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Clinical importance of surgical emphysema post-local anesthetic thoracoscopy: A multi-center review of practice

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ABSTRACT

Local anaesthetic thoracoscopy is a crucial intervention in the diagnosis and management of an unexplained exudative pleural effusion and increasingly performed as a day case procedure. Indwelling pleural catheters or large bore drains are usually inserted at the end of the procedure. Surgical emphysema post-local anesthetic thoracoscopy is common and benign in the absence of visceral air leaks. Concurrent surgical drains at the time of day case thoracoscopy with indwelling pleural catheter are not required.

Keywords: Indwelling pleural catheter, Large bore drain, Local anesthetic thoracoscopy, Surgical emphysema

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INTRODUCTION

The role of local anesthetic thoracoscopy (LAT) is in investigating unexplained exudative pleural effusions is well established. It offers a one stop approach for relieving symptoms, namely breathlessness, by draining pleural effusions, for diagnosis by allowing biopsies of abnormal areas of parietal pleura under direct vision and finally for therapeutic purposes by enabling pleurodesis via talc slurry or poudrage or fluid control by indwelling pleural catheter (IPC) insertion [1]. The technique, indications and evidence are well described in international guidelines and in expert opinions [1, 2]. The relevant technique is described later.

Local anesthetic thoracoscopy is an extremely safe procedure [1]. One of the complications of LAT is surgical emphysema (SE). Surgical emphysema, air in the subcutaneous tissues, occurs when air escapes from the alveolar/pleural spaces due to pneumothoraces for example, or from diffuse infections due to gas forming organisms, trauma to the chest, or procedures such as cardiothoracic surgery (incidence approximately 6%) or LAT or even abdominal laparoscopy [3–5]. A palpable shift in practice in the United Kingdom (UK) has been the increasing provision of day case LAT with IPC insertion [6–8]. Local anesthetic thoracoscopy has typically required admission thereafter with a large bore chest drain inserted at the end of the LAT, but insertion of an IPC instead can allow same day discharge with domiciliary drainage [9].

Surgical emphysema is one of those complications which might prevent same day discharge, as it might signify an air leak, presumably from rupture or iatrogenic injury of the visceral pleura.

Expert opinion is divided, while the guidance suggests that SE is a measurable complication, others such as the senior authors in this paper, would argue that without a concurrent air leak, the presence of SE in the absence

of an air leak is of no clinical significance. Some expert thoracoscopists from other UK centers advocate the concurrent insertion of a large bore chest drain and an IPC to reduce SE, and others advocate insertion of the IPC at different entry site from the one done to perform LAT [10].

We hypothesized that SE post-day case LAT with concurrent IPC insertion, in the absence of an air leak, is of no clinical significance and that SE requires no further large bore drain insertion and an IPC can be inserted into the same entry site used for the LAT.

CASE SERIES

We performed a case note review of all consecutive patients undergoing day case LAT and IPC insertion in 3 UK based centers (Northumbria Healthcare NHS Foundation Trust, University Hospitals of North Midlands NHS Trust and Kettering General Hospital) performing day case LAT with IPC insertion.

We collected demographics and clinically relevant outcomes relevant to the presence of SE on the postoperative imaging, air leak (characterized by ongoing bubbling from the drains post-procedure) and requirement for further procedures and admission rates. We did not look at overall complications as this was a very targeted analysis related to SE. This registered as a multi-center audit with local information governance approval from Northumbria Healthcare NHS Foundation Trust (Ref 8491). Informed consent was not required as this was a retrospective audit with anonymized data shared. Continuous variables are presented as median with interquartile range and categorical variables were expressed as frequencies (n) and percentages (%). Analysis was performed with descriptive methodology using Microsoft Excel (2025). We did not perform formal statistical analyses between groups due to this being a retrospective, descriptive analysis.

