiratory distress syndrome⁽¹²⁾.

Clinical grading of postoperative chest conditions according to the study of Collins and his coworkers.

- * Grade I: Normal chest.
- * Grade II: Mild basal bronchitis and/or collapse as shown by diminished breath sounds with numerous rhonchi, fine crepitations at the lung base and slight rise of temperature.
- * Grade III: Moderate bronchitis with mucopurulent sputum, collapse and /or segmental consolidation with marked elevation of temperature.
- * Grade IV: Marked consolidation and /or collapse with severe constitutional disturbance and anxiety⁽¹³⁾.

Radiological grading of postoperative chest condition according to the same study of Collins and his coworkers.

- Clear radiograph; no signs other than raised diaphragm.
- Minor lesions ; linear or segmental collapse in one or both lung fields.
- Major lesions ; signs of lobar collapse or consolidation in one or both lung fields(13).

ATELECTASIS

Atelectasis means incomplete expansion and defined as complete collapse of one or more definite anatomic lung unit such as lobule, segment, lobe or entire lung⁽¹⁴⁾.

Pathogenesis of postoperative atelectasis:-

The pathogenesis of atelectasis involves obstructive and non-obstructive factors. Obstruction may be caused by retained secretions resulting from chronic obstructive pulmonary disease, intubation or anaesthetic agents, occasionally by blood clots, vomitus or malposition of endotracheal tube⁽¹⁵⁾.

In most of cases, the cause is not obstructive but due to closure of bronchioles starting by small bronchioles when the lung volume reaches a critical point called the closing volume and this mechanism is more frequent in older patients and smokers owing to loss of elastic recoil of the lungs⁽¹⁴⁾.

A characteristic feature of postoperative atelectasis is its early onset perhaps even on the operating table during anaesthesia⁽¹⁶⁾.

Micro or miliary atelectasis in the postoperative period can be explained by changes in breathing pattern during general anaesthesia leading to an alteration of lung

surfactant and collapse of peripheral airways, in addition to the inability to inspire deeply with subsequent premature closure of the peripheral airways⁽¹⁴⁾.

Postoperative atelectasis may cause pleural effusion due to a more negative pleural pressure that favours pleural fluid collection⁽⁶⁾.

Clinical diagnosis of postoperative atelectasis:

Atelectasis is the most common cause of postoperative fever manifested within 48 hours following abdominal surgery. Other symptoms of atelectasis are cough and increased sputum production⁽³⁾.

The temperature, pulse and respiratory rates begin to rise within 12 to 18 hours in the postoperative period. The patient may present a striking picture of respiratory distress and his face is often flushed or even cyanosed⁽¹⁴⁾.

On examination of the chest, the physical signs are diminished movement of the affected side with impaired note or dullness on percussion. Auscultation reveals absent or diminished air entry and often loud bronchial breathing at the lung base. Bronchial breathing is a good sign as it indicates that the major bronchi are patent⁽¹⁵⁾.

Radiological diagnosis of atelectasis:

Radiologic changes of atelectasis usually become apparent 24 hours after surgery including elevation of the diaphragm, subsegmental linear or curved opacities at the lung base, less frequently segmental, lobar or whole lung opacification and may be pleural effusion⁽¹⁷⁾.

Volume loss is usually evident but retained secretions may cause dense consolidation with only minimal volume loss⁽¹⁷⁾.

The opacities are characterized by rapid progression and rapid clearing after physical therapy or suctioning and this clearing was found to be more rapid in patients without air bronchogram due to the fact that air bronchogram is prevented by mucus obstructing large airways which are most amenable to physical clearing⁽¹⁰⁾.

The distinction between postoperative atelectasis and pneumonia is often difficult but if atelectasis fails to clear by the third or fourth postoperative day, secondary infection should be suspected⁽¹⁴⁾.

SIMPLE BRONCHITIS

Simple bronchitis represents a common postoperative pulmonary complication after abdominal surgery⁽²⁾.

The use of contaminated endotracheal tubes and unsterile analgesic lubricants during intubation plays an important role in precipitating bronchial infection⁽¹⁸⁾.

The pathology of simple bronchitis may vary from minimal accumulation of secretions that follows most operations for a brief period of time, to the presence of acute infective process with production of excessive purulent sputum⁽¹⁸⁾.

The first symptom is an irritating non-productive cough with mild upper retrosternal pain. When the bronchi become fully involved, there is a sensation of tightness in the chest, dyspnoea and wheezy respiration. The sputum at first is scanty mucoid and difficult to bring up, two days later it becomes mucopurulent and more copious with rise of the temperature⁽¹⁹⁾.

Examination of the chest reveals vesicular breath sounds with prolonged expiration, bilateral rhonchi and occasionally coarse crepitations⁽¹⁹⁾.

In the majority of cases, recovery takes place gradually over the next 4 to 8 days with no radiological changes unless complicated by pneumonia(20).

PNEUMONIA

Postoperative pneumonia is usually apparent several days after abdominal surgery⁽²¹⁾.

Pneumonia is a rare primary complication of surgery but usually complicate bronchial retention of secretions, atelectasis or aspiration pneumonitis⁽¹⁹⁾.

Chronic obstructive pulmonary disease, tracheal intubation, diabetes mellitus and coma predispose to colonization of the upper respiratory tract with gram negative organisms which acts as endogenous source of infection⁽¹²⁾.

Postoperative pneumonia is suspected when the moderate fever produced by atelectasis become higher with systemic toxicity, respiratory difficulty and cough becomes productive with abundant secretions. The physical examination of chest reveals evidence of consolidation⁽²¹⁾.

Radiologically, postoperative pneumonia tends to produce a localized basal opacity than that of atelectasis and progresses more slowly. Infections due to gram negative bacilli most often produce patchy bibasilar infiltrates that sometimes cavitate⁽¹²⁾.

ASPIRATION OF GASTRIC CONTENTS (ASPIRATION PNEUMONITIS)

The aspiration of gastric contents during and after abdominal surgery remains a major cause of postoperative pulmonary complications⁽²²⁾. It is predisposed by reduced level of consciousness with subsequent disturbed glottic closure and cough reflex. Mechanical disruption of the cardiac sphincter by nasogastric feeding tubes is another factor⁽²³⁾. Despite early recognition and treatment of aspiration, 28 percent of these patients usually die because of respiratory failure⁽¹²⁾.

Silent aspiration is common as many patients recover without clinical evidence of chemical pneumonitis, but some cases of postoperative atelectasis may be due to silent aspiration. These patients are usually radiologically free or may show diffuse patchy infiltrates that clear rapidly⁽²³⁾.

Chemical pneumonitis develops within hours after aspiration of gastric contents with a pH of less than 2.5, producing fever, tachypnoea and rales over the chest⁽¹²⁾.

Radiologically, infiltrates produced are most frequent at the lung base or perihilar regions, patchy or acinar. Interstitial thickening may be evident. Sometimes, bilateral symmetrical diffuse infiltrates that mimic congestive heart failure are produced because of their rapid progression⁽²⁴⁾.

As a general rule, the infiltrates will progress for the first 24-48 hours, then start to clear over the next several days, so after the third day any increase in the infiltrates suggests superadded infection with gram negative organisms⁽¹²⁾.

Landy et al (1978) found that the extent of infiltrates in the postoperative chest X-ray film was of limited prognostic significance as some patients with minimal radiographic changes developed serious clinical problems whereas others with grossly abdominal-chest radiograms had an uncomplicated clinical course⁽²⁴⁾.

LUNG ABSCESS

Postoperative lung abscess is uncommon complication after abdominal surgery and usually is due to aspiration of septic material or an acute infection in a collapsed area of the lung(25).

The presence of septic teeth, gross tonsillar and nasal sepsis predispose to the development of postoperative lung abscess(25).

The upper lobar segment of the lung acts as the most dependent site for accumulation of secretions when the anaesthetized patient is placed on his side during or after the operation, while the apical segment of the lower lobe is the most common site when the patient lies on his back with subsequent pulmonary collapse which may later suppurate forming a lung abscess(19).

The aspirated gastric contents during vomiting will produce inflammatory lung lesion followed by secondary infection with commensals and anaerobic organisms(14).

The onset of the disease is either insidious or acute within 2-10 days after surgery. Cough, purulent sputum, high fever, anorexia, shivering and sweating are the presenting symptoms(26).

Physical signs on the chest are those of consolidation. frank signs of cavitation are rare. Pleural rub is often present(26).

Radiologically, postoperative lung abscess will appear early as a homogenous opacity then multiple small cavities form and become visible when the contents are discharged and air enters as a cavity with a fluid level(19).

SUBPHRENIC ABSCESS

The subphrenic area can be divided into four intraperitoneal spaces, two on each side separated by the falciform ligament, the right subphrenic area is divided by the right coronary ligament into the right anterior subphrenic space and the right posterior subphrenic space (subhepatic space), while the left subphrenic area is divided into the left anterior subphrenic space (left subphrenic space) and the left posterior subphrenic space (the lesser sac)⁽²⁷⁾.

The right subphrenic space is in communication with the right paracolic gutter while on the left side, this communication is prevented by phrenicocolic ligament⁽²⁷⁾.

Subphrenic abscess is considered to be any abscess between the diaphragm and the transverse colon⁽²⁸⁾.

Gastroduodenal, splenic and biliary surgery represents the majority of abdominal operations followed by subphrenic collection⁽²⁹⁾.

Subphrenic abscess is usually presented in the late post-operative period by hypochondrial pain, high fever, chills and

leucocytosis. These symptoms may be masked with antibiotic treatment giving only a low grade fever⁽³⁰⁾.

Basal pneumonia is the most frequent serious pulmonary complication of subphrenic abscess, less frequent complications include lung abscess, empyema, pneumothorax, bronchopleural fistula and pyopericardium⁽¹²⁾.

The radiologist plays an important role in suggesting, confirming and localizing a subphrenic abscess⁽²⁸⁾.

The classic radiographic finding of subphrenic abscess are:

- * Limitation of the diaphragmatic movement on the involved side so fluoroscopy is mandatory when suggesting subphrenic collection.
- * Elevation of the hemidiaphragm on the involved side.
- * Pleural effusion which is usually small on the the involved side and possibly due to irritation of the parietal pleura.
- * A patch of pneumonia or atelectasis in the lung base above the elevated hemidiaphragm^(29,30).
- * Loculated gas under the diaphragm may be detected⁽²⁸⁾.
- * Ultrasound is the investigation of choice for detecting subphrenic collection. Computed tomography and combined liver and lung isotope scanning have greatly improved the ability to diagnose subphrenic collection⁽¹²⁾.

