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Original Research Article

Are routine post drain removal chest X-rays necessary after oesophagectomy?

Mohamed Saad Aboul-Enein[1,2]*, William R. C. Knight[1], Daniel Foley[1,3], Luke McKnickle[1], Harrison Carter[1], James A. Gossage[1,4,5]

[1]Department of Surgery, Guy's and St. Thomas' Oesophago-gastric Centre, London, United Kingdom
[2]Department of General Surgery, Faculty of Medicine, Tanta University, Tanta, Egypt
[3]Monash Medical Centre, Melbourne, Australia
[4]School of Cancer and Pharmaceutical Sciences, King's College London, United Kingdom
[5]Department of Molecular Medicine and Surgery, Karolinska Institute, Stockholm, Sweden

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***Correspondence:**
Dr. Mohamed Saad Aboul-Enein,
E-mail: msaad@med.tanta.edu.eg

ABSTRACT

Background: Routine chest X-rays (CXR) are often performed following the removal of chest drains placed during oesophagectomy. CXRs are costly and inconvenient for the patient, often being performed out of working hours. The aim of this study was to evaluate whether routine CXR is necessary following drain removal or if CXRs should only be performed when indicated by the clinical status of the patient.
Methods: This was a retrospective study of oesophagectomies performed at a single high volume centre. Routine post chest drain removal CXRs were analyzed and compared to baseline post-operative CXRs. The clinical status of the patient before and after chest drain removal was recorded.
Results: 188 patients were identified. 111/188 (59%) had a pleural effusion or pneumothorax on their baseline post-operative CXR. Abnormal findings on post drain removal CXR were common with 72/188 (38.3%) patients having a new or worse pleural effusion or pneumothorax. Only, 5.6% (11/188) of these patients actually developed clinical signs after chest drain removal. Of these, only 2.1% (4/188) required chest drain re-insertion. No patients underwent intervention without showing clinical deterioration. No re-intervention was prompted by CXR finding alone.
Conclusions: Routine CXR following chest drain removal is unnecessary. It is safe to only perform CXRs on patients who develop clinical signs.

Keywords: Oesophageal cancer, Oesophagectomy, Chest radiograph, Chest drain removal

INTRODUCTION

An oesophagogastrectomy is one of the most invasive procedures in surgery, involving surgical access to both the abdomen and thorax. It is also a highly morbid procedure. Patients are at risk of post-operative anastomotic leakage, and the accumulation of air, blood or chyle in the chest cavity. The British thoracic society guidelines advise that either 1 or 2 chest drains are inserted following the thoracic component of the procedure. These are needed to aid complete lung expansion and to allow detection of air, chyle or anastomotic leaks.[1]

It is common practice to perform a chest X-ray (CXR) within 6 hours of the removal of a chest drain for all oesophagectomy patients.[2,3-8] The rationale behind this is to identify a pneumothorax or recollection of pleural fluid which would necessitate reinsertion of the chest drain.[2,4-7] The performance of a routine CXR following chest drain removal is costly and some studies have argued that it is

not necessary.[7] The recent enhanced recovery after surgery (ERAS) society guidelines for post-oesophagectomy care suggest chest drain use should be minimized and do not explicitly recommend chest radiographs post removal.[3]

This study examines a single institution's experience with routine CXR following chest drain removal. The aim is to describe the common findings of routine CXR performed following chest drain removal and determine whether it is these findings or a patient's clinical deterioration that prompts the need for intervention or deviation from routine post-operative care.

METHODS

Patients

A retrospective study was performed utilizing a prospectively collected patient database of all oesophago-gastric cancer resections performed at Guy's and St. Thomas' Hospital. Ethical approval for use of the database through an integrated research application system (IRAS reference: 12-NW-0511). Included in the study were all consecutive patients undergoing transthoracic oesophagectomy with notes available for retrospective analysis between December 2011 and July 2018. Excluded were patients undergoing transhiatal oesophagectomy, or patients with incomplete notes. Any additional data was retrospectively analyzed. All patients underwent a standard protocol of preoperative investigations including computed tomography (CT) and positron emission tomography-computed tomography (PET CT) and lung function tests.

