

Prevalence and Characteristics of Abnormal Pre-Operative Chest X-Rays in Patients Undergoing Elective Surgery

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Objective: To determine the prevalence of pre-operative abnormal chest x-rays (CXRs) in patients undergoing elective surgery, and to describe the management of the patients with abnormal CXRs. In addition, we question whether the healthy patients aged more than 45 years really needs pre-operative chest radiographs.

Material and Method: Patients undergoing elective surgery between June 2013 and May 2014 were recruited, and medical records were retrospectively reviewed.

Results: Data for 960 patients was included. CXRs were abnormal in 485 patients (50.5%), with cardiomegaly being the most common abnormality. Among patients who had pre-operative abnormal CXRs, 91 patients (18.8%) required consultation or other investigation pre-operatively, and three patients (0.6%) had their treatment plans altered. Comparing between age groups, there was no different of abnormal results (p -value = 0.606).

Conclusion: Prevalence of pre-operative abnormal CXRs was high; however, the abnormalities seldom led to changes in case management.

Keywords: Pre-operative chest x-ray, Elective surgery, Screening test

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Pre-operative evaluation and investigation are important for identifying patients at risk and decreasing the number of perioperative morbidities and mortalities. As a result of systematic reviews, we found that abnormal pre-operative chest radiographs were identified in 0.3% to 64.7% of cases, but anesthetic managements were changed for only 0% to 13.3% of the abnormal results⁽¹⁻⁵⁾. Inappropriate investigation results in unnecessary expenses, while a lack of informative investigation might lead to anesthetic-related complications or postponement of a procedure if an abnormality is detected later.

Chest x-rays are recommended by the American Society of Anesthesiologists⁽⁶⁾ in patients with a history of smoking, recent respiratory tract infection, chronic obstructive pulmonary disease, and heart disease. Joo et al⁽¹⁾ recommended that patients aged less than 70 without any risk factors did not

require pre-operative chest x-rays. Since Thailand is considered to be an endemic area of tuberculosis, some patients have received chest x-rays for this reason. According to the World Health Organization⁽⁷⁾, Thailand was 1 of 22 high-burden countries, with the prevalence of tuberculosis being 161:100,000 in 2011. Two studies in Thailand during the 1990s showed that tuberculosis was found in 1.2% and 5.35% of pre-operative chest x-rays^(8,9). In general, Thais do not have regular health surveillance, and they are at risk of developing unrecognized tuberculosis. The Siriraj Preanesthesia Assessment Center (SiPAC) recommends that healthy patients aged more than 45 without comorbidity should have chest radiographs prior to anesthesia. This study aims to determine the prevalence and type of abnormal chest x-rays in pre-operative patients undergoing elective surgery, and to describe the management of those patients with abnormal chest x-rays. In addition, we question whether the healthy patients aged more than 45 really needs pre-operative chest radiographs.

Material and Method

After approval from the Institutional Review

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Board, we recruited the data of patients undergoing elective surgery in Siriraj Hospital between June 2013 and May 2014. Anesthetic records for the period were retrieved from the Department of Anesthesiology, and then chest electronic radiographic reports were accessed. The data of patients that met the following criteria was included in the study: elective surgery in all divisions; a pre-operative chest x-ray with an official report by a radiologist; aged more than 18; and an American Society of Anesthesiologists (ASA) physical status classification of 1, 2, or 3. Pregnant women and patients with incomplete medical records or uninterpretable chest x-rays (i.e., with images of suboptimal inspiration) were excluded. The study was a descriptive study with stratified, random sampling by hospital division. Electronic medical records of the first 80 eligible patients in each month were retrospectively reviewed by one of the two anesthesiologists in the team (SD or TK).

Outcomes

We retrieved demographic data, indications for chest x-rays, and results of chest x-rays. In the event that abnormal results were reported, we classified the abnormalities into three groups: a cardiac group, a pulmonary group, and another-lesions group. We identified whether patients with abnormal chest x-rays needed further consultation, investigation and treatment, or not. The effects of abnormal chest x-rays on the patients' operations were classified into no further management, postponement, cancellation, and alteration of management. All patients with abnormal chest radiographs were assessed for tuberculosis.