A short description of how LAT is performed is also warranted—after all the required pre-procedural safety checks, the patient is placed into the lateral decubitus position with the affected side facing upwards. After the patient is sedated, the site of the port of entry is identified with thoracic ultrasound and local anesthetic infiltrated. An incision is made with a scalpel and entry to the pleural space is obtained either with blunt dissection or with Boutin needles. An artificial pneumothorax is created, pleural fluid suctioned out, and after visual inspection of the parietal pleura, targeted biopsies can be taken. In two centers, an IPC (Rocket Medical PLC) is inserted through the same hole as the initial LAT port, and the drain brought out 5 cm distally, and at one site, an IPC (PleurX Pleural Catheter System) is inserted at different site from LAT. At the end of the procedure, the IPC is connected to an underwater drainage bottle, and a chest X-ray (CXR) is performed. In the absence of bubbling from the drain (signifying no visceral air leak), and satisfactory drain position placement on the CXR, the IPC is capped and the patient discharged once he has sufficiently recovered from the procedure. No digital suction devices were used. Only 1 center (Kettering General Hospital) performs routine talc pleurodesis via poudrage at the time of LAT in patients with macroscopically suspicious pleura.

Results

Partial results were presented at the Winter British Thoracic Society Conference meeting in November 2024 in London [11].

From locally held procedure lists, 256 day case consecutive LATs were identified between July 2020 and January 2024 in the 3 sites. The mean age across the whole cohort was 72 years (IQR 14.5) and 93 (36.3%) patients were male. The predominant diagnoses were pleural mesotheliomas (83, 32.4%), lung cancers (60, 23.4%), and benign pleuritis (63, 24.6%). This is shown in Figure 1.

Sixty-four patients (25%) developed post-procedure SE. This group had a median age 71.3 years, IQR 14, were predominantly female patients (45, 70%), diagnoses were predominantly mesothelioma (32, 50%) and lung cancer (20, 31%), with the others being breast [3] and ovarian cancer (2), and benign inflammation (7) and 4 of those had concurrent air leaks. In those, there were no instances of visceral pleural puncture or lung injury, and all the air leaks were felt due to the pleural surfaces and lung shearing away at pneumothorax induction during the initial stages of LAT.

Of those 4 patients, specifically, 3 had non-expandable lung at thoracoscopy and on the post-procedure chest X-ray (CXR), and 3 diagnoses were mesothelioma and 1 had lung cancer. Three were admitted post-procedure. In 3 patients, the IPC remained connected to a chest drain bottle, and in 2, the air leak settled after an average of four days. There was no requirement for large bore drain insertion. In the final one in this group, as the patient was very well and ambulant, an ambulatory bag was connected to the IPC on the day of the procedure, enabling same day discharge—the air leak settled in four days after discharge. One patient's SE progressed despite the IPC being connected to a chest drain bottle, signifying that the diameter of the IPC was not sufficient for that

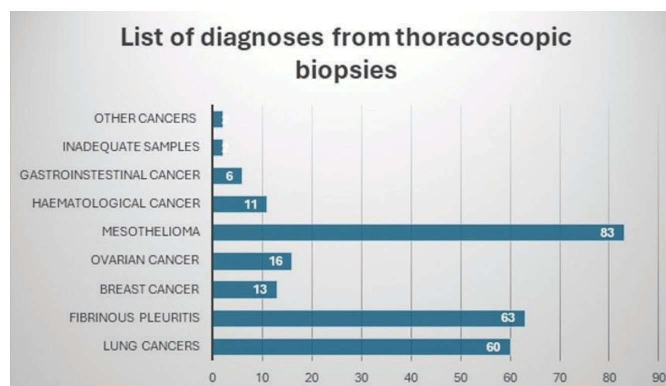

Figure 1: List of diagnoses from thoracoscopic biopsies.

air leak, and so a 24 French gauge (Fr) chest drain was inserted with air leak resolution at three days. Figure 2 shows the management of patients with SE.

