

Impact of Chest CT Screening During COVID-19 in Discovering Incidental Thoracic Lesions

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Abstract

Background: Corona virus disease (COVID-19) has become a global pandemic on March 11, 2020. SARSCoV-2 causes damages in multiple organs and tissues. Chest CT possesses an essential role in the diagnosis and follow-up of patients infected with COVID-19 pneumonia.

It should also be taken into account that by doing large number of chest CT scans during the pandemic, it helped in the early diagnosis of many deadly hidden thoracic lesions.

Aim of Study: This study aimed was to evaluate the incidental lung lesions found during routine chest CT screening during first and second waves of COVID-19 pandemic. High light the role of routine chest CT in early detection of many thoracic lesions needs surgical intervention.

Patients and Methods: This retrospective cross-sectional cohort study included patients of both sex from age 18 to 70 years old with incidentally detected lung lesions on routine chest CT during the first and second waves of COVID-19 pandemic then were surgically treated at our Department of Thoracic Surgery.

With evaluation and follow-up of previously COVID-19 positive patients preoperative and ideal time for surgical intervention post corona virus infection.

Results: The study was applied on 110 patients and (51.82%) was asymptomatic to any complaint (48.3%) had hidden thoracic lesion threatening life as lung, pleural cancers and emphysematous pulmonary lesions (31%, 17.3% respectively) and early diagnosis using chest CT screening during COVID-19 helped in improve outcome. And it's also recommended patients who were previously diagnosed with COVID-19 should postpone any thoracic surgical intervention for at least 6 weeks.

Conclusion: Large number of Chest CT that were performed during pandemic had great effect in early diagnosis of life threatening thoracic lesions.

Key Words: COVID-19 – Corona virus – Chest CT – Thoracic surgery – Pandemic.

Introduction

CORONAVIRUS disease (COVID-19) has become a global pandemic on March 11, 2020 [1,2]. COVID-19 pathological reports have shown that SARSCoV-2 causes damages in multiple organs and tissues, with severe lung involvement similar to that found in other coronavirus infection. Chest CT possesses an essential role in the diagnosis and follow-up of patients infected with COVID-19 pneumonia [3].

Radiologists should be familiar with chest CT scan findings of COVID-19 pneumonia and its differential diagnosis. Typical imaging features are commonly seen during the pandemic are peripheral bilateral ground glass opacities (GGO) with or without consolidation, crazy-paving pattern, reverse halo sign or other findings related to organizing pneumonia, and multifocal GGO of the rounded morphology with or without consolidation or visible intralobular lines (crazy-paving) [4].

It should also be taken into account that by doing large number of chest CT scans during the pandemic, it helped in the early diagnosis of many deadly hidden thoracic lesions.

Aim of the work:

Detect and Evaluate the incidental lung lesions found during routine chest CT screening during first and second waves of COVID-19 pandemic that were surgically treated at the Cardiothoracic Surgery Department of Ain Shams University from January 2020 to December 2022.

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Patients and Methods

This retrospective cross-sectional cohort study included 110 patients of both sex from age 18 to 70 years old with incidentally detected lung lesions on routine chest CT during the first and second waves of COVID-19 pandemic who were surgically treated at the Cardiothoracic Surgery Department Ain Shams University from January 2020 to December 2022 with excluding patients with age less than 18 years old and more than 70 years old or Patients with suspected symptoms or finding of COVID-19 without any surgical thoracic lesion in chest CT needed thoracic surgical intervention or Patients refuse giving consent for study or Patients who lost during the study.

The study was conducted after an approval from Local Ethical Committee.

All data were collected and organized in EXCEL spreadsheet and All statistical analyses were carried out using SPSS program data were expressed as mean and standard deviation for continuous data or number and percent for categorical data. Comparison of independent groups of data was done using *t*-student test for continuous data or Chi-square for categorical data. *p*-value was considered significant if less than 0.05.