Sample size calculation and statistical analysis

According to a previous study⁽²⁾, routine pre-operative chest x-rays revealed abnormalities in 12% of patients undergoing elective and emergency surgery. Since the present study was conducted in a population aged more than 18, we estimated that the prevalence of abnormal chest x-rays would approximate 10%, with a 95% confidence interval (CI) of 2%. The calculated sample size was at least 864 patients. As this figure was then inflated by 10% to allow for incomplete records, data for 80 patients a month was retrieved for the retrospective period of one year between June 2013 and May 2014. Descriptive statistics were used to analyze the demographic data, and the statistics were presented by frequency, percentage, mean, and standard deviation. The prevalence of abnormal chest x-rays was reported by number, percentage, and the

95% confidence interval. As for the necessity of routine pre-operative chest x-rays regarding patients' age, the Chi Square statistic was used to compare the results of chest x-rays between different age groups.

Results

Data for 1,787 chest films was screened; however, 827 films did not have an official report by radiologists. Data relating to 960 patients from 14 divisions were included in the final analysis. Around two-thirds of the patients were female, with a mean age of 58.2 years. The number of patients with ASA classifications 1, 2, and 3 were 165, 503, and 299, respectively. Other demographic data are presented in Table 1.

The most common indication for chest x-rays was cardiovascular disease (45.8%). The two other major indications were systemic disease (17.7%), and healthy patients aged more than 45 (16.8%). The reports of pre-operative CXRs were abnormal in the case of 485 patients (50.5%). The most common abnormality was cardiomegaly (20%). Other causes were inactive

Table 1. Demographic data

Variables	Number (%) or mean \pm SD
Gender	
Male	339 (35.3)
Female	621 (64.7)
Age (years)	58.2 \pm 16.4
ASA Physical Status	
I	165 (17.2)
II	503 (52.4)
III	292 (30.4)
Department of surgical procedure	
General surgery	76 (7.9)
Urology	64 (6.7)
Orthopedics	75 (7.8)
Gynecology	85 (8.9)
Ear-nose-throat	75 (7.8)
Neurosurgery	76 (7.9)
Head neck breast surgery	83 (8.6)
Cardiovascular and thoracic surgery	70 (7.3)
Ophthalmology	73 (7.6)
GI endoscope	73 (7.6)
Radiology	74 (7.7)
Plastic	68 (7.1)
Cardiac catheterization laboratory	65 (6.8)
Dental	3 (0.3)

ASA = The American society of anesthesiologists

pulmonary infiltration (lung fibrosis); bony lesion (scoliosis or degenerative change of the spine); other lung lesions (pleural thickening); and a lung nodule or mass in 9.8%, 7.3%, 5.6%, and 4.7% of cases, respectively (Table 2).

Of the 485 patients with abnormal chest x-rays, 391 (80.6%) did not receive any further management. Another 91 patients (18.8%) required consultations and investigations pre-operatively, but only 3 patients (0.6%) had their treatment plans altered. The first of those three patients was diagnosed as having hepatocellular carcinoma with pre-existing obstructive pulmonary disease, and he was given a pre-operative chest radiograph before undergoing a hepatectomy. Upon further investigation, he was diagnosed with severe obstructive pulmonary disease; subsequently, the operation was changed to radiofrequency ablation due to the pulmonary disease. The second case, an 83-year-old male, was found to have cardiomegaly when given chest x-rays prior to urosurgery. The clinical care team decided to change his operation's queue position from the last to the first on that day. The last of the three patients was an 80-year-old female who was scheduled for orthopedic surgery. Her pre-operative chest x-ray demonstrated a right upper lung mass. Upon further investigations,

which were a bronchoscopy and a chest CT scan, she was diagnosed with lung cancer. The operation was changed from orthopedic surgery to a lung lobectomy. Four patients (0.4%) had active tuberculosis. Two of them had been previously diagnosed with tuberculosis and were receiving anti-TB drugs before surgery. The third patient was diagnosed after surgery as a result of the routine pathological report following a lung lobectomy. The diagnosis of tuberculosis in the fourth individual, a neurosurgical patient, was missed, and consequently, the patient did not receive any treatment before surgery. A pre-operative chest x-ray was described as lung metastasis. This patient was diagnosed because of readmission two weeks after surgery due to dyspnea and acute respiratory distress syndrome (ARDS). A sputum examination was done, and a positive result for acid-fast bacilli was reported.

There were 161 patients underwent chest radiograph because the patients aged more than 45 years without co-morbidity. The results of abnormality were detected in 49 out of 161 patients. The most common abnormality was cardiomegaly (18 patients). Other abnormalities were bony lesion, inactive infiltration and lung nodule or mass in 14, 13 and 3 patients, respectively. Comparing between age groups, there was no different of abnormal results (p -value = 0.606). Additionally, most abnormalities did not require further management (Table 3).