PULMONARY EMBOLISM

Pulmonary thromboembolism accounts about five percent of postoperative deaths, while postoperative deep vein thrombosis is present in about 25% of abdominal surgery patients over the age of 40 years⁽¹²⁾.

In addition to surgery, the predisposing factors include a previous history of pulmonary embolism, venous or cardiac disease, obesity, contraceptive pills intake, hypercoagulability and dehydration⁽¹²⁾.

Pulmonary embolism is usually presented late in the postoperative period on the seventh to tenth postoperative days⁽³¹⁾.

It is symptomatic only in ten percent of cases, while the remainder produces only minor changes in respiratory rate⁽³¹⁾.

Clinically, postoperative pulmonary embolism should be suspected in any patient with chest pain and dyspnoea out of proportion to the underlying condition in the existence of the possibility of deep vein thrombosis⁽³²⁾.

When it is associated with pulmonary infarction, there is a sudden onset of chest pain, haemoptysis and a progressive shortness of breath⁽³²⁾.

The radiographic signs of pulmonary embolism include: elevation of the hemidiaphragm on the affected side, linear atelectasis, segmental pulmonary consolidation and pleural effusion. Westermark's sign is strongly suggestive of pulmonary embolism which is a local hypertranslucency representing hyperperfused lung area⁽³³⁾.

Pleural effusion may be the only radiographic finding of pulmonary embolism. It is usually small, unilateral and appears soon after the onset of the embolism. Effusion that appears later in the course of the disease is usually due to recurrent pulmonary embolism or superadded pulmonary infection⁽³⁴⁾.

Patients with impaired bronchial arterial circulation due to arteriosclerotic coronary disease are at higher risk to develop pulmonary infarction producing a cone-shaped parenchymal opacity in chest X-ray film⁽³³⁾.

The combination of highly suggestive and non-specific ECG changes with the clinical manifestations of pulmonary embolism

together with the radiological signs increase the sensitivity of diagnosis of postoperative pulmonary embolism⁽³²⁾.

Isotope lung scan and pulmonary angiography remain the best method for the diagnosis of pulmonary embolism. A normal perfusion lung scan excludes the possibility of pulmonary embolism while the wedge-shaped localized perfusion defects must be accompanied by a normal ventilation lung scan to distinguish pulmonary embolism from other conditions as pulmonary infections and emphysema which produce defects in both perfusion and ventilation scans⁽³⁵⁾.

PLEURAL EFFUSION

Small pleural effusions are common after abdominal surgery and most resolve spontaneously within two weeks⁽⁶⁾.

Patients with postoperative atelectasis are more prone to develop pleural effusion in the immediate postoperative period⁽⁶⁾. This can be explained by two mechanisms: the loss of volume of atelectatic lung produces a more negative pleural pressure leading to imbalance of the forces governing the formation and reabsorption of pleural fluid favouring the collection of pleural fluid. Moreover, the minute areas of infection in the atelectatic lung lead to the collection of parapneumonic effusion⁽¹²⁾.

In the absence of pulmonary embolism and heart failure, the appearance of pleural effusion late in the postoperative period suggests subphrenic abscess or acute pancreatitis⁽³⁴⁾.

One half of patients with postoperative pulmonary embolism present a pleural effusion⁽³⁴⁾.

decubitus chest X-ray films are very sensitive to detect small pleural effusion, with more fluid collection. The posterior costophrenic sinus is obliterated before the lateral costophrenic sinus so lateral chest X-ray film shows pleural effusion earlier than the frontal chest X-ray film⁽⁶⁾.

PNEUMOTHORAX

Pneumothorax is uncommon complication after abdominal surgery. Most postoperative pneumothoraces are produced during anaesthesia due to trauma to the lung apex during insertion of a subclavian venous catheter or due to excessive positive pressure ventilation⁽¹²⁾

The application of excessive positive pressure ventilation may cause alveolar rupture with a perivascular spread of gas to the hilum followed by perfusion through the mediastinal pleura. Rupture of a bleb on the lung surface produces postoperative pneumothorax⁽³³⁾.

Pneumothorax may complicate abdominal surgery such as radical nephrectomy and adrenalectomy that require dissection under the posterior part of the diaphragm, causing intra-operative trauma to the diaphragm. Air that reach through the drain of the wound to the diaphragm, thus can reach the pleural space⁽¹²⁾.

Many cases of pneumothorax go unrecognized and need no treatment, otherwise, it must be considered as a cause of postoperative respiratory distress⁽³³⁾

Pneumothorax in an erect patient causes lung retraction towards the hilum producing a sharp white line of the visceral pleura separated from the chest wall by radiolucent pleural space devoid of lung markings. While in the decubitus film, the pleural air can be seen along the lateral chest wall(12).

PULMONARY OEDEMA

Pulmonary oedema in the postoperative period may be cardiogenic or non-cardiogenic. The non-cardiogenic oedema involves overhydration and the adult respiratory distress syndrome(33).

Postoperative cardiogenic oedema shows radiographic changes as cardiomegaly, upper lobe redistribution of pulmonary vessels, followed by interstitial pulmonary oedema, then patchy perihilar alveolar oedema and finally dense bilateral alveolar oedema and Kerley's lines which represented thickened interlobular septae(12).

The administration of large volume of intravenous fluids in the postoperative period may induce pulmonary oedema in patients without underlying heart disease due to overhydration with a temporary high output left ventricular failure(36). In this type of non-cardiogenic pulmonary oedema, cardiomegaly and upper lobe redistribution of pulmonary vessels are absent but the chest radiograph shows interstitial oedema followed by alveolar pulmonary oedema(33).

ADULT RESPIRATORY DISTRESS SYNDROME (ARDS)

Adult respiratory distress syndrome is a combination of clinical, physiologic and radiographic changes in the lungs after a major systemic insult such as major abdominal surgery, massive trauma, haemorrhage, sepsis or burns⁽¹²⁾.

The incidence of ARDS has increased dramatically in recent years partly due to wider availability of modern techniques for recognition of respiratory failure, and mainly it is a reflection of the success of sophisticated resuscitation procedures which permit survival of many patients who previously would have died earlier following major abdominal surgery⁽³⁷⁾.

Adult respiratory distress syndrome (ARDS) passes through different radiographic changes:-

- * Phase -1- up to 24 hours after injury • normal radiograph.
- * Phase -2- 24 to 36 hours • chest radiograph shows:-
interstitial pulmonary oedema followed by alveolar oedema without cardiomegaly or pleural effusion.
- * Phase -3- 35 to 72 hours • No further radiographic changes.
- * Phase -4- 72 hours to 6 weeks • Complete resolution of infiltrates if the patient survives⁽³⁸⁾.

After the initial injury, there is a period of severe shock followed by latent period 12-24 hours before clinical or radiographic abnormalities are noted. Followed by progressive respiratory distress, hypoxia and a progressive decrease in lung compliance and arterial oxygen tension. Cyanosis, tachycardia and secondary pulmonary sepsis are common⁽³⁷⁾.

The prognosis of adult respiratory distress syndrome is poor. The overall mortality is 65%, complete resolution of the lungs infiltrates occurs in most of survivors while parenchymal scarring may persist in survivors of more severe disease⁽³⁴⁾.

AIM OF THE WORK

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The aim of this work was:

1. The study of the incidence of postoperative pulmonary complications after abdominal surgery.
2. Correlation of the radiological manifestations of the pulmonary complications with the clinical diagnosis.

MATERIAL

MATERIAL

This study was carried out on eighty patients admitted at the Medical Research Institute Hospital for elective abdominal surgery during the period of three months between April and June 1989.

They were classified into two groups:-

- I. The first group included forty patients admitted for upper abdominal surgery.
- II. The second group included forty patients admitted for lower abdominal surgery.

METHODS

METHODS

All patients in this study were subjected to:-

{A} Preoperative assessment:-

1. A thorough history taking with particular emphasis on smoking habit and history of chest complaint.
2. Clinical chest examination.
3. Preoperative chest radiograph was done for each patient to assess the condition of the chest and as a base line to detect postoperative changes.

All cases with pulmonary diseases are excluded.

{B} Postoperative assessment:-

1. Clinical chest examination was done in the first 24 hours of postoperative period to detect any pathological chest condition.
2. 24 hours-postoperative chest radiograph was taken to detect radiological findings to be correlated with the clinical diagnosis.
3. Patients who developed clinical pulmonary disorders later in the postoperative period as detected by physicians were examined by further radiographs.

RESULTS

RESULTS

This study was carried out on eighty patients admitted for various types of elective abdominal surgery.

They were chosen at random free from preexisting pulmonary diseases.

They were classified into two main groups:-

GROUP I

- * It included 40 patients admitted for upper abdominal surgery.
- * They were 12 females (30%) and 28 males (70%).
- * Their age ranged from 18 to 75 years.
- * Twenty three patients were smokers (57.5%) and 17 patients were non-smokers (42.5%).

GROUP II

- * It included 40 patients admitted for lower abdominal surgery.
- * They were 22 females (55%) and 18 males (45%).
- * Their age ranged from 18 to 75 years.
- * Fourteen patients were smokers (35%) and 26 patients were non-smokers (65%), (Tables I, II, III).

POSTOPERATIVE RESULTS:-**Incidence of pulmonary complications:**

Postoperative pulmonary complications are detected in:

- Twenty eight patients out of 80 patients (35%).

According to both clinical and radiological diagnosis, in:

Group I: 20 patients out of 40 patients (50%).

GROUP II: 8 patients out of 40 patients (20%), (table IV).

- Twenty patients out of 80 patients (25%).

According to the radiological diagnosis only, in:-

Group I: 15 patients out of 40 patients (37.5%).

GROUP II: 5 patients out of 40 patients (12.5%), (table V).

Clinical and radiological presentations of postoperative pulmonary complications after abdominal surgery:-

- Eight patients out of twenty eight patients with postoperative pulmonary complications were radiologically free (28.57%). They were diagnosed clinically as acute bronchitis.

- Seven patients out of 28 patients with postoperative pulmonary complications were clinically free (25%). They were diagnosed radiologically as small pleural effusions and atelectasis.

- Clinical signs of postoperative pulmonary complications on chest examination were detected in 21 patients out of 28 patients with postoperative pulmonary complications (75%).

TABLE I: AGE AND SEX DISTRIBUTION IN PATIENTS OF
GROUP I (Upper abdominal Surgery).

AGE	SEX	Males		Females		Total	
		No.	%	No.	%	No.	%
18—39 (Years)		9	22.5	7	17.5	16	40
40—75 (Years)		19	47.5	5	12.5	24	60
Total		28	70.0	12	30.0	40	100

TABLE II: AGE AND SEX DISTRIBUTION IN PATIENTS OF
GROUP II (Lower abdominal Surgery).

