

## CLINICAL ASSESSMENT COMPARED WITH CHEST-X-RAY AFTER REMOVAL OF CHEST TUBE TO DIAGNOSE PNEUMOTHORAX

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### ABSTRACT

**Objective:** To evaluate clinical judgment in ruling out pneumothorax during the removal of the chest tube by auscultating the chest before removal and after the extubation of the chest tube in comparison to x ray radiological results.

**Study Design:** Descriptive cross sectional study.

**Place and Duration of Study:** Combined Military Hospital (CMH) Lahore Pakistan, from August 2015 to March 2016.

**Material and Methods:** A sample size of 100 was calculated. Patients were selected via non probability purposive sampling. Children under 14 years were not included. The patients with mal-positioned chest tube, surgical site infection, air leak and the patients with more than one chest tube on one side were excluded. A proforma was made and filled by one person. Chest tubes were removed by two trained senior registrars according to a protocol devised. It was ensured that there was no air leak present before removal clinically and radiologically. Another chest x-ray was done within 24 hours of extubation to detect any pathology that might have occurred during the process. Any complication in the patient clinically was observed till the x-ray film became available. Two sets of readings were obtained. Set A included auscultation findings and set B included x ray results.

**Results:** Out of 100 patients, 60 (60%) were males and 40 (40%) females. The ages of the patients ranged between 17-77 years. Mean age of the patient was  $43.27 \pm 17.05$  years. In set A out of 100 (100%) no pneumothorax developed clinically. In set B out of 100 patients 99 (99%) showed no pneumothorax on chest x ray, only 1 (1%) showed pneumothorax which was not significant (less than 15% on X ray). However, the patient remained asymptomatic clinically and there was no need of reinsertion of the chest tube.

**Conclusion:** Auscultatory findings in diagnosing a significant pneumothorax are justified. Hence, if the chest tube is removed according to the protocol, clinically by auscultation we can be sure that no significant pneumothorax developed during extubation, thus there is no need of x-ray after wards.

**Keywords:** Chest tube, Pneumothorax, X-ray.

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## INTRODUCTION

Chest tube intubation is not only common in cardiothoracic surgery but is one of the common procedures performed at bedside and in emergency room to drain pleural cavity with air, blood, pus and chyle<sup>1</sup>. It plays a very important role in saving the life of the patient who has suffered chest trauma, but on the other hand it is associated with various complications like abdominal or chest injury, bronchopulmonary fistula, vascular injury, pneumothorax, infection at the surgical site and malpositioning of the

chest tube<sup>2</sup>. The postgraduate training level is a major factor that predicts the adverse outcomes in tube thoracostomy procedure. Senior registrars have very less complication rate as compare to junior postgraduate trainee<sup>3</sup>. Pneumothorax can occur during the extubation of the chest drain, for which we perform an x-ray after extubation. We conducted this research to see that can we avoid the routine chest x-ray done after extubation of the chest tube. Secondly, to compare the result so that clinical assessment can prevent any delay treating any pneumothorax if it occurs.

## MATERIAL AND METHODS

It was a descriptive cross sectional study conducted at CMH Lahore medical college for the

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duration of 6 months from August 2015 to March 2016. A sample size of 100 was calculated. Patients were selected via non probability purposive sampling. Children under 14 years were not included. The patients with mal-positioned chest tube, surgical site infection, air leak and the patients with more than one chest tube on one side were excluded. Only the patient with one chest tube on one side of chest, with no air leak and expanded lungs, chest x-ray done before removal, no chest tube site infection, with properly positioned chest tube and the patients with chest tube removed by trained persons followed by the protocol devised with x-ray done within 24 hours of removal of chest tube were included. A perfoma was constructed and filled by single person. Chest tubes were removed by two trained senior registrars according to a protocol devised as following.