Table 2. Data of preoperative chest x-rays

Variables	Number (%)
Indication	
None	98 (10.2)
Age more than or equal to 45 years old (without other conditions)	161 (16.8)
Concurrent cardiovascular diseases	440 (45.8)
Concurrent respiratory diseases	91 (9.5)
Systemic diseases	170 (17.7)
Results	
Normal	475 (49.5)
Abnormal	485 (50.5)
Cardiomegaly	192 (20)
Active pulmonary infiltration	10 (1)
Inactive pulmonary infiltration	94 (9.8)
Lung nodule or mass	54 (5.6)
Other lung lesion	45 (4.7)
Bony lesion	70 (7.3)
Other	20 (2.1)
Management of abnormal CXR (485)	
None	391 (80.6)
Consulted specialists and worked up	91 (18.8)
Alteration of management	3 (0.6)

Discussion

The prevalence of abnormal chest x-rays was 50.5%, which was higher than in other studies. For example, Lim and Liu's study⁽²⁾ in Singapore, which is in the same geographical region as Thailand, found abnormalities in only 12% (representing 38 patients) of routine chest x-rays done of patients who were undergoing non-cardiothoracic surgery, with or without comorbidity. Of the abnormality group, alterations were made to the anesthetic management or the treatment plan of 28.9% (11 patients); nine of those patients were ASA classification 3 or 4, while two were ASA class 2. There are several possible reasons why our presented study had a higher prevalence of abnormal chest radiographs than previous studies. One is that patients undergoing cardiothoracic and cardiac catheterization were included. In addition, minor abnormalities revealed by the chest x-rays, such as a degenerative change of the spine or scoliosis, were categorized in the abnormal group.

In the presented study, there were only three patients whose chest radiographs resulted in an

Table 3. Results of chest x-rays in patients without comorbidity, compared between age groups

Age (years)	45-50	51-54	55-60	61-64	65 or more
Normal CXR (112)	30	22	21	15	24
Abnormal CXR (49)	5	7	11	3	23
Cardiomegaly	2	3	3	0	10
Inactive infiltration	1	3	2	1	6
Lung nodule or mass	0	1	1	1	0
Bony lesion	1	0	5	1	7
Management of abnormal CXR					
None	4	6	10	2	17
Consulted specialists and worked up	1	1	1	1	6
Alteration of management	0	0	0	0	0

alteration of their management. We hypothesized two reasons to explain the low percentage of management modification. Firstly, an abnormal chest x-ray might not be the sole factor to change a physician's decision. The patients' factors such as pre-existing diseases and co-morbidity are also considered. The chest x-rays were, therefore, only a part of the information available to help with the physician's decision-making, such as important medical history and a physical examination. Secondly, surgical patients had undergone fundamental history-taking and a physical examination by their primary doctors. Active medical conditions should have been detected and treated before they were scheduled for surgery. Thus, patients scheduled for surgery were less likely to have an abnormal chest radiograph which had never been detected before than general medical patients. Even if an abnormality were found, it rarely changed the anesthetic management. We recommend that pre-operative chest x-rays should be done as indicated whenever abnormal clinical findings from a patient's medical history or physical examination are demonstrated.

The prevalence of tuberculosis in our study was 0.42% (4 in 960, or 417 in 100,000), which was lower than in two previous studies in 1990 and 1994. Nevertheless, the number was still higher than the prevalence of tuberculosis among the general Thai population in 2014. Bhuripanyo et al⁽⁹⁾ found 5.35% of tuberculosis-like lesions in 1990, while Panich and Panjasawadwong⁽⁸⁾ found 1.2% of tuberculosis was detected from pre-operative chest radiographs in 1994. WHO global tuberculosis reports showed that the prevalence of tuberculosis in Thailand had increased from 160 per 100,000 in 2011 to 236 per 100,000 population in 2014^(7,10). In settings where the tuberculosis prevalence in the general population is

higher than 100/100,000 population, WHO has a conditional recommendation that systematic screening for active tuberculosis should be considered among people who are seeking health care, or who are in health care and who belong to selected risk groups⁽¹¹⁾. Of the four tuberculosis patients in our study, two had been diagnosed and were receiving tuberculosis medications prior to investigation; the other two were not diagnosed from their pre-operative chest radiographs. We used a chest radiograph followed by sputum smear microscopy as a screening tool, as recommended by WHO, but a pre-operative chest radiograph did not improve tuberculosis detection in our study.