SEX AGE	Males		Females		Total	
	No.	%	No.	%	No.	%
18—39 (Years)	10	25.0	12	30.0	22	55
40—70 (Years)	8	20.0	10	25.0	18	45
Total	18	45.0	22	55.0	40	100

TABLE III: SMOKING HABIT IN EIGHTY PATIENTS UNDERGOING ELECTIVE ABDOMINAL SURGERY

Group	Smokers		Non-smokers		Total
	No.	%	No.	%	
Group I*	23	57.5	17	42.5	40.00
Group II+	14	35.0	26	65.0	40.00
Total	37	46.25	43	53.75	80.00

* = Upper Abdominal Surgery.

+ = Lower Abdominal Surgery.

TABLE IV: THE INCIDENCE OF POSTOPERATIVE PULMONARY
COMPLICATIONS ACCORDING TO BOTH CLINICAL
AND RADIOLOGICAL DIAGNOSIS.

Group	No. of comp	Total No. of cases	Incidence
Group I*	20	40	50%
Group II ⁺	8	40	20%
Total	28	80	35%

No. = Number.

comp = complications

* = Upper Abdominal Surgery.

+ = Lower Abdominal Surgery.

TABLE V: THE INCIDENCE OF POSTOPERATIVE PULMONARY
COMPLICATIONS ACCORDING TO RADIOLOGICAL
DIAGNOSIS.

Group	No. of comp	Total No. of cases	Incidence
Group I*	15	40	37.5%
Group II+	5	40	12.5%
Total	20	80	25%

No. = Number.

comp = complications

* = Upper Abdominal Surgery.

+ = Lower Abdominal Surgery.

TABLE VI: RADIOLOGICAL PRESENTATIONS IN 28 PATIENTS WITH POSTOPERATIVE PULMONARY COMPLICATIONS

RADIOLOGICAL PRESENTATIONS	NUMBER	PERCENT
- Free.	8	28.57
- Consolidation.	10	35.71
- Atelectasis.	10	35.71
- Pleural effusion.	6	21.43
- Postoperative air under the diaphragm.	17	60.71
- High coupla with free mobility.	12	42.86
- High coupla with sluggish movement.	3	10.71

TABLE VII: CLINICAL PRESENTATIONS IN 28 PATIENTS WITH POSTOPERATIVE PULMONARY COMPLICATIONS.

CLINICAL PRESENTATIONS	NUMBER	PERCENT
- Free.	7	25.00
- Fever	19	67.86
- Productive cough	8	28.57
- Dyspnoea	10	35.71
- Chest pain	4	14.29
- Hypochondrial pain	3	10.71
- Haemoptysis	1	3.57

TYPES OF POSTOPERATIVE PULMONARY COMPLICATIONS

1. Postoperative atelectasis was found in:-

* 10 patients: (12.5%)

Group I : 9 patients (22.5%).

Group II: 1 patients (2.5%).

* Clinical presentation:

- . 3 cases were free.
- . 3 cases manifested by dyspnoea in the first postoperative day with rhonchi on the chest.
- . 2 cases manifested by fever, dyspnoea and productive cough in the first postoperative day with signs of collapse and associated consolidation on the chest.
- . 2 cases manifested late in the postoperative period with pulmonary embolism and subphrenic abscess.

* Radiological presentation: (Figure 1,2,3)

- . Three cases were linear atelectasis (Fleischer's plate atelectasis).
- . Five cases were thick bands of atelectasis.
- . Two cases were segmental basal opacities with loss of volume.
- . Eight cases were left sided and 2 cases were right sided.
- . Eight cases were on the same side of surgery (80%).

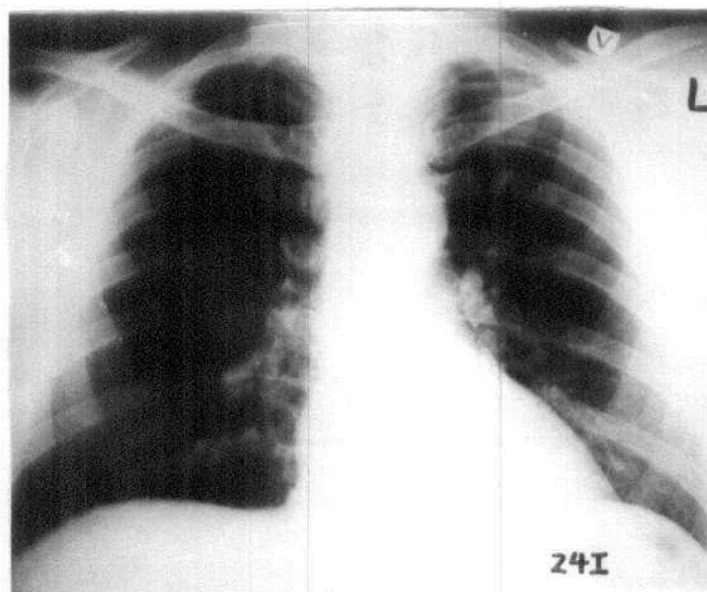


Figure 1: Preoperative chest radiograph for patient No. (24 I): No active lung lesion.

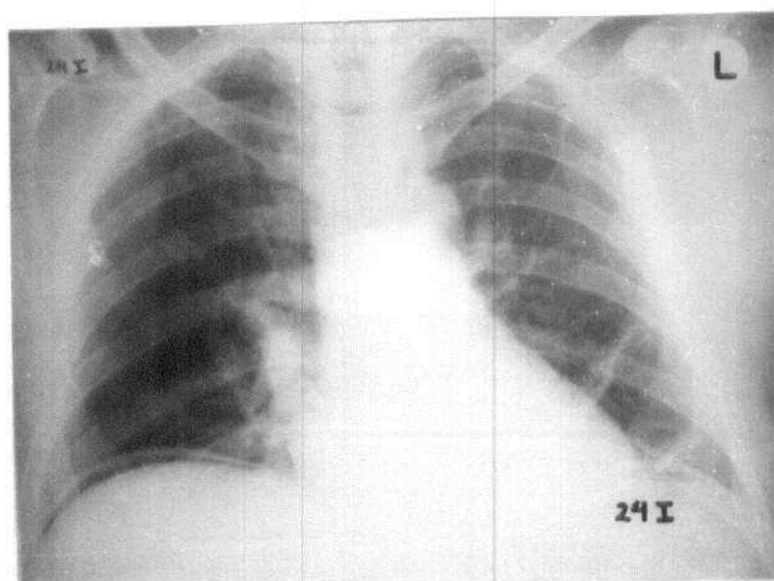


Figure 2: Postoperative chest radiograph for the same patient (24 hours after surgery): showing two left basal curved linear atelectatic bands with bilateral pneumoperitoneum.

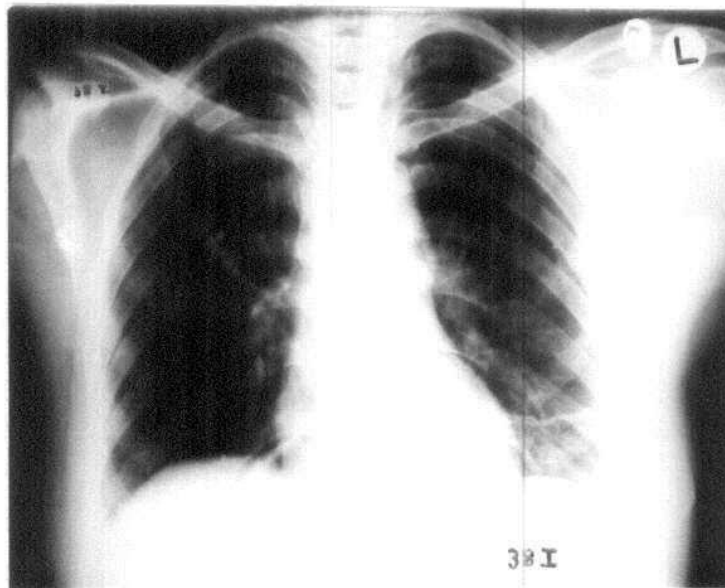


Figure 3: Postoperative chest radiograph for patient No. 38 I (24 hours after surgery): showing Bilateral linear atelectasis (right midzonal and left basal). Left basal diminished aeration.

2. Postoperative acute bronchitis was found in:-

* 8 patients: (10%)

Group I : 5 patients (12.5%).

Group II: 3 patients (7.5%).

* Clinical presentation:

productive cough and low grade fever with rhonchi on the chest in the first postoperative day.

* Radiological presentation: (Figure 4)

They were free except for right sided surgical emphysema in one patient.

3. Postoperative subphrenic collection: was found in

* 3 patients: (3.75%) proved by ultrasonography.

. Two cases were drained surgically.

. One case responded to medical treatment.

. They were from group I (2 cases following splenectomy on the left side, and one case following cholecystectomy on the right side).

* Clinical presentation:

Fever, dyspnoea and hypochondrial pain on the second to the fourth week of postoperative period.

* Radiological presentation: (Figures 5-8)

. Two cases were on the left side and one case was on the right side.

- . elevation of the coupla of the diaphragm with sluggish movement was present in the three cases.
- . basal lung opacity and pleural collection were present in 2 cases.
- . linear atelectasis was present in the third patient.

4. Postoperative pleural effusion was found in:-

* 6 patients: (7.5%)

Group I : 5 patients (12.5%).

Group II: 1 patient (2.5%).

* Clinical presentation:

- . Three cases were free.
- . One case was associated with consolidation on the chest and presented on the second postoperative day.
- . Two cases were manifested late in the postoperative period by a picture suggestive of subphrenic collection.

* Radiological presentation: (Figure 9)

- . small pleural effusions.
- . They were 5 cases on the left side and one case on the right side.
- . 5 cases (83.3%) were on the same side of surgery.

5. Postoperative pneumonia was found in:-

* 7 patients: (8.75%)

Group I : 3 patients (7.5%).

Group II: 4 patients (10%).

* Clinical presentation:

fever, dyspnoea and productive cough with signs of consolidation on the affected side of the chest between second and fourth postoperative days.

* Radiological presentation: (Figure 10,11,12)

- . patches of consolidation with air bronchogram.
- . Four cases were on the right side and 3 cases were on the left side.

They responded to antibiotic treatment.

6. Postoperative pulmonary embolism:

One patient (1.25%) from group I, was diagnosed by the clinical presentations, radiological findings and electrocardiographic findings as pulmonary embolism. The patient responded to treatment by heparin and dicoumarol.