A purse string suture is applied to the patient. Two persons are required to remove the chest tube. First person auscultates on anterior, lateral and posterior side of the chest before the process of removal of the drain, in order to make sure that the lung has expanded. Sticking is removed. Hands are sterilized and gloves are worn. One person cuts the suture holding the tube and the second person makes a half-knot of the purse string. Patient is given the command to take a deep breath and hold it while the first person swiftly removes the tube and places a piece of gauze, while the second person immediately ties the purse string. Now the first person again auscultates the chest again, at the same sites of the chest to make sure that the lung is expanded at the same points as auscultated previously.

It was ensured that no air leak was present before removal, clinically and radiologically via chest X ray. Another chest x ray was done within 24 hours of extubation to detect any pathology that might have occurred during the process. Any complication in the patient clinically was observed till the chest x ray film became available. Two sets of readings were obtained after removing chest tube, set A and set B. Set A

included auscultation findings and set B included x-ray results.

## RESULTS

In set A out of 100 (100%) no pneumothorax developed clinically as shown in fig-1A. In set B out of 100 patients 99 (99%) showed no pneumothorax on chest x-ray, only 1 (1%) showed pneumothorax which was not significant (less than 15% on x-ray) as shown in fig-1B. However, the patient remained asymptomatic

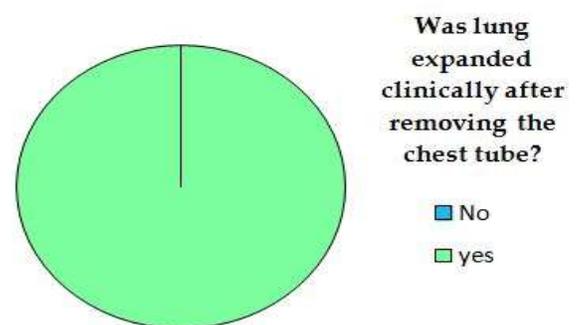


Figure-1A: Results of set A.

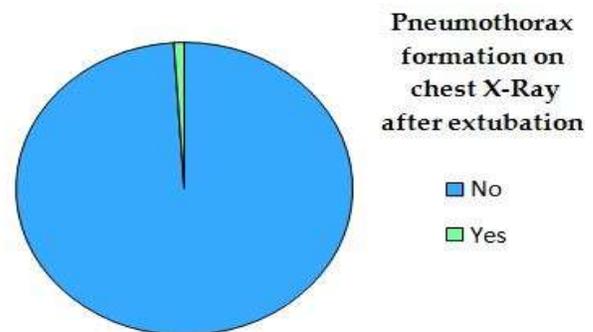


Figure-1B: Results of set B.

clinically and there was no need of reinsertion of the chest tube.

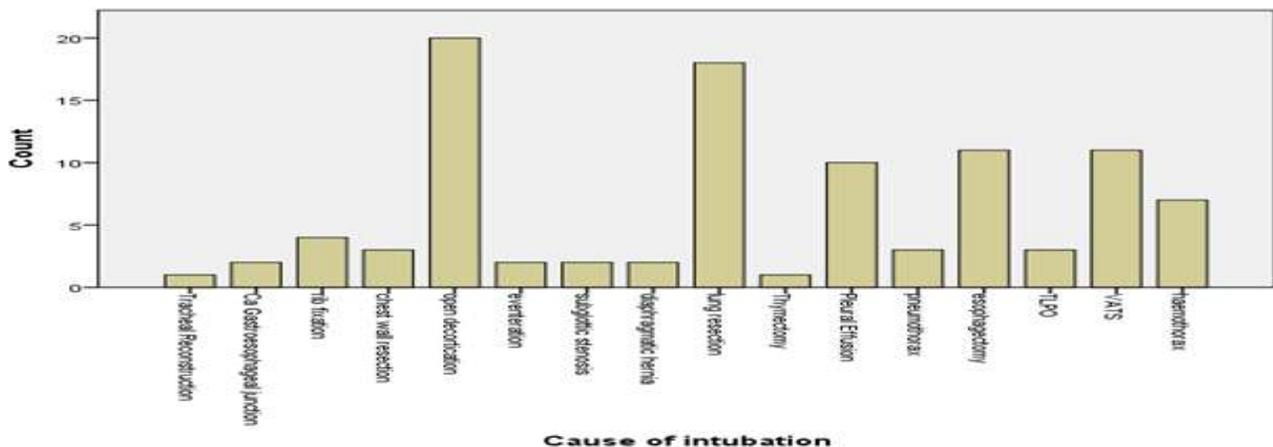
Out of 100 patients, 60 (60%) were males and 40 (40%) females. The ages of the patients ranged between 17-77 years. Mean age of the patient was  $43.27 \pm 17.05$  years. Patients were intubated for various reasons; causes included open decortications (20%), lung resections (18%), pleural effusions (10%), esophagectomy (11%), video-assisted thoracoscopic surgery (VATS) (11%), hemothorax (7%), rib fixation( 4%), chest