Results

110 patients who underwent surgical resection due to incidental finding of lung lesions in period from 2020 to 2022 at Department of Cardiothoracic Surgery.

Most of cases 59 of total 110 found cases were men and 51 were women.

Their were 84 patients (76.4%) aged from 40 to 60 years old & 26 patients (23.6%) aged from (60-70 years old). With mean age was 46.32 ± 14.51 years old. As shown in Table (1).

Table (1): Demographic characteristics of patients with incidental thoracic lesions during Covid-19 pandemic.

Variables	Number (n=110)	Percent
Age:		
<60 years	84	76.4
>60 years	26	23.6
Gender:		
Male	59	53.6
Female	51	46.4

As shown in Table (2), the most frequent clinical feature in the studied patients was asymptomatic (51.82%), followed by persistent cough (18.18%), fever (14.55%), dyspnea (7.27%), chest pain (6.36%) and diarrhea (1.82%).

Table (2): Clinical features in patients with incidental thoracic lesions during Covid-19 pandemic.

Variables	Number (n=110)	Percent
Asymptomatic	57	51.82
Persistent cough	20	18.18
Fever	16	14.55
Dyspnea	8	7.27
Chest pain	7	6.36
Diarrhea	2	1.82

As shown in Table (3) most of the patients (89.1%) had negative test for Covid-19, while a small proportion (10.9%) had positive test. Most of positive cases were discharged after operation after recovery of Covid-19 without complications (75%), while (25%) developed complications as Empyema & wound infection & Lung collapse or Continuous air leak. Elective operation was done on Covid-19 positive patients without complication after 7 weeks in one patient, 8 weeks in 5 patients, and 10 weeks in 3 patients. Elective operation was done on Covid-19 positive patients with complication after 4 weeks in 2 patient, and 5 weeks in one patient as patients with other comorbidity as diabetes mellitus and tuberculosis and developed moderate air leak, bronchopleural fistula and respiratory failure.

Table (3): Results of serology test for Covid-19 in patients with incidental thoracic lesions during Covid-19 pandemic, incidence of complication in patients post COVID-19 infection, Period for elective thoracic surgery post Covid-19 without and with complications.

Serology for COVID-19	Number (n=110)	Percent
Negative	98	89.1
Positive	12	10.9
Patients with complication	Number (n=12)	Percent
Negative	9	75
Positive	3	25
Period for elective thoracic surgery after positive Covid-19 without complications	Number (n=9)	Percent
7 weeks	1	11.11
8 weeks	5	55.56
10 weeks	3	33.33
Period for elective thoracic surgery after positive Covid-19 with complications	Number (n=3)	Percent
4 weeks	2	75
5 weeks	1	25

As shown in Table (4) the most frequent incidental thoracic lesions was lung mass (26.5%), followed by mediastinal mass (18.2%), lung bullous lesion (17.3%), lung cavitory lesion (14.5%), pleural mass or thickening (6.4%), bronchiectasis (4.5%), chest wall mass (3.6%), diaphragmatic hernia (3.6%), lung nodule (3.6%), lung cyst (0.9%), and mediastinal lymphadenopathy (0.9%).

Table (4): Types of incidental thoracic lesions during Covid-19 pandemic.

Incidental lesions	Number (n=110)	Percent
Lung mass	29	26.5
Mediastinal mass	20	18.2
Lung bullous lesion	19	17.3
Lung cavitory lesion	16	14.5
Pleural mass or thickening	7	6.4
Bronchiectasis	5	4.5
Chest wall mass	4	3.6
Diaphragmatic hernia	4	3.6
Lung nodule	4	3.6
Lung cyst	1	0.9
Mediastinal lymphadenopathy	1	0.9

As shown in Table (5) the pathological diagnosis of incidental thoracic lesions during Covid-19 pandemic after surgical excision included: Emphysematous bullous lesion (17.3%), chronic lung abscess (13.6%), squamous cell carcinoma (10%), large cell lung cancer (7.3%), lung adenocarcinoma (7.3%), thymoma (6.4%), neuro-fibroma (5.5%), carcinoid tumor (5.5%), bronchiectasis (4.5%), and other miscellaneous lesions.