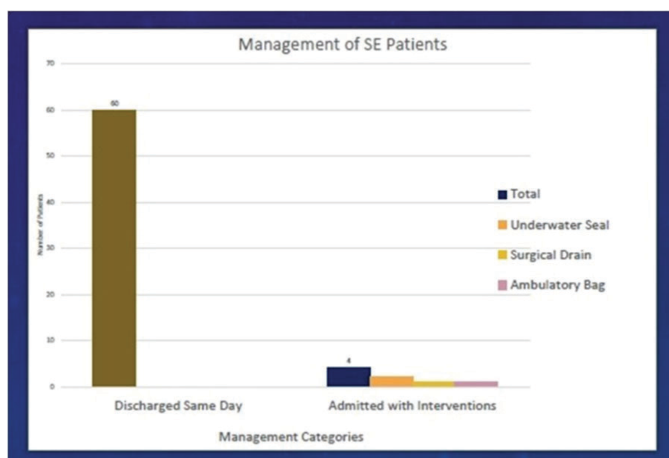

Figure 2: The management of patients with surgical emphysema.

DISCUSSION

Our retrospective data, from a multi-center audit of practice in 3 expert thoracoscopy centres in the UK, signals that SE at the end of day case LAT with IPC insertion, in the absence of air leak, is of no clinical consequence. While this is not a formal randomised trial with control groups, we believe the data can be practice changing given that LAT practice is increasing throughout the UK, and worldwide [6,12]. This is a large dataset coming from experienced LAT centres and contains simple observational data.

It is worth highlighting the limitations of the above study. We did not do formal statistical comparisons given there are no equal comparator groups and this is a not a formal trial. We did not measure the severity of the SE. Surgical emphysema can be graded from 0–4 (0 being SE seen, 1 is SE just the LAT or IPC site, 2 is involving the ipsilateral hemithorax, 3 is all the above and involving the neck on the same side, and 4 is involving the contralateral hemithorax) [13]. We also did not measure the incidence of non-expandable lung (NEL) as all the patients had an IPC inserted—when we insert an IPC, the presence of absence of NEL does not really matter. The definition of clinically significant SE is also debatable—unless there is an active air leak, SE is benign and will resolve [14]. All the centers in this study also have a practical approach and do not repeat chest radiographs to see if the SE resolves.

Our data have an interesting signal that SE, whilst common, does not cause morbidity.

The practice of day case LAT in the centres was started at the start of Coronavirus 19 pandemic where bed pressures across healthcare systems were increased and day case thoracoscopy and IPC insertion allowed same day discharge, thus freeing up beds. Two of the centres in this study have published preliminary findings about this practice, both showing the feasibility and cost savings associated with day case LAT [7, 8]. This was borne out of expert opinion, and a formal trial [The randomized thoracoscopic talc poudrage + indwelling pleural catheters versus thoracoscopic talc poudrage only in malignant pleural effusion trial (TACTIC)] has finished recruiting, and published results are awaited [15].

The mechanism of SE during LAT is due to air escaping into the subcutaneous tissues from the pleural space. This can be totally expected as the air from the artificial pneumothorax can seep out. More importantly, lung injury during the LAT procedure can cause an air leak which would be picked up by continuous bubbling into the chest drain bottle after the procedure. The IPC drain is a 16 Fr drain, and is approximately 5.3 mm in diameter, and there is concern from other centres that the 16 Fr drain is just not enough for SE and that additional large bore (traditionally defined as more than 20 Fr) should be inserted through the LAT port with the IPC in another intercostal space [10]. This was the case in one of our patients where additional chest drainage was required. We do not formally measure our air leaks with digital suction devices and go via the assessment of bubbling into the chest drain—this cannot be measured retrospectively [16].