wall resection (3%), tibial plateau leveling osteotomy (TLPO) (3%), pneumothorax (3%), diaphragmatic hernia (2%), subglottic stenosis (2%), eventration of diaphragm (2%), tracheal reconstruction (1%), carcinoma gastroesophageal junction (2%) and thymectomy (1%). Causes of intubation are shown in fig-2.

Patient auscultation was performed at three different sites on the chest before and after removal. If the breath sounds were present on the same sites of chest than we assumed that no pneumothorax developed due to removal of chest tube. Secondly one chest x ray was done before removal and one after removal of chest tube within 24 hours and compared whether there was

removal of chest tube by auscultating, than we can avoid the chest x-ray. The duration for which chest tube was intubated had no impact on the result as we had only removed chest tube when there was no air leak and lung had expanded.

A retrospective cohort study of 1021 consecutive patients who had cardiac surgery was done in 2002 by McCormick<sup>4</sup>. Analysis of two cohorts was carried out. One was a routine group in which routine chest x-ray after extubation of chest drain was done and the other in which no x-ray was done. In the routine chest x-ray group, 419 (60%) of the x rays were normal, effusions were found in 251 (36%), pneumothorax occurred in 22 (3%) and effusion plus pneumothoraxes



**Figure-2: Causes of intubation of chest tube in 100 patients.**

a significant pneumothorax or not and hence whether there was a need of reinsertion of chest tube or not.

## DISCUSSION

During the process of chest tube extubation there is a risk of air entering into the chest leading to pneumothorax which can be fatal. If chest tube is not reinserted. To rule out this we do a post removal x-ray chest. Our objective was to show that x-ray can be omitted after removal of chest tube by relying on auscultation findings with the condition that chest tube should be removed by trained persons and a proper protocol. We wanted to show that if we are satisfied that no pneumothorax develops after

found in 11 (2%). Fourteen patients (2%) underwent thoracentesis or had chest tubes reinserted. In the non-routine CXR group, 14 patients (5%) had clinically indicated chest x-rays, of which in 3 (1%) no pathology was found, in 6 (2%) effusions occurred, in 4 (1.3%) pneumothoraxes were found and in 1 (0.3%) both effusions and pneumothoraxes found. Only two patients (0.6%) required reinsertion of the chest tube. Two hundred and eighty three patients (95%) were found asymptomatic and required no re-intervention. Chest x-ray analysis was done and it was found that pathology occurred in 11 of 14 (79%) clinically indicated chest x-rays and 281 of 703 (40%) of routine CXR showed pathology ( $p=0.005$ ).