As shown in Table (6) the overall frequency of postoperative complications was 13.6%. The postoperative complications included: Continuous air leak for 2 weeks (2.7%), continuous air leak for 1 week (1.8%), empyema and wound infection (1.8%), hidden brain mets (0.9%), lung collapse & wound infection (0.9%), moderate air leak for 3 months and wound infection (0.9%), isolated wound infection (0.9%), chylothorax & trapped lung with thick peel with air leak for 1 month (0.9%), isolated chylothorax (0.9%), continuous air leak for 3 weeks and wound infection (0.9%), and continuous air leak with broncho-pleural fistula (0.9%) as shown in Table (7).

Table (8) shows the comparison of postoperative complications according to positivity of Covid-19 revealed non-significant differences.

Table (5): Pathological diagnosis of incidental thoracic lesions during Covid-19 pandemic.

Pathology	Number (n=110)	Percent
Emphysematous bullous lesion	19	17.3
Chronic lung abscess	15	13.6
Squamous cell carcinoma	11	10
Large cell lung carcinoma	7	6.4
Adenocarcinoma	7	6.4
Thymoma	7	6.4
Neuro-fibroma	6	5.5
Carcinoid tumor	6	5.5
Bronchiectasis	5	4.5
Elasto-fibroma	4	3.6
Noncancerous lung nodule	4	3.6
Diaphragmatic hernia (Left)	3	2.7
Chronic inflammatory pleurisy	2	1.8
Schwannoma	2	1.8
Solitary fibrous tumor	2	1.8
Small cell lung carcinoma	1	0.9
Bronchogenic cyst	1	0.9
Diaphragmatic hernia (Right)	1	0.9
Fungal ball	1	0.9
Inter-lobar sequestration	1	0.9
Leiomyosarcoma	1	0.9
Lymphoma Hodgkin	1	0.9
Lymphoma Large B cell	1	0.9
mediastinal	1	0.9
Mesothelioma		
PECOMA tumor	1	0.9
Pleural lipoma	1	0.9
Pleuro-pericardial lipoma	1	0.9
Sarcoidosis	1	0.9
Undifferentiated round cell tumor	1	0.9

Table (6): Overall frequency of postoperative complications in patients with incidental thoracic lesions during Covid-19 pandemic.

Outcome	Number (n=110)	Percent
No complication	95	86.4
Complications	15	13.6

Table (7): Types of postoperative complications in patients with incidental thoracic lesions during Covid-19 pandemic.

Complications	Number (n=110)	Percent
Continuous air leak for 2 weeks	3	2.7
Continuous air leak for 1 week	2	1.8
Empyema & wound infection	2	1.8
Hidden brain metastasis	1	0.9
Lung collapse & wound infection	1	0.9
Moderate air leak for 3 months & wound infection	1	0.9
Wound infection	1	0.9
Chylothorax	1	0.9
Chylothorax & trapped lung with thick peel with air leak for 1 month	1	0.9
Continuous air leak for 3 weeks & Wound infection	1	0.9
Continuous air leak with broncho-pleural fistula	1	0.9

Table (8): Distribution of postoperative complications according to positivity of Covid-19 in patients with incidental thoracic lesions during Covid-19 pandemic.

Complications	Negative (n=98)	Positive (n=12)	p-value
No complication	86 (87.8%)	9 (75%)	0.22
Chylothorax	1 (1%)	0 (0%)	1
Chylothorax+ Prolonged air leak	1 (1%)	0 (0%)	1
Hidden brain metastasis	1 (1%)	0 (0%)	1
Prolonged air leak	4 (4.1%)	1 (8.3%)	0.44
Prolonged air leak + Broncho-pleural fistula	0 (0%)	1 (8.3%)	0.10
Wound infection	1 (1%)	0 (0%)	1
Wound infection + Empyema	1 (1%)	1 (8.3%)	0.20
Wound infection + Lung collapse	1 (1%)	0 (0%)	1
Wound infection + Prolonged air leak	2 (2%)	0 (0%)	1

Discussion

In the period from 2020 to 2022, all concerns were directed to the dark side of COVID-19, but this paper is an attempt to focus on the bright side of COVID-19.