Clinical presentation:

Acute chest pain, dyspnoea, fever and blood tinged sputum on the tenth postoperative day with chest wheezes on both sides.

Radiological presentations: (Figure 13)

Right upper lobar partial lung collapse with and elevated right coupla of the diaphragm, and left basal band of atelectasis.

TABLE VIII: THE TYPES OF POSTOPERATIVE PULMONARY
COMPLICATIONS ACCORDING TO THE FINAL
DIAGNOSIS.

Types of Complications	GROUP I*		GROUP II+		TOTAL	
	No.	%	No.	%	No.	%
- Acute bronchitis	5	12.5	3	7.5	8	10
- Atelectasis	9	22.5	1	2.5	10	12.5
- Pneumonia	3	7.5	4	10.0	7	8.75
- Subphrenic abscess	3	7.5	-	-	3	3.75
- Pleural effusion	5	12.5	1	2.5	6	7.5
- Pulmonary embolism	1	2.5	-	-	1	1.25

* = Upper abdominal surgery.

+ = Lower abdominal surgery.

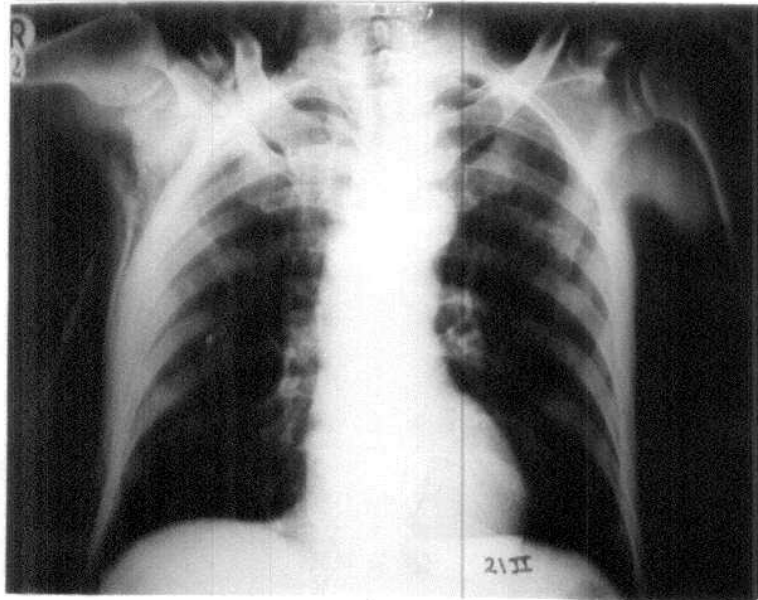


Figure 4: Postoperative chest radiograph for patient No. 21 II (24 hours after surgery): showing right sided surgical emphysema.

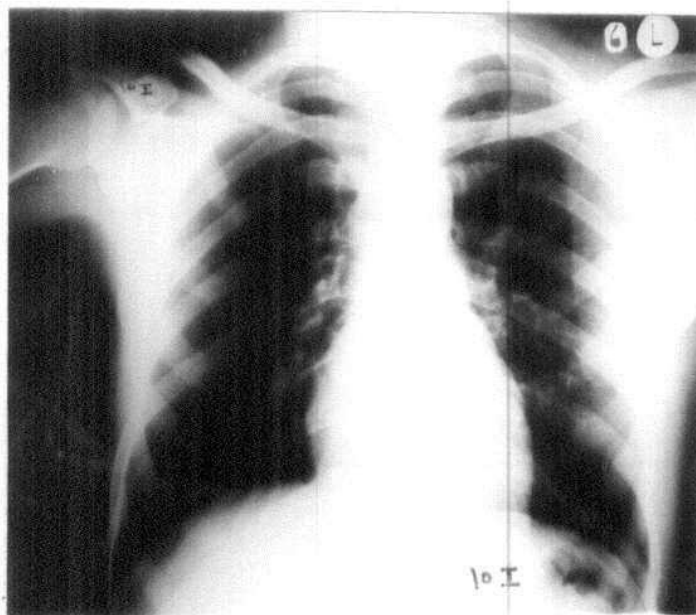


Figure 5: Preoperative chest radiograph for patient No. (10 I): No active lung lesion.

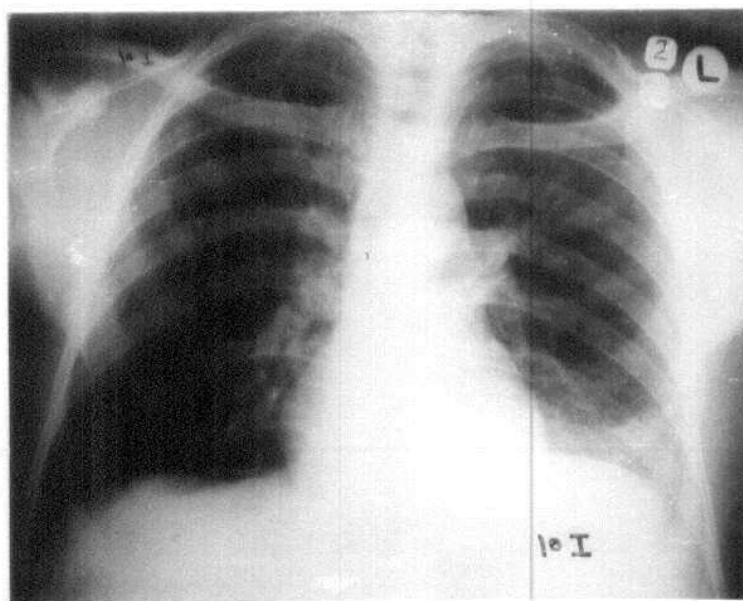


Figure 6: Postoperative chest radiograph for the same patient (24 hours after surgery): showing left basal diminished aeration. Pneumoperitoneum is seen under right coupla of the diaphragm.

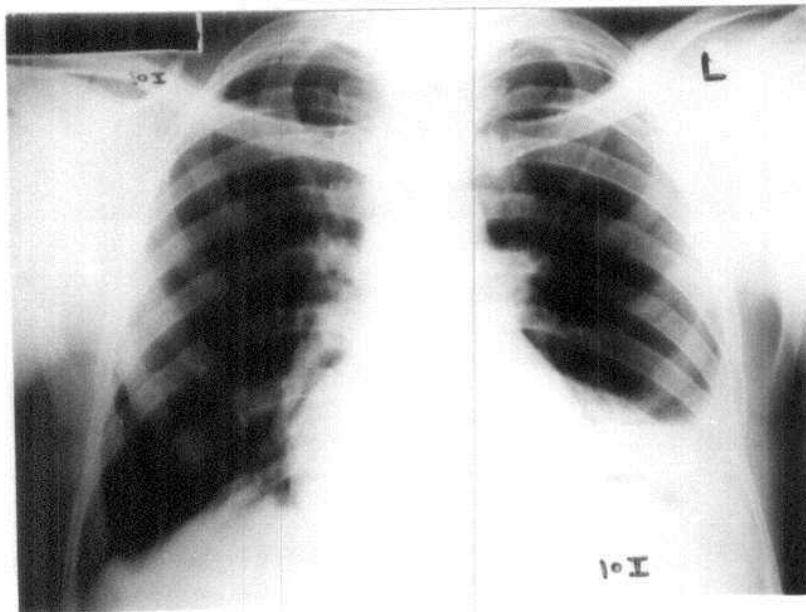


Figure 7: Postoperative chest radiograph for the same (four weeks after surgery): showing left basal lung opacity with left pleural effusion. The left coupla is high with sluggish movement by fluoroscopy. The picture suggested left subphrenic collection (confirmed by ultrasonography).

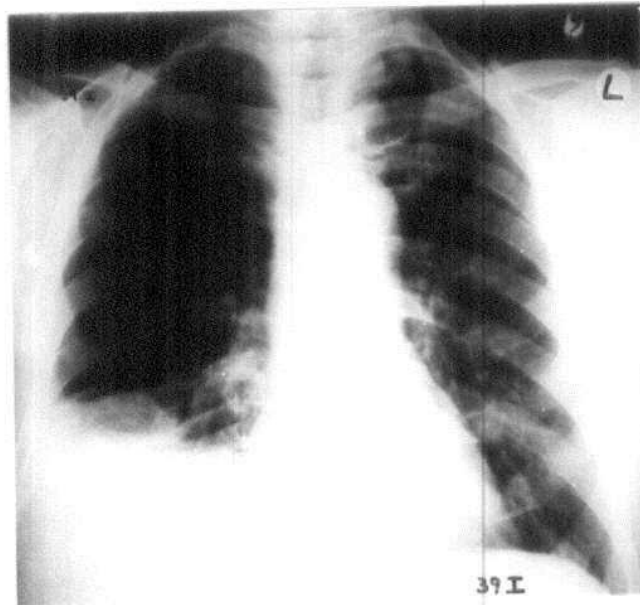


Figure 8: Postoperative chest radiograph for patient No. 39 I (two weeks after surgery): showing right basal lung opacity with right pleural collection. The right coupla is high with sluggish movement by fluoroscopy. The picture suggested right subphrenic collection (confirmed by ultrasonography).

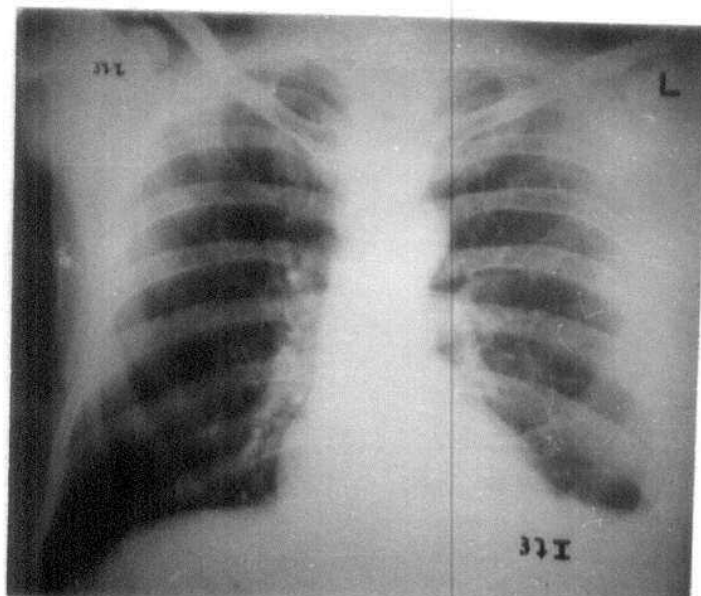


Figure 9: postoperative chest radiograph for patient No. 37 I (24 hours after surgery): showing left sided pleural effusion.