According to our study, patients' age should not be an indication of pre-operative chest film. The result of abnormal pre-operative chest film was not different between age groups, and there was no alteration of treatment plan. Nevertheless, a study from Srinagarind Hospital concluded that a pre-operative chest x-ray may be useful in patients' aged more than or equal 45 years⁽⁹⁾. NICE clinical guidelines proposed that the value of the pre-operative chest x-rays would increase in the same direction with a patient's age and ASA grade. Pre-operative CXR may be considered in older healthy patients aged more than 60 years who are undergoing major surgery⁽⁵⁾. In addition, Joo et al⁽¹⁾ recommended that the pre-operative chest x-rays should be done in patients aged more than 70 without risk factors.

The main limitation of our retrospective study was that it was unable to detect the alteration of management in the event that a primary doctor changed the management from operation to non-operation as a result of an abnormal chest radiograph. In this situation, the value of the pre-operative chest radiographs in our study would be underestimated. In future, cost-

effectiveness and cost-benefit analyses of pre-operative chest x-rays in relation to their impact on both the perioperative outcomes and tuberculosis screening should be conducted. In addition, the optimal cut-point of which age would benefit for pre-operative CXR was not demonstrated in our study.

In conclusion, the prevalence of abnormalities detected from pre-operative chest x-rays among patients undergoing elective surgery was high in our setting. Nevertheless, the abnormalities seldom led to a change in further management.

What is already known on this topic?

Abnormal pre-operative chest radiographs were identified in 0.3% to 64.7% of cases, but anesthetic managements were changed for only 0% to 13.3% of the abnormal results.

Healthy patients without risk factors do not require pre-operative chest radiographs.

Thailand is an endemic area of tuberculosis.

What this study adds?

The prevalence of abnormal pre-operative CXRs was high; however, the abnormalities were consistent with co-existing diseases, and the tests seldom led to changes in case management.

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Potential conflicts of interest

None.

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ความชุกของภาพถ่ายรังสีทรวงอกที่ผิดปกติเตรียมก่อนผ่าตัดในผู้ป่วยที่มารับการผ่าตัดแบบไม่ฉุกเฉิน

สุภัฏญา เดชอาคม, ธาณิกา เกียรติชัย, อรุโณทัย ศิริอัสวกุล

วัตถุประสงค์: เพื่อหาความชุกของความผิดปกติภาพถ่ายรังสีทรวงอกในผู้ป่วยเตรียมก่อนผ่าตัดแบบไม่ฉุกเฉิน และในรายที่ภาพถ่ายรังสีทรวงอกผิดปกติ มีการจัดการกับผู้ป่วยเพิ่มเติมแบบใด และผู้ป่วยที่แข็งแรงไม่มีโรคประจำตัวอายุมากกว่า 45 ปีจำเป็นต้องมีการถ่ายภาพรังสีทรวงอกก่อนผ่าตัดหรือไม่

วัสดุและวิธีการ: ตรวจสอบเวชระเบียนผู้ป่วยย้อนหลังในผู้ป่วยที่มารับการผ่าตัดแบบไม่ฉุกเฉินระหว่างเดือนมิถุนายน พ.ศ. 2556 ถึง พฤษภาคม พ.ศ. 2557

ผลการศึกษา: มีจำนวนข้อมูลของผู้ป่วย 960 รายที่นำมาศึกษา พบว่ามีภาพถ่ายรังสีทรวงอกผิดปกติ 485 ราย (50.5%) ภาวะผิดปกติที่พบบ่อยที่สุดคือหัวใจโต ผู้ป่วยที่มีภาพถ่ายรังสีทรวงอก 91 ราย (18.8%) ที่ต้องส่งปรึกษาแพทย์เฉพาะทางแผนกอื่นหรือมีการตรวจทางห้องปฏิบัติการเพิ่มเติมก่อนเข้ารับการผ่าตัด และมีผู้ป่วยเพียง 3 รายที่เปลี่ยนแผนการรักษา การเปรียบเทียบผลความผิดปกติของภาพถ่ายรังสีทรวงอกในแต่ละกลุ่มอายุพบว่าไม่มีความแตกต่างกันของผลความผิดปกติ

สรุป: ความชุกของความผิดปกติภาพถ่ายรังสีทรวงอกเตรียมก่อนผ่าตัดค่อนข้างสูง แต่มีเพียงส่วนน้อยของผู้ป่วยที่ต้องได้รับการจัดการเพิ่มเติม