The largest meta-analysis of complications from thoracoscopy, where 90 studies were reviewed, showed overall pooled complication rates at 0.040 (95% confidence interval: 0.029–0.052) [17]. Surgical emphysema is consistently included in most of the studies as a complication [10]. The British Thoracic Society (BTS) Clinical Statement on pleural procedures also suggests that that most SE in the context of LAT is benign and will resolve spontaneously. However, the BTS statement suggests as a good practice point, that the IPC post LAT insertion should be inserted in another rib space [18]. While we do not perform this, we acknowledge that this approach would mean further incisions, pleural punctures and sutures around initial thoracoscopy posts as well as around the IPC tract, and an additional drain—this has cost implications and perhaps over-complicates LAT. Interestingly, the TACTIC trial suggested placing the IPC in a different intercostal space, and a large bore drain in the LAT port—and the results of the trial will perhaps shed more light on this issue. Our data from two out of three centres would suggest that placement of the IPC into the initial LAT port (99 procedures in total) is feasible, safe, and any resultant SE is benign.

A final important point that must be emphasized that IPCs are offered to all patients undergoing LAT, and without the IPC placement, the overall procedure cannot easily take place due to continuous pressures on beds and the move to outpatient management. However, the correct practice would be to offer patients the choice between having an IPC and a large bore drain at the end of the LAT procedure (which is removed, and the patient goes home without any drains), as the psycho-social

aspects of having an IPC is well documented and patients often do not like having them [19]. Further research in this field should concentrate on the acceptability of IPC insertion at the end of LAT and the lived experience of those patients.

CONCLUSION

In the absence of simultaneous air leaks, the presence of SE in day case LAT with IPC insertion is of no clinical importance. Concurrent drainage of air via IPCs and surgical drains is not required. However, until formal randomised controlled trials are performed (day case LAT with IPC versus day case LAT with IPC and large bore drain insertion, and IPC insertion in the same intercostal space versus a different one), expert opinions and retrospective reviews can provide the evidence base required to inform practice.

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Author Contributions

Suvojit Misra – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Laura Waller – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Sidra Kiran – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Mohamed Haris – Conception of the work, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Raja Reddy – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

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Elizabeth Turnbull – Conception of the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Avinash Aujayeb – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Guarantor of Submission

The corresponding author is the guarantor of submission.

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Consent Statement

No consent was required due to the retrospective anonymized nature of this project.

Conflict of Interest

Authors declare no conflict of interest.

Data Availability

All relevant data are within the paper and its Supporting Information files.

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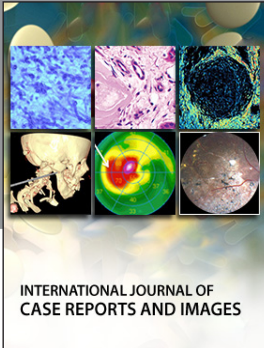
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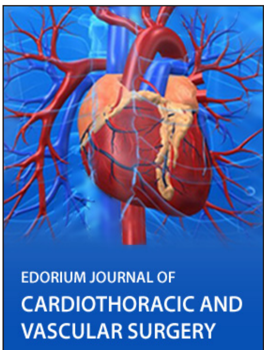
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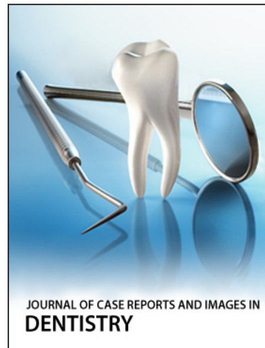
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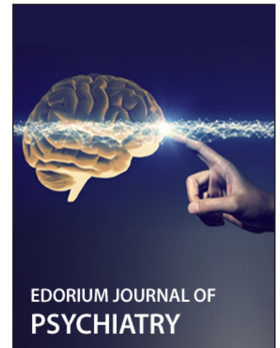
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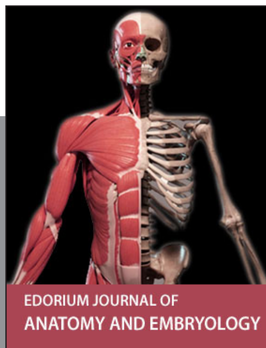
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