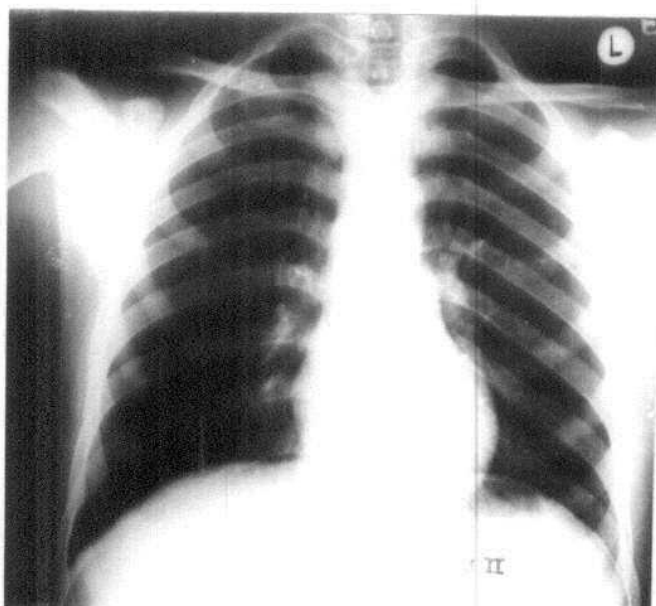


Figure 10: Preoperative chest radiograph for patient No. (8 II): No active lung lesion.

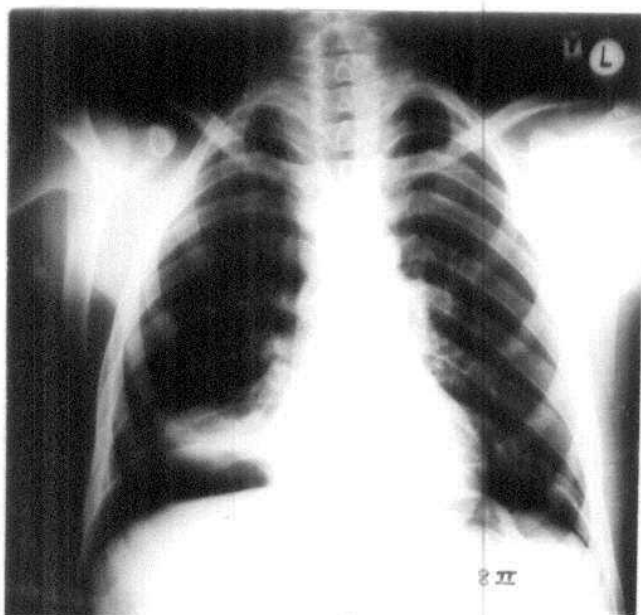


Figure 11: Postoperative chest radiograph for the same patient (24 hours after surgery): showing right basal patch of consolidation. Bilateral pneumoperitoneum elevating both couplae of the diaphragm.

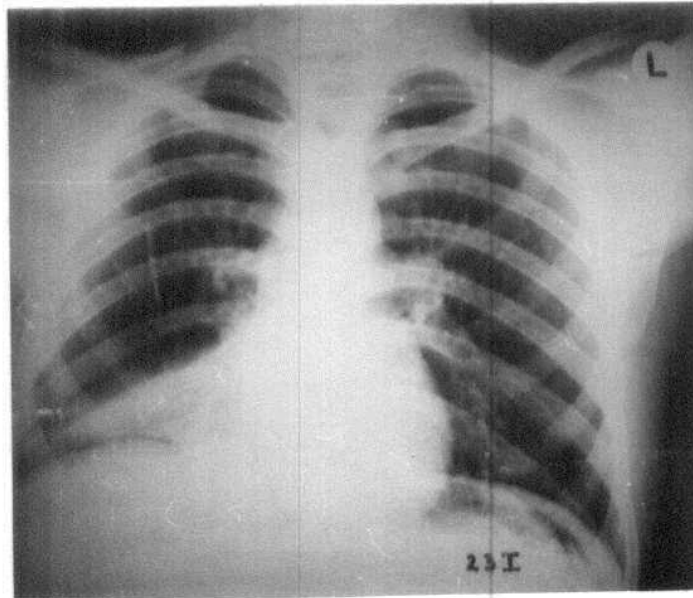


Figure 12: Postoperative chest radiograph for patient No. 23 I (24 hours after surgery): showing right basal patch of consolidation-collapse. Postoperative pneumoperitoneum is seen under elevated right coupla.

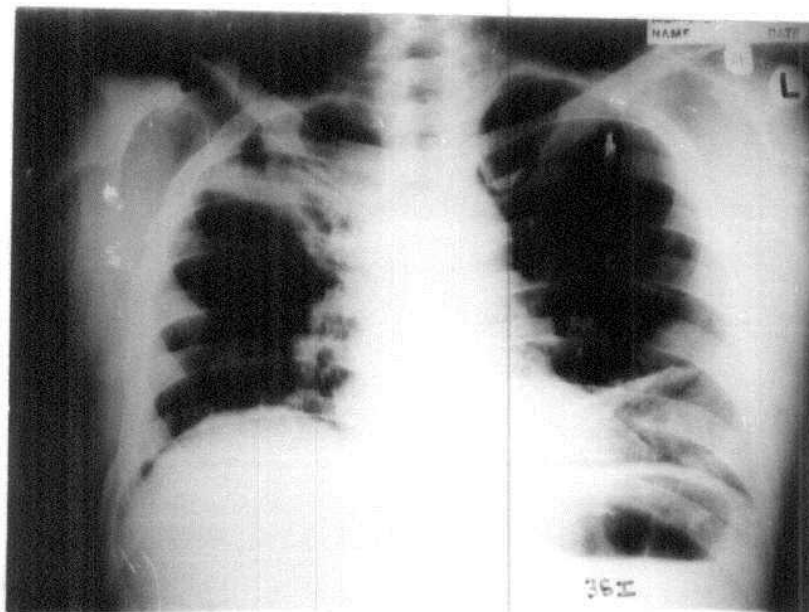


Figure 13: Postoperative chest radiograph for patient No. 36 I (on the 10th. postoperative day) showing partial right upper lobar lung collapse , elevated right coupla of the diaphragm. Left basal linear atelectasis. It was suspected to be left sided pulmonary embolism.

The incidence of postoperative pulmonary complications in relation to age

There was a higher incidence of postoperative pulmonary complications in old age group (40-75 years) compared to young age group (18-39 years) (table IX).

The incidence of postoperative pulmonary complications in relation to sex

There was a higher incidence of postoperative pulmonary complications in males compared to females (table X).

The incidence of postoperative pulmonary complications in relation to smoking

There was a higher incidence of postoperative pulmonary complications in smokers compared to non-smokers (table XI).

The incidence of postoperative pulmonary complications in relation to type of surgery

There was a higher incidence of postoperative pulmonary complications after gastroduodenal (60%), splenic (61.9%) and hepatobiliary surgery (45.5%) (table XII).

The incidence of postoperative pulmonary complications in relation to postoperative air under the diaphragm

- The incidence of postoperative pulmonary complications was higher in patients with postoperative pneumo-peritoneum (60.7%) compared to patients without postoperative pneumo-peritoneum (39.2%) (table XIII).

- The highest incidence of postoperative pneumo-peritoneum was found with atelectasis (90%) (Table XIV).

The incidence of postoperative pulmonary complications in relation to surgical opening of the peritoneal cavity

- The incidence was higher after operations in which the peritoneal cavity was opened (42.38%) compared to operations in which the peritoneal cavity was not opened (14.28%) (table XV).

TABLE IX: THE INCIDENCE OF POSTOPERATIVE PULMONARY
COMPLICATIONS IN RELATION TO AGE.

GROUP AGE	Complicated Group		Non-complicated Group	
	No. of case	%	No. of case	%
18—39 (Years)	8	28.57	30	57.69
40—75 (Years)	20	71.43	22	42.31
Total	28	100.00	52	100

TABLE X: THE INCIDENCE OF POSTOPERATIVE PULMONARY
COMPLICATIONS IN RELATION TO SEX.

Group	Group I*		Group II+		Total	
	No. of Comp.	%	No. of Comp.	%	No. of Comp.	%
Males	15	75.0	4	50.0	19	67.86
Females	5	25.0	4	50.0	9	32.14
Total	20	100.00	8	100.00	28	100.00

* = Upper abdominal surgery.

+ = Lower abdominal surgery.

No. = Number.

Comp. = Complications.

TABLE XI: THE INCIDENCE OF POSTOPERATIVE PULMONARY
COMPLICATIONS IN RELATION TO SMOKING
HABIT.

Group	Group I*		Group II+		Total	
	No. of Comp.	%	No. of Comp.	%	No. of Comp.	%
Smokers	15	75.0	4	50.0	19	67.86
Non-smokers	5	25.0	4	50.0	9	32.14
Total	20	100.00	8	100.00	28	100.00

* = Upper abdominal surgery.

+ = Lower abdominal surgery.

No. = Number.

Comp. = Complications.

TABLE XII: THE INCIDENCE OF POSTOPERATIVE PULMONARY
COMPLICATIONS IN RELATION TO THE TYPE OF
SURGERY.

Types of Surgery	No. of Comp.	Total	Incidence %
- Splenic surgery	13	21	61.9
- Hepatobiliary surgery	5	11	45.45
- Hernias	1	17	5.88
- Genitourinary surgery	3	11	27.27
- Colorectal surgery	3	8	37.50
- Gastroduodenal surgery	3	5	60.00
- Retroperitoneal mass	-	3	0
- Pancreatic Surgery	-	2	0
- Appendicectomy	-	2	0
TOTAL	28	80	35.00

No. = Number.

Comp. = Complications

TABLE XIII: THE INCIDENCE OF POSTOPERATIVE PULMONARY
COMPLICATIONS IN RELATION TO POSTOPERATIVE
AIR UNDER THE DIAPHRAGM.

GROUP	Complicated Cases		Non-complicated Cases		Total	
	No.	%	No.	%	No.	%
No. of cases with postoperative air under diaphragm.	17	60.71	20	38.46	37	46.25
No. of cases without postoperative air under the diaphragm	11	39.29	32	61.54	43	53.75
TOTAL	28	100.00	52	100.00	80	100.00

TABLE XIV: THE TYPES OF POSTOPERATIVE PULMONARY
COMPLICATIONS IN RELATION TO POST-
OPERATIVE AIR UNDER THE DIAPHRAGM.