In 2012, Amir H. Sepehri<sup>5</sup> searched 365 articles on cardiothoracic surgery related to the importance of chest X-ray performed after removal of chest drain and its diagnostic or therapeutic advantage over clinically indicated X Rays<sup>5</sup>. Out of these 6 articles gave the best evidence to answer the question, that whether chest x ray is required after removal of the chest

trauma center<sup>6</sup>. Review of medical records and official chest x-ray film reports, both before and after removal of chest tube extubation was done and data was collected. Eight patients had reports that were different before and after the tube thoracotomy. In which only 2 patients were reinserted with chest tube to prevent recurrence of a pneumothorax. The decision to reinsert the

**Table: Comparison of studies related to chest x ray done after removal of chest tube.**

Study	Total No of Patients	Patients in which x ray was done after extubation	Patients in which pneumothorax developed	Patients in which chest tube was reinserted
The efficacy of X-rays after chest tube removal' by PalestyJa, 2000	73	73	8	2
The use of routine chest X-ray films after chest tube removal in postoperative cardiac patients' by McCormick JT, 2002	283	0	0	0
Are chest radiographs routinely indicated after chest tube removal following cardiac surgery?' By Esineberg RL, 2011	345	0	6	0
Validity of clinical assessment compared with CXR performed after removal of chest tube to diagnose pneumothorax' by Farhan, 2016	100	100	1	0

tube or not. The rate of intervention after the routine chest x-ray was done was as high as 4% in the smallest study and clinical signs and symptoms suggesting of pathology were a significant predictor of major re-intervention ( $p < 0.01$ ). Hence, if these routine chest x-rays in patients following cardiothoracic surgery are not done, it is safe, According to this study chest x-rays should only be performed when clinically indicated.

In 2000 Palesty JA did a 5 year retrospective study of 73 patients with tube thoracotomies in intensive care unit of a level II

chest tube was made based more on the clinical appearance of the chest rather than on chest x ray. According to him the chest x-ray performed after the procedure of chest tube removal should not be routinely performed but only when clinically indicated.

Eisenberg showed in a research in 2011 conducted on post cardiac surgery patients that chest x-rays after chest tube removal are only indicated if there is some respiratory changes, hemodynamic changes or some default in technical aspect of the way the chest tube is removed<sup>7</sup>. Out of 400 patients, 37 of them

developed new pneumothorax after chest tube removal. Of these 9.3% who developed pneumothorax, 70.3% were tiny, 27% were small and 2.7% were medium sized pneumothorax. The incidence of small and medium sized pneumothorax was more in patients who have a doubt of pneumothorax on clinical management. In 345 patients with very less doubt of pneumothorax on clinical judgment no chest x-ray was done. Six patients developed a small pneumothorax but no intervention was required. The comparison of studies is given in the table.

### CONCLUSION

Auscultatory findings in diagnosing a significant pneumothorax are justified. Hence, if the chest tube is removed according to the protocol, clinically by auscultation we can be sure that no significant pneumothorax developed during extubation, thus there is no need of x-ray after wards..

### CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

### REFERENCES

1. Miller KS, Sahn SA. Chest tubes. Indications, technique, management and complications. *CHEST Journal* 1987; 91(2): 258-64.
2. Kwiatt M, Tarbox A, Seamon MJ, Swaroop M, Cipolla J, Allen C, et al. Thoracostomy tubes: A comprehensive review of complications and related topics. *International journal of critical illness and injury science* 2014; 4(2): 143.
3. Aziz A, Pirzada MT, Haider J, Alam SN, Malik KA. Complications of Tube Thoracostomy in Isolated Chest Injuries. *Journal of Surgery Pakistan (International)* 2010; 15(3): 126.
4. McCormick JT, O'Mara MS, Papasavas PK, Caushaj PF. The use of routine chest X-ray films after chest tube removal in postoperative cardiac patients. *The Annals of thoracic surgery* 2002; 74(6): 2161-4.
5. Sepehrpour AH, Farid S, Shah R. Is routine chest radiography indicated following chest drain removal after cardiothoracic surgery?. *Interactive cardiovascular and thoracic surgery* 2012; 14(6): 834-8.
6. Palesty JA, McKelvey AA, Dudrick SJ. The efficacy of X-rays after chest tube removal. *The American journal of surgery* 2000; 179(1): 13-5.
7. Eisenberg RL, Khabbaz KR. Are chest radiographs routinely indicated after chest tube removal following cardiac surgery? *American Journal of Roentgenology* 2011; 197(1): 122-4.