Oesophagectomy

Patients underwent either an open or laparoscopically assisted left thoraco-abdominal (LTA) or Ivor Lewis (IL) oesophagectomy depending on the site of the disease and surgeon preference. All thoracic components of the operation were performed open. Two-field lymphadenectomy was performed, and a circular stapler was used for the anastomosis. Two drains were tunnelled trans-thoracically with one placed apically near the anastomosis and one basally. The basal drain was used to drain the contralateral pleural cavity if the pleura had been breached on that side. Standard 28 Fr chest drains were used with under water seals.

Post-operative treatment

Patients were recovered using a standardized enhanced recovery protocol. All patients were transferred intubated to overnight intensive recovery (OIR) straight after surgery. The OIR protocol is to obtain portable CXR once they arrive to check the position of the central line and endotracheal tube and also to check for lung re-inflation after surgery. Early mobilization and chest physiotherapy were routine. Water soluble contrast swallows were performed on day three to detect anastomotic leaks. If the anastomosis was intact, one chest drain (usually apical) was removed with a post removal CXR performed within 6 hours as standard. The second chest drain was removed, depending on volume and type of fluid drained (usually <150 ml) and the patient's clinical status, with another CXR performed within 6 hours.

During the operation we leave a long purse string sutures, ready to be tied after removal of the drains. Nurses in our unit are trained to remove chest drains and to tie the purse strings.

Outcome measures

Baseline oncological and clinical characteristics of each patient were recorded. Any radiological findings on post drain removal CXRs were recorded and compared to the baseline day 0 CXR. All CXRs were reported by a consultant radiologist. Findings included pneumothorax, pleural effusions or both. Clinical parameters: oxygen saturation of arterial blood (SaO2), oxygen partial pressure of the arterial blood (PaO2), respiratory rate, dyspnoea, and clinical examination findings were retrospectively analyzed before and after chest drain removal from post-operative notes and care plans. Patients with radiological signs were either managed conservatively or with an intervention. Interventions were classified as either non-invasive (increased monitoring, physiotherapy and serial CXRs) or invasive (reinsertion of drain). Any intervention was then classified as one based upon findings from the routine CXRs alone or based on the clinical deterioration of the patient. Statistical analysis was descriptive in nature.

RESULTS

Demographics

499 patients were identified who underwent potentially curative oesophagectomy from December 2011 and July 2018. 193 patients undergoing transhiatal esophagectomy were excluded. 188 patients undergoing transthoracic oesophagectomy (Ivor Lewis or left thoracoabdominal) were included in the analysis. Patient characteristics are outlined in Table 1. The mean age at surgery was 62, and 70.2% of the patients were males. 54.8% underwent an Ivor Lewis oesophagectomy (right thoracotomy). The majority of patients had adenocarcinoma. A median of 2 routine chest radiographs was performed with a range of 1-23.

Radiological signs

111/188 (59.0%) had a pleural effusion and/or pneumothorax on baseline post-operative CXR. A total of 72 patients (38.3%) demonstrated new or worsening radiological findings after their post drain removal CXR. Of these, 36 patients (19.1%) had post drain removal pneumothorax, 30 (16%) had a pleural effusion and 6 (3.2%) had both (Table 2).

Table 1: Patient demographics.