Types of Complications	No. of Cases*	Total No.	%
- Atelectasis	9	10	90.00
- Simple bronchitis	2	8	25.00
- Pneumonia	4	7	57.19
- Subphrenic abscess	2	3	66.67
- Pleural effusion	2	6	33.33
- Pulmonary embolism	-	1	0

No. = Number.

* = Patients with postoperative pneumo-peritoneum.

TABLE XV: THE INCIDENCE OF POSTOPERATIVE PULMONARY
 COMPLICATIONS IN RELATION TO SURGICAL
 OPENING OF THE PERITONEAL CAVITY.

Group	Intraperitoneal Surgery		Retroperitoneal Surgery		TOTAL
	No.	%	No.	%	
Complicated cases	25	42.38	3	14.28	28
Non-complicated cases	34	57.62	18	85.71	52
TOTAL	59	100.00	21	100.00	80

DISCUSSION

DISCUSSION

The postoperative pulmonary complications remain a major problem following abdominal surgery⁽³⁹⁾. Despite advances in preoperative care, anaesthetic technique and postoperative management, postoperative pulmonary complications are still representing the largest single cause of morbidity and prolonged hospitalization after abdominal surgery⁽²⁾. This is possibly due to the fact that operative treatment is now used for patients who were considered unfit for surgery in the past on the ground of their pulmonary disability⁽³⁾.

In this work, the postoperative pulmonary complications were studied in 80 patients admitted for elective abdominal surgery at the *Medical Research Institute Hospital*. They were classified into two groups according to whether the surgery was upper or lower abdominal, each group included 40 patients.

A preoperative assessment of the patients was carried out by history taking, clinical chest examination and preoperative chest radiographs. All patients were selected free from preexisting pulmonary diseases.

A postoperative assessment of the patients was carried out by both clinical and radiological chest examination in the first 24 hours of postoperative period. Further chest radiographs were taken for patients who developed pulmonary complications later in the postoperative period as detected clinically.

In this study, the incidence of pulmonary complications after abdominal surgery was 35% considering both the clinical and radiological diagnosis.

Harris (1943), Fayed (1980) and Bartlett et al (1973) found that the incidences of pulmonary complications after abdominal surgery were 35%, 27.5% and 42% respectively (39.40.1).

On the other hand, Laszlo et al (1973) found that the incidence of pulmonary complications after abdominal surgery was 55% and this high incidence could be explained by the fact that 37% of their patients were with preexisting pulmonary diseases (20).

Ti et al (1974) and Wightman (1968) found an incidence of 16.2% and 10.3% respectively. These incidences were low because these studies considered the clinical diagnosis only so many complications were missed which were evident radiologically and did not include pulmonary embolism as a pulmonary complication (41.2).

Refr - upper ①

Further analysis of the results showed that the incidence of pulmonary complications after *upper abdominal surgery* was 50%.

Fayed (1980), Latimer et al (1971) and Collins et al (1968) found that the incidences of pulmonary complications after the upper abdominal surgery were 45%, 48% and 52.5% respectively (40.5.13).

On the other hand, Wiren et al (1982) found that the incidence was 60%. This incidence was high because the study was carried out on male patients only of older age (40-75 years) admitted for gastric and biliary surgery which carried a high risk of postoperative pulmonary complications. This study considered postoperative pulmonary hypoxaemia in addition to the clinically and radiologically manifested pulmonary complications (42).

Laszlo et al (1973) found that the incidence was 80% because the study did not exclude patients with preexisting pulmonary diseases (20). Ti et al (1974) and Wightman (1968) found that the incidences of pulmonary complications after upper abdominal surgery of were 28% and 21.2% respectively. These low results were because these studies considered the clinical diagnosis only (41.2).

The incidence of pulmonary complications *after lower abdominal surgery* was 20% and this incidence agrees with the incidences reported by Laszlo et al (1973) and Fayed (1980) which were 29% and 10% respectively(20.40).

The occurrence of postoperative pulmonary complications after abdominal surgery was attributed to many factors discussed by different studies. (P)

After abdominal surgery, *the tidal volume, total lung capacity, functional residual capacity and vital capacity* are reduced in addition to *the alteration of surfactant* which promotes alveolar stability. These changes result in the development of *microatelectasis*(5).

There is a definite change in the pattern of breathing after abdominal surgery where there is a loss of the bellows effect of the diaphragm and a relative decrease in the period of inspiration with each breath producing *monotonous shallow breathing without spontaneous deep breathes*(1.43).

The *impedance* of diaphragmatic movement in the post-operative period is due to restrictive bandaging, *persistent pneumoperitoneum*, surgical interference with respiratory muscles and possibly abdominal pain(3). This abnormal pattern

of breathing in the postoperative period facilitates the progression of microatelectasis into clinically detectable atelectasis. The collapsed alveoli may be perfused but not adequately ventilated resulting in *increased transpulmonary shunting up to 20% of the cardiac output and associated hypoxaemia*⁽⁵⁾.

An upper abdominal incision is associated with a greater degree of hypoxaemia in the postoperative period than a lower abdominal incision, thus the closer the incision to the diaphragm, the marked reduction of pulmonary function⁽⁴⁴⁾.

Postoperative pulmonary function changes usually come and go without being becoming evident, while progression of these changes will produce postoperative pulmonary complications⁽⁴³⁾.

The incidence of postoperative pulmonary complications was higher in *old age group* (71.43%) compared to *young age group* (28.57%).

Fayed (1980), Ti et al (1974), Laszlo et al (1973), Wiklander et al (1957) and Collins et al (1968) found the same result^(40,41,20,45,13).

On the other hand, Wightman (1968) could not find an

increase of the incidence of postoperative pulmonary complications with advancing age⁽²⁾.

The higher incidence of the postoperative pulmonary complications with advancing age in this study could not be attributed to the higher incidence of preexisting pulmonary diseases because these cases were excluded from the study. This result could be a reflection of the age distribution in our patients where 60% of them were above 40 years old.

Nunn (1965) found a significant correlation between advancing age and postoperative hypoxaemia⁽⁴⁶⁾.

The incidence of postoperative pulmonary complications was higher in *males* (67.86%) than in *females* (32.14%).

Fayed (1980) , Ti et al (1974) , Latimer et al (1971) and Wightman (1968) came to the same conclusion^(40,41,5,2).

On the other hand, Wiklander et al (1977) found that the incidence of postoperative pulmonary complications was equal in males and females⁽⁴⁵⁾.

The high incidence of postoperative pulmonary complications in males could be attributed to the difference in smoking habit.

The incidence of postoperative pulmonary complications was higher in *smokers* (67.86%) than in *non-smokers* (32.14%) and this was the same result reported by Fayed (1980), Ti et al (1974), Laszlo et al (1973), Latimer et al (1971), Wightman (1968) and Wiklander et al (1957) (40.41.20.5.2.45).

The relation between smoking habit and postoperative pulmonary complications in this work was not mediated through the preexisting pulmonary diseases because these patients were excluded from the study. This could be attributed to the increase in viscosity of bronchial secretions produced by smoking (45).

Postoperative *pneumoperitoneum* was found to be a risk factor in the development of pulmonary complications after abdominal surgery where 60.71% of patients with postoperative pneumoperitoneum developed pulmonary complications, while only 39.29% of the patients without postoperative pneumoperitoneum developed pulmonary complications in the postoperative period.

Wiklander et al (1957) found the same result (45).

Postoperative pneumoperitoneum was found to impede the diaphragmatic movement, thus interfere with the ventilation of bases of lungs and produce abnormal breathing pattern. These changes help the development of postoperative pulmonary complications particularly atelectasis⁽³⁾.

Postoperative pneumoperitoneum could be considered as normal radiographic finding up to the tenth postoperative day⁽⁴⁵⁾.

The highest incidence of postoperative pulmonary complications was after splenic surgery (61.9%), gastroduodenal surgery (60%), and hepatobiliary surgery (45.45%).

Ti et al (1974) found that the incidence of pulmonary complications after gastroduodenal and biliary tract surgery was almost three times as great as after other abdominal surgery⁽⁴¹⁾.

The incidence of postoperative pulmonary complications was low after operations in which the peritoneal cavity was not opened as pancreatic, retroperitoneal mass and inguinal hernias surgery (zero%). It was 27% after genitourinary surgery.

These results came to the same findings reported by Wightman(1968)⁽²⁾. The low incidence of pulmonary complications after retroperitoneal surgery could be attributed to that the incisions of these operations were away from the diaphragm and the peritoneal cavity was not opened.

The role of *physiotherapy* in the prevention of the post-operative pulmonary complications after abdominal surgery was evaluated by different studies. (1) R

Early ambulation of the patients in the first postoperative day reduces the incidence of subsequent postoperative pulmonary complications after abdominal surgery⁽⁴⁵⁾.

Preoperative deep breathing exercises and postoperative deep breathing and postural drainage of the chest minimize the incidence of postoperative pulmonary complications particularly atelectasis⁽¹⁾.

The value of preoperative breathing exercises is to make the patient familiar with the procedure and could co-operate with the physiotherapist soon after the operation. The application of postoperative physiotherapy twice a day during the immediate postoperative period gives satisfactory results in the prevention of postoperative pulmonary complications⁽⁴⁵⁾.

Bartlett et al (1973) and Van DeWater et al(1972) suggested that postoperative maximal inspiration exercises decrease the incidence of pulmonary complications after abdominal surgery(1,43).

The incentive spirometer is a device which encourages the patient to make a large inspiratory effort, Van DeWater et al (1972) found that incentive spirometer is more effective than intermittent positive pressure breathing in preventing postoperative pulmonary complications(43).

Mandelson et al (1987) and Mann et al (1988) showed that the preoperative chest radiographs were important as a screening device for preexisting cardiopulmonary diseases and as a base line for comparison in patients with postoperative pulmonary complications(47,48).

Postoperative *atelectasis* had the highest incidence of pulmonary complications after abdominal surgery (12.5%) while the incidence of postoperative *pneumonia* was 8.75%.

Atelectasis was much common after upper abdominal surgery (22.5%) than after lower abdominal surgery (2.5%) while postoperative pneumonia was nearly equal in both groups.

Fayed (1980) found a higher incidence of postoperative pneumonia (12.5%) and a lower incidence of postoperative atelectasis (10%)⁽⁴⁰⁾. On the other hand, Ti et al (1974) and Wightman (1968) found that the incidences of postoperative atelectasis and pneumonia were 8.7% and 6.5% respectively. These results were low because these studies considered the clinical diagnosis only^(41,2).

Latimer et al (1971) found that the incidence of postoperative atelectasis was 31.2%. This high incidence was because the study considered spirometric, clinical and radiological diagnosis of postoperative pulmonary complications⁽⁵⁾.

Postoperative *acute bronchitis* was found in 10% of patients and was detected clinically while the postoperative radiographs were free except for the evidence of the right side subcutaneous emphysema in one patient. This was possibly due to the insertion of central venous pressure catheter or excessive positive pressure ventilation.

Ti et al (1974) and Fayed (1980) found acute bronchitis in 7% and 8% respectively in the postoperative patient after abdominal surgery. These findings agreed with the result of the present study^(41,40).

On the other hand, Laszlo et al (1973) found postoperative bronchitis in 22% after abdominal surgery. This incidence was high because the study did not exclude patients with preexisting pulmonary diseases⁽²⁰⁾.

The use of non-sterile lignocaine jelly for lubrication of endotracheal tubes is an important factor in the pathogenesis of postoperative respiratory tract infections⁽¹⁸⁾.

Postoperative *pleural effusion* was found in 12.5% after upper abdominal surgery and in 2.5% after lower abdominal surgery with a total incidence 7.5% after abdominal surgery.

In group I, postoperative pleural effusion was found on the same side of surgery.

Ti et al (1974) and Wightman (1968) found postoperative pleural effusion in 0.9% and 0.22% respectively after abdominal surgery. These low incidences were because these studies considered only the clinical diagnosis of pleural effusion^(41,2).

On the other hand, Light et al (1976) found postoperative pleural effusion in 49% after abdominal surgery and it was more common after upper abdominal surgery. This high incidence was because the patients were subjected to bilateral decubitus

chest radiographs which are very sensitive to detect small pleural effusions which could be missed by the standing chest radiographs(6).

Postoperative pleural effusion in the first few days after abdominal surgery could be due to diaphragmatic irritation during upper abdominal surgery with subsequent increased permeability of the diaphragmatic pleura and accumulation of the pleural fluid.

Postoperative atelectasis may help the development of pleural effusion by two mechanisms; either the loss of volume of atelectatic lung that produces more negative pleural pressure leading to imbalance of the forces governing the formation and reabsorption of pleural fluid favouring the formation of pleural effusion or the minute areas of infection in the atelectatic lung lead to the collection of parapneumonic effusion(12).

In the late postoperative period, pleural effusion could be a manifestation of subphrenic collection, pulmonary embolism, acute pancreatitis or hypervolaemic heart failure(6).

Postoperative *pulmonary embolism* was found in 1.25% after abdominal surgery. It was diagnosed by clinical chest examination, chest radiograph on the tenth postoperative day and electrocardiographic findings. The patient responded to anticoagulant therapy.

This result agrees with that reported by Wightman (1968) who found postoperative pulmonary embolism in 0.9% after abdominal surgery⁽²⁾.

Isotope lung scanning and pulmonary angiography remain the best methods for the diagnosis of pulmonary embolism⁽³⁵⁾.

Postoperative *subphrenic collection* was found in 3.75% and all cases were after upper abdominal surgery particularly splenectomy and cholecystectomy. Elevated coupla of the diaphragm on the affected side with limitation of its movement was present in all cases of postoperative subphrenic collection. These results agreed with that reported by Miller et al (1967)⁽²⁸⁾.

Ziemski et al (1987) suggested that drainage of the subphrenic region should not be routinely undertaken in every case, and if the splenic bed is left dry, drains should be avoided since postsplenectomy subphrenic collection was related to the drainage of subphrenic area⁽⁴⁹⁾.

SUMMARY

SUMMARY

This work was carried on 80 patients admitted for elective abdominal surgery at the Medical Research Institute Hospital aiming at the study of the incidence of postoperative pulmonary complications after abdominal surgery and the correlation of the radiological manifestations of these complications with the clinical presentations.

Their age ranged between 18 and 75 years. They were of both sexes. They were classified into two groups according to whether the surgery was upper or lower abdominal. Each group included 40 patients.

Preoperative assessment of the patients was carried out after 24 hours of the surgery by clinical and radiological chest examination. Further chest radiographs were taken for patients who developed pulmonary complications later in the postoperative period as detected clinically by physicians.

In this study, the overall incidence of postoperative pulmonary complications after abdominal surgery was 35%.

The incidence was higher after upper abdominal surgery (50%) than lower abdominal surgery (20%).

28.5% of the complicated cases were radiologically free and diagnosed clinically as postoperative acute bronchitis, while 25% of the complicated cases were clinically free and diagnosed radiologically as postoperative atelectasis and postoperative pleural effusion.

Atelectasis was the commonest postoperative pulmonary complications (12.5%) especially after upper abdominal surgery (22.5%).

Acute bronchitis was detected clinically in 10% of cases without radiological manifestations in the first 24 hours of postoperative period.

Postoperative pneumonia was detected both clinically and radiologically in 8.75% of cases.

Postoperative pleural effusion was diagnosed in 7.5% of cases and it was much commoner after upper abdominal surgery (12.5%) than after lower abdominal surgery (2.5%).

Postoperative pulmonary embolism was diagnosed in one patient (1.25%) on the tenth postoperative day by the clinical and radiological chest manifestations, in addition to the electrocardiographic features and the response to anticoagulant therapy.

Postoperative subphrenic collection was suggested in 3.75% of the patients in the late postoperative period (between second and fourth postoperative weeks) by both clinical and radiological chest examination and was confirmed by ultrasonographic examination.

The older age group patients, males and smokers were more susceptible to postoperative pulmonary complications.

The incidence of postoperative pulmonary complications was higher in patients with postoperative pneumoperitoneum.

The highest incidence of postoperative pulmonary complications was detected after splenic and gastroduodenal surgery (61.9% and 60% respectively).

Postoperative pulmonary complications were uncommon after operations in which the peritoneal cavity was not opened.

CONCLUSIONS

CONCLUSIONS

1. Postoperative pulmonary complications still represent a major problem after abdominal surgery.
2. Postoperative pulmonary complications were commoner after upper abdominal surgery than lower abdominal surgery.
3. Postoperative pulmonary complications were uncommon after retroperitoneal surgery.
4. Postoperative pneumoperitoneum was a risk factor in the pathogenesis of postoperative pulmonary complications after abdominal surgery.
5. Males, smokers and old age group patients were more liable to develop pulmonary complications after abdominal surgery than females, non-smokers and young age group patients.
6. Atelectasis was the commonest postoperative pulmonary complication after abdominal surgery.
7. Small pleural effusion and linear atelectasis were common after abdominal surgery and most resolve spontaneously without producing clinical manifestations, on the other hand, postoperative acute bronchitis was not associated with radiological changes.

8. It is recommended that all patients undergoing abdominal surgery should be carefully investigated preoperatively by clinical and radiological chest examination, then followed up in the postoperative period clinically and radiologically to diagnose and treat postoperative pulmonary complications as early as possible.

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مواظفة
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RADIOLOGICAL MANIFESTATIONS OF POSTOPERATIVE
PULMONARY COMPLICATIONS OF ABDOMINAL SURGERY

المظاهر الاشعاعية للمضاعفات الرئوية بعد عمليات جراحة البطن

Protocol of a thesis submitted
to the Faculty of Medicine,
University of Alexandria, in
Partial fulfilment of the
Requirements of the degree of
Master of Radiodiagnosis

By

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1989

خطة بحث مقدمة
لكلية الطب
جامعة الاسكندرية
ابناء جزئيا لشروط
الحصول على درجة

ماجستير الاشعة التشخيصية

من

طارق يوسف عبد الرحمن عارف
بكالوريوس الطب والجراحة (الاسكندرية)

طبيب مقيم الاشعة التشخيصية
معهد البحوث الطبية
جامعة الاسكندرية

قسم الاشعة
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الاستاذ الدكتور / سلامه عمر الشيخ
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 أستاذ مساعد الاشعة التشخيصية
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INTRODUCTION

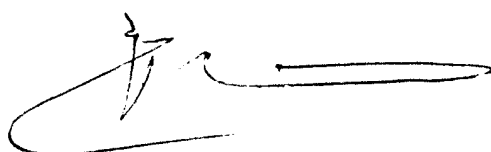
Postoperative pulmonary complications comprise the largest single cause of morbidity and prolonged hospitalization after major abdominal procedures.⁽¹⁾

Despite advances in preoperative care, anaesthetic techniques and postoperative management, the postoperative pulmonary complications remain a major problem.⁽²⁾ This is possibly because operative treatment is now used for patients who were considered unfit for surgery in the past on the ground of their pulmonary disability.⁽³⁾

After laparotomy, twenty to thirty percent of the patients exhibit pulmonary complications and one in eight postoperative deaths is attributable to these pulmonary complications.⁽¹⁾

Hypoxaemia is the most frequent physiologic pulmonary alteration in the postoperative period and may be due to diffuse microatelectasis or differences in the regional distribution of ventilation in the lung.⁽⁴⁾

Most problems of radiographic interest occurring in the first two postoperative days are due to



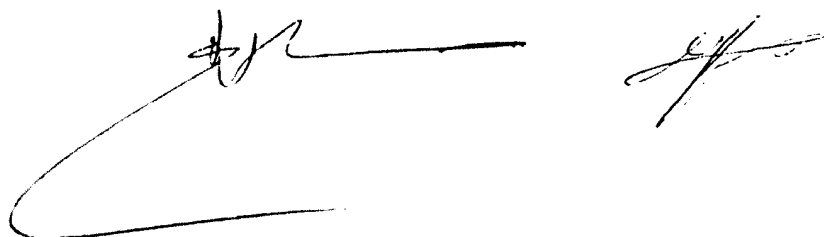
atelectasis, operative or postoperative aspiration or pulmonary oedema, while delayed complications are usually due to infection, pulmonary embolism or the adult respiratory distress syndrome.⁽⁵⁾

The chest radiograph is a valuable aid in evaluating postoperative pulmonary complications, since bed-side radiographs can be taken with the help of the portable chest x-ray technic.⁽⁶⁾

Roentgenography has played a significant role in the diagnosis of subphrenic abscess in the postoperative period.⁽⁷⁾

The lateral decubitus examination can detect a postoperative pneumothorax in patients who cannot stand or to detect small pleural effusions.⁽⁵⁾

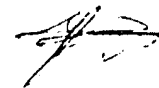
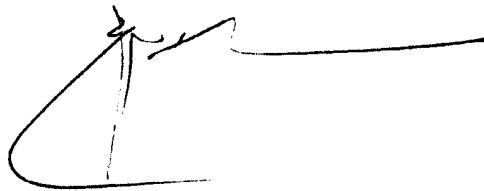
The postoperative radiographic changes as obtained by postoperative chest radiographs together with the patients' clinical state may help the proper diagnosis of postoperative pulmonary complications.⁽⁵⁾

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AIM OF THE WORK

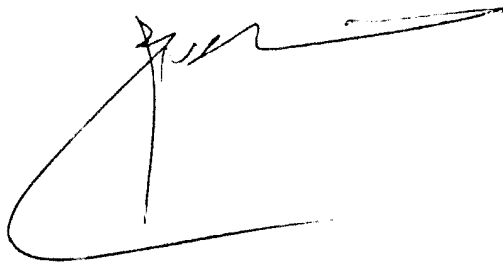
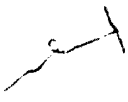
This work aims at:

1. A study of the incidence of postoperative pulmonary complications after abdominal surgery by comparing the pre and postoperative chest radiographs after abdominal surgery.
2. Correlation of the radiological manifestations of these complications and the patient's clinical state.