The serious role played by diagnostic imaging has increased the number of CT examinations performed and, as chest CT became more widely used, radiologists began to detect a wave of findings unrelated to the clinical indications for which the examinations were recommended [6,7]. Radiologists have now specified some of the visual physical characteristics such as lesion size, assessment, and surrounding cystic airspace, distinguish benign or malignant lesions. The radiological characteristics can quanti-

tatively capture the shape, volume, size, and texture of the tumor from normal tissue area [8,9].

In our study most of patients were males under the age of sixty years old with a percentage of 53.6%, 76.4% respectively. The attention was given to patients who didn't suffer from any complaints and chest CT scan was done because of their contact with infected patient of COVID-19 or because of the severe state of terror that most people suffered from due to the pandemic. It turned out that (51.8%) of patients suffer from thoracic lesions that require surgical intervention without any complaints or pain, Thus chest CT has become a valuable tool to support diagnosis in patients in addition to its utility for monitoring progress and detecting possible complications [9].

COVID-19 PCR analysis was performed to all patients before any surgical intervention, as a procedure followed during the pandemic, It was found that (10.9%) of the patients were PCR positive for COVID-19. Only three patients (25%) of the total positive patients with COVID-19 suffered from complications after surgical intervention, and the difference between patients who were positive for COVID-19 is the element of the time in which the surgical intervention was performed after the positive diagnosis with COVID-19, Only three patients had complications due to the early procedure of surgery in time less than six weeks duration, while the patients who were operated after six weeks didn't have any complications.

Centers for disease control and prevention reported the time that COVID-19 recovered patients should remain isolated for at least 10 days after onset of symptom and for at least 3 days after recovery [10].

Another prospective study demonstrated that acute respiratory infection in the month before surgery was an independent risk factor for postoperative lung complications [11], airway hypersensitivity following an upper respiratory infection may last 2–6 weeks and may lead to surgical complications [12].

A recent multicenter cohort study of 1,128 COVID positive patients undergoing emergent (74%) and elective (26.1%) surgeries noted that pulmonary complications occurred in 51.2% of patients with a thirty days mortality of 38% (82% of all deaths were due to COVID-19 infection). (13) The authors noted that during the COVID-19 era in Wuhan, China, 34 patients who were asymptomatic with COVID-19 and undergoing elective surgeries developed severe complication postoperatively. Postoperative ICU admissions were 44.1% with 20.5% COVID-19 related mortality within 4 weeks [14]. The mortality rate was much higher than expected for similar surgeries in patients without COVID-19.

Recent guidelines for triage of lung cancer surgery during the COVID-19 pandemic highlight different “phases” based on hospital resources and COVID-19 prevalence. As example “Phase I” when capacity is widely preserved, immediate surgery is recommended for solid or predominantly solid lung cancers over 2cm, node positive cancers and cancer post neoadjuvant therapy [15].

In our study pathological analysis was done for all samples that were resected from the patients and it was found that the most hidden surgical thoracic lesions are cyst lung lesions (34 case 30.9%) and lung cancers (32 case 29%) which may affect patient’s life and may lead to death.

In a retrospective study conducted with a large autopsy series in which incidental findings were investigated, primary lung cancer was detected in 0.87% of the cases (217/24.708) [16]. In another study investigating the incidental findings in CT scans for lung cancer screening, the primary lung was diagnosed in 0.62% (2/320) of patients [17].

In the CT scans performed for lung cancer by Morgan et al., incidental findings were detected in 69.6% of the patients (n=223) in the respiratory system. Among these findings, the most common finding was emphysema (50.6%), bronchial wall thickening (39.4%), and atelectasis (16.3%) [19]. In the study of Jacobs et al., the frequency of bronchiectasis was 0.72-9.8%, mediastinal lymphadenopathy (0.13-3.0%) [18].

In our study the frequency of emphysema (17.3%), frequency of bronchiectasis (4.5%) and mediastinal lymphadenopathy (0.9%).

Early-stage lung cancers are mainly detected in thoracic imaging studies (lung cancer screening or an incidental finding) [19]. The national lung screening trials reported chest CT screening of patients at high risk for developing lung cancer that mortality due to lung cancer decreased from 309 deaths per 100000 person-years in the radiography group to 247 deaths from lung cancer per 100000 person-years in the low-dose CT group, a decrease of 20%, with 6.7% fewer patients dying in the low-dose CT group [20].

In our study patients were followed in the ward or ICU to track the occurrence of early complications after the surgery. It was found that the complications occurred at a rate of (13.6%), and all of complications are common after chest exploration operations for chest tumor and others, but the complications with previously COVID-19 infected patients who went to perform surgery before six weeks after the diagnosis with COVID-19 were due to general affection of the lung tissue led to the occurrence of prolonged air leak and broncho-pleural fistula in two patients, and deficiency in the immune

system led to the occurrence of wound infection and empyema.

Conclusion:

Massive chest CT scans that were conducted during COVID-19 era helped in early diagnosis and management of hidden thoracic lesions which could have led to patients death with the late diagnosis, especially lung cancers.

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تأثير الأشعة المقطعية على الصدر التي تم استخدامها كإجراء روتيني في التشخيص أثناء جائحة كورونا في تشخيص عدد من الأمراض الصدرية عن طريق المصادفة

أثبتت التقارير الطبية المختلفة أن كوفيد-١٩ الذي عرف كجائحة عالمية طبقاً لتقارير منظمة الصحة العالمية في ١١ مارس ٢٠٢٠ يسبب اضرار متعددة بأنسجة الجسم وكذلك أنسجة الرئة كمثل جميع سلالة SARS-CoV-2

وتلعب الأشعة المقطعية على الصدر دوراً أساسياً في تشخيص ومتابعة المرضى المصابين بالتهاب الرئوى نتيجة الإصابة بكوفيد-١٩.

ويجب ان يأخذ بالاعتبار أنه خلال هذه الجائحة تم اجراء عدد كبير من فحوصات الأشعة المقطعية على الصدر كإجراء روتيني أثناء الموجتين الأولى والثانية للاشتباه الإصابة بفيروس كوفيد-١٩ والتي قد ساعدت في التشخيص المبكر لكثير من أمراض الرئة والقفص الصدري التي تحتاج إلى التدخل الجراحي لإستئصالها والتي كانت من الممكن ان تؤثر بالسلب على حياة المرضى أو قد تؤدي إلى الوفاة مع التشخيص المتأخر لمثل هذه الأمراض خاصة أورام الرئة وأمراض التكيسات الهوائية بالرئة وهذا هو الهدف من هذه الدراسة وهو تسليط الضوء على اهم الامراض الصدرية التي تؤدي إلى نتائج ايجابية مع التشخيص والعلاج المبكر لها.

تم تطبيق الدراسة على ١١٠ مريض وكان (٨٢,٥١٪) بدون أعراض لأي شكوى. (٣,٤٨٪) كان لديهم آفة صدرية خفية تهدد الحياة مثل سرطان الرئة وأفات الرئة الانتفاخية (٣١,٣٪، ١٧,٣٪) والتشخيص المبكر باستخدام الاشعة المقطعية للصدر أثناء كوفيد-١٩ ساعد في تحسين النتيجة. ويوصى أيضاً بأن يؤجل المرضى الذين تم تشخيصهم بكوفيد-١٩ أى تدخل جراحى فى الصدر لمدة ٦ أسابيع على الأقل.