Patient characteristics	N (%)
Age [median+interquartile range (IQR)]	62 (13.7)
Gender	
Male N (%)/female N (%)	132 (70.2)/56 (29.8)
Length of stay (median+IQR)	10 (5)
Surgical approach (total 188)	
Ivor Lewis oesophagectomy N (%)	103 (54.8)
Left thoracoabdominal oesophagectomy N (%)	85 (45.2)
CXRs	
Number of post-operative CXRs (median+IQR)	5 (3)
Number of post drain removal CXRs (median+IQR)	2 (2)
Total number of CXRs performed in cohort	968
Histology	
Adenocarcinoma	174 (92.6)
Squamous cell carcinoma	14 (7.4)
Postoperative pathology	
pT0	19 (10.1)
pT 1-2	48 (25.5)
pT 3-4	121 (64.4)
pN 0	73 (38.82)
pN 1, 2 and 3	115 (62.7)
Circumferential resection margin (CRM) <1 mm	55 (29.25)

Table 2: Number of patients with pathologic chest radiograph findings post removal chest drain.

Pathologic findings on CXR	N (%)
Total pathologic findings on CXR	72 (38.3)
Pneumothorax	36 (19.1)
Pleural effusion	30 (16.0)
Pneumothorax and pleural effusion	6 (3.2)

Table 3: Clinical details of patients needing intervention.

Patients	Intervention	Clinical deterioration: signs	Time to deterioration post drain removal (hours)	CXR findings
1	Ultrasound guided drainage	dyspnoea, increased oxygen requirement, low oxygen saturation and decreased breath sounds on auscultation	14	Pneumothorax and pleural effusion
2	Ultrasound guided drainage		12	Pleural effusion
3	CT guided drainage		5	Pneumothorax and pleural effusion
4	Re-insertion of the drain under local anaesthesia	Drain site hissing loudly with expiration, reduced air entry and hyper-resonance thorax.	1 hour	Pneumothorax

Signs of clinical deterioration

Within the group of the patients that had positive radiological findings, only 11 patients (11/72) showed a synchronous clinical deterioration. The clinical signs were in the form of dyspnoea, increased oxygen requirement, low oxygen saturation and decreased breath sounds on auscultation. One patient reported left sided chest pain whilst observations and clinical examination were unremarkable. The clinical and radiological parameters for each patient requiring intervention is shown in Table 3.

Intervention

Overall, 5% (11/188) required additional treatment after removal of the chest drains. Only four (4/188) patients required invasive treatment. Three patients were treated with radiologically guided drains (ultrasound or CT

guided) and one patient required the drain to be re-inserted on bedside under local anaesthesia (Table 3). The rest of the patients in this group (7/188) did not require any invasive therapy, they were treated conservatively with chest physiotherapy, close monitoring, repeated clinical examination and serial CXR. All the patients that required additional treatment were within the group of patients that showed clinical deterioration. None of the radiologically positive patients that were clinically stable required any extra steps in their post-operative care.

DISCUSSION

Routine radiological screening after removal of chest drains remains commonplace. Post-operative pleural effusions are a common finding and asymptomatic pneumothoraces can occur as a result of chest drain removal.[9,10] Based on this study, patients with these radiological findings are unlikely to undergo intervention unless there has been a clinical deterioration. As a clinically deteriorating patient is likely to be imaged as part of their clinical assessment, it follows that asymptomatic patients do not require routine CXR following chest drain removal.

There are multiple causes of pleural effusions and pneumothoraces following an oesophagectomy. Oesophagectomy involves an extensive thoracic dissection and a lymphadenectomy which will result in the accumulation of haemo-serous fluid in the post-operative period. Also, a reactive effusion can form as a result of the presence of the chest drain in the thoracic cavity. Similarly, 4-8% of patients with a chest drain will suffer a pneumothorax as a result of the chest drain removal.[9,10] These effusions and pneumothoraces are mostly managed conservatively, especially when there is no change in the clinical status of the patient. More worrying causes of an effusion or pneumothorax include pneumonia, bleeding, chyle leak, anastomotic leak, airway injury or incorrectly sited chest drain. These complications will either be apparent prior to drain removal or will be identified by a change in the clinical status of the patient. A routine CXR will not necessarily determine a benign or malignant cause of the effusion or pneumothorax.