MATERIAL

This work will include fifty patients who will be admitted to the surgical department of Medical Research Institute hospital for elective abdominal surgery.

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METHODS

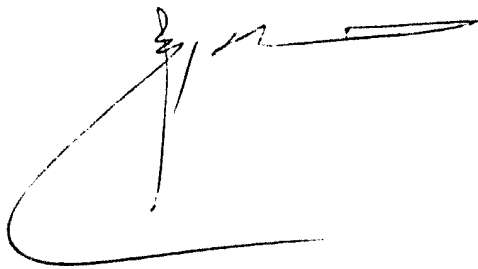
All patients will be subjected to:

I. Preoperative assessment by:

1. History taking.
2. Clinical chest examination.
3. A preoperative plain chest x-ray.

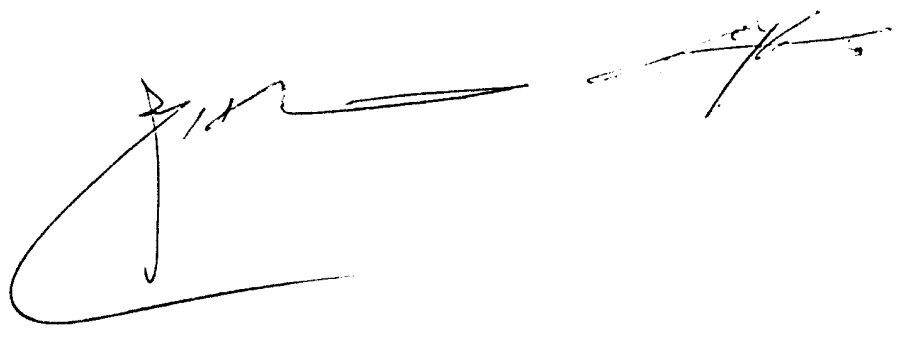
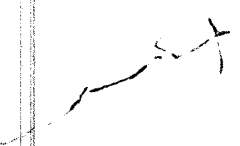
II. Postoperative follow-up: by

1. 24 hour postoperative chest x-ray.
2. Clinical chest examination.
3. Patients who will develop late postoperative pulmonary complications will be examined by further radiographs.

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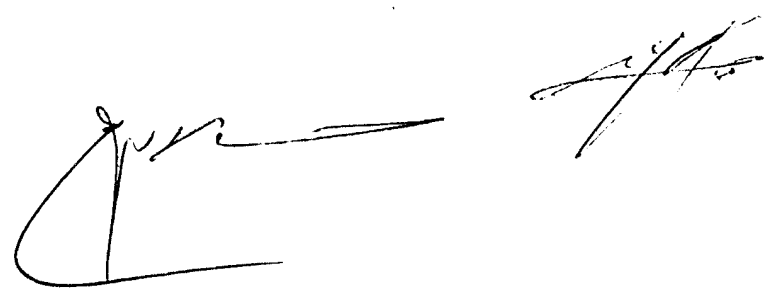
RESULTS

The results of this study will be analysed, tabulated and statistically oriented.

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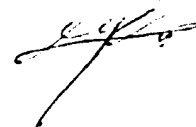
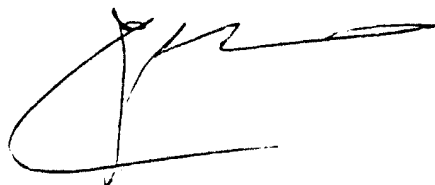
DISCUSSION

The findings of this study will be discussed in view of the achievement of the aim, their significance and their comparison with other available works and information.

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ARABIC SUMMARY

الملخص العربي

بسم الله الرحمن الرحيم .

"المظاهر الإشعاعية للمضاعفات الرئوية بعد
جراحة فتح البطن." "

الملخص العربي

ما زالت المضاعفات الرئوية بعد جراحة فتح البطن تمثل أكبر سبب منفرد لسوء حالة المريض و طول مدة بقائه بالمستشفى بعد الجراحة .

و لقد كان الهدف من هذا البحث دراسة نسبة المضاعفات الرئوية بعد جراحة فتح البطن. و مفاهاة المظاهر الإشعاعية لهذة المضاعفات مع العلامات الإكلينيكية .

و أجريت هذة الدراسة على ٨٠ مريضاً أدخلوا إلى مستشفى معهد البحوث الطبية لإجراء جراحة فتح البطن. و قد تراوحت أعمارهم ما بين ١٨ ، ٧٥ عاماً و قد كانوا من الجنسين .

فى هذة الدراسة قسم المرضى إلى مجموعتين: المجموعة الاولى و اشتملت على ٤٠ مريضاً أدخلوا لإجراء جراحة بالجزء العلوى من البطن و المجموعة الثانية و اشتملت على ٤٠ مريضاً أدخلوا لإجراء جراحة بالجزء السفلى من البطن .

و قد تم تقييم حالة المرضى قبل إجراء الجراحة بأخذ التاريخ المرضى لهم و فحص الصدر إكلينيكيًا و بالأشعة العادية . و قد اختير المرضى فى هذه الدراسة خاليين من الأمراض الرئوية .

ثم جرى تقييم حالة المرضى بعد إجراء الجراحة بواسطة فحص الصدر إكلينيكيًا و بالأشعة العادية بعد ٢٤ ساعة من إجراء الجراحة . و أخذت أشعات عادية للصدر أخرى للمرضى الذين ظهرت عليهم علامات إكلينيكية لمضاعفات رئوية فيما بعد خلال فترة مابعد الجراحة لوحظت بواسطة الطبيب المعالج .

و قد كانت النسبة الكلية للمضاعفات الرئوية بعد جراحة فتح البطن هى ٣٥% . و كانت النسبة أعلى بعد جراحة الجزء العلوى من البطن (٥٠%) عنها بعد جراحة الجزء السفلى من البطن (٢٠%) .

و جد أن ٢٥% من حالات المضاعفات الرئوية خالية من العلامات الإكلينيكية . و قد شخصوا بواسطة أشعة الصدر العادية بعد الجراحة همود رئوى و إنصباب بلورى .

بينما كانت نسبة ٢٨,٥% من حالات المضاعفات الرئوية خالية من المظاهر الإشعاعية و قد شخصوا بواسطة الفحص الإكلينيكى للمدر كالتهاب شعبى حاد بعد الجراحة .

كانت حالات الهمود الرئوى أكثر المفاعفات شيوعاً (١٢,٥%) بعد جراحة فتح البطن و كانت النسبة بعد جراحة الجزء العلوى من البطن (٢٢,٥%) أعلى منها بعد جراحة الجزء السفلى (٢,٥%). و وجد الهمود الرئوى على نفس الناحية التى أجريت فيها الجراحة فى ٨٠% من المرضى.

و بالنسبة للإلتهاب الشعبى الحاد فقد شخص فى ١٠% من المرضى بعد إجراء الجراحة بواسطة العلامات الإكلينيكية على المدر.

أما الإلتهاب الرئوى فقد شخص فى ٨,٧٥% من المرضى خلال الايام الأربعة الأولى بعد إجراء الجراحة بواسطة العلامات الإكلينيكية والمظاهر الإشعاعية بالمدر.

و بالنسبة للإنصباب البلورى فقد وجد فى ٧,٥% من المرضى بعد إجراء الجراحة و كانت نسبة بعد جراحة الجزء العلوى من البطن (١٢,٥%) أعلى منها بعد جراحة الجزء السفلى من البطن (٢,٥%). و كانت نصف حالات الإنصباب البلورى خالية من العلامات الإكلينيكية.

و قد اشتبه فى حالات الإلتهاب تحت الحجاب الحاجز نسبة ٣,٧٥% من المرضى بواسطة العلامات الإكلينيكية و أشعة المدر العادية ما بين الأسبوع الثانى و الرابع بعد إجراء الجراحة. و قد أكد فحص الموجات فوق الصوتية هذا التشخيص.

أما السدة الرئوية فقد شخمت فى مريض واحد بنسبة ١,٢٥% فى اليوم العاشر بعد إجراء الجراحة بواسطة العلامات الإكلينيكية و أشعة الصدر العادية و بواسطة التفويرات فى رسم القلب و باستجابة المريض سريعاً للعلاج بواسطة الأدوية المضادة للتجلط.

و قد كانت نسبة المفاعلات الرئوية فى المرضى ذوى الأعمار أكثر من ٤٠ عاماً (٧١,٤٣%) أعلى منها فى المرضى ذوى للأعمار أقل من ٤٠ عاماً (٢٨,٥٧%). و كذلك كانت نسبة المفاعلات الرئوية فى الذكور (٦٧,٨٦%) أعلى منها فى الإناث (٣٢,١٤%) و فى المدخنين (٦٧,٨٦%) أعلى منها فى الغير مدخنين (٣٢,١٤%).

و كانت النسبة فى المرضى الذين وجد فيهم تجمع هوائى تحت الحجاب الحاجز (٦٠,٧١%) أعلى منها فى المرضى الذين لم يوجد فيهم هذا التجمع الهوائى تحت الحجاب الحاجز بواسطة أشعة الصدر بعد إجراء الجراحة (٣٩,٢٩%). و قد كان ملحوظاً جداً مع الحالات الهمود الرئوى حيث و جد تجمع هوائى تحت الحجاب الحاجز فى أشعة الصدر العادية بعد إجراء الجراحة فى ٩٠% من هؤلاء المرضى.

الإشعاع

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المظاهر الإشعاعية للمضاعفات الرئوية بعد جراحة فتح البطن

بحث مقدم

لكلية الطب - جامعة الاسكندرية
إيفاء جزئياً لشروط الحصول على درجة

ماجستير الأتعة التثنيمة

من

طارق يوسف عبد الرحمن عارف
بكالوريوس الطب و الجراحة (الاسكندرية)

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جامعة الاسكندرية
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