A number of studies have examined post chest drain removal CXRs after thoracic surgery and have come to similar conclusions.[2,4-8] Two of these studies were in paediatric populations where unnecessary irradiation will be seen as potentially more harmful and more important to forgo.[2-5] In thoracic surgery chest drains are required to detect ongoing air leaks following pulmonary resections. Lung injuries are rare in oesophagectomy.

One paper examined post chest drain removal CXR in 117 robotic oesophagectomy patients.[7] Six patients (5.1%) required chest drain reinsertion and all showed increased oxygen requirements and dyspnoea prior to this. No interventions were made on radiological findings alone.

Another study, looked at the use of post drain removal CXRs in patients following trauma and found the annual saving for foregoing routine CXRs was $16,280.[8] The authors argue that clinically insignificant radiological findings can also lead to chest drains being left in for longer. This results in an increased length of stay and the added costs of repeated CXRs to monitor the radiological findings. This present study was not designed to validate this. However, the safe omission of routine CXRs will help streamline limited resources. In this study 177 patients were asymptomatic. If these patients were to forgo routine radiography the savings in radiology, portering and reporting costs would have been significant.

There are limitations to this study. This was a retrospective observational study which relied on sometimes incomplete documentation. Also, this study relied on documentation which would not routinely focus on the decision-making process behind timings of chest drain removal. However, when a patient deteriorated clinically and underwent a chest drain reinsertion, it was clearly documented.

CONCLUSION

In conclusion, this study has demonstrated that none of the patients undergoing oesophagectomy are treated on the findings of routine radiology alone following chest drain removal. Clinically significantly pleural effusions and pneumothoraces can be detected safely by monitoring patients and requesting investigations on the basis of clinical assessment.

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REFERENCES

1. Havelock T, Teoh R, Laws D, Gleeson F. Pleural procedures and thoracic ultrasound: British Thoracic Society pleural disease guideline 2010. Thorax. 2010;65:61-76.
2. Cunningham JP, Knott EM, Gasior AC, Juang D, Snyder CL, St Peter SD, et al. Is routine chest radiograph necessary after chest tube removal? J Pediatr Surg. 2014;49:10:1493-5.
3. Low DE, Allum W, Manzoni G, Ferri L, Immanuel A, Kuppusamy M, et al. Guidelines for Perioperative Care in Esophagectomy: Enhanced Recovery After Surgery (ERAS®) Society Recommendations. World J Surg. 2019;43(2):299-330.
4. Sepehripour AH, Farid S, Shah R. Is routine chest radiography indicated following chest drain removal after cardiothoracic surgery?. Interact Cardiovasc Thorac Surg. 2012;14(6):834-8.
5. Johnson B, Rylander M, Beres AL. Do X-rays after chest tube removal change patient management? J Pediatr Surg. 2017;52(5):813-5.

6. Tanveer K, Girish C, Romany D, Mallikarjuna S, Wade D. Is routine chest X-ray following mediastinal drain removal after cardiac surgery useful? Eur J Cardio-Thoracic Surg. 2008;34(3):542-4.
7. Kingma BF, Marges OM, Van Hillegersberg R, Ruurda JP. Routine chest X-rays after the removal of chest tubes are not necessary following esophagectomy. J Thorac Dis. 2019;11(5):799-804.
8. Goodman MD, Huber NL, Johannigman JA, Pritts TA. Omission of routine chest x-ray after chest tube removal is safe in selected trauma patients Am J Surg. 2009;199(2):199-203.
9. Mao M, Hughes R, Papadimos T, Stawicki S. Complications of chest tubes: a focused clinical synopsis Current Opinion in Pulmonary Medicine. 2015;21(4):376-86.
10. Cerfolio RJ, Bryant AS, Skylizard L, Minnich DJ. Optimal technique for the removal of chest tubes after pulmonary resection. J Thorac Cardiovasc Surg. 2013;145:1535-